

Appendix "O" Item No.30

BIOTECHNOLOGY

Scheme and Syllabus (With effect from 2020-21 admitted batch)

B.Tech I Year - I Semester

Course CreditsC code	Category	Course Title	Hours per week			Internal Marks	External Marks	Total Marks	
			L	T	P				
BT-1101	BS	Mathematics – I	3	0	0	30	70	100	3
BT-1102	BS	Chemistry	3	0	0	30	70	100	3
BT-1103	HSS	English	3	0	0	30	70	100	3
BT-1104	ES	CPNM	3	0	3	30	70	100	3
BT-1105	ES	Biology	3	0	0	30	70	100	3
BT-1106	HSS	English Language Lab	0	0	2	50	50	100	1.5
BT-1107	BS	Chemistry Lab	0	0	3	50	50	100	1.5
BT-1108	ES	CPNM Lab	0	0	3	50	50	100	1.5
Total Credits									19.5

B.Tech I Year - II Semester

Course CreditsC code	Category	Course Title	Hours per week			Internal Marks	External Marks	Total Marks	
			L	T	P				
BT-1201	BS	Mathematics – II	3	0	0	30	70	100	3
BT-1202	BS	Physics	3	0	0	30	70	100	3
BT-1203	ES	Engineering Graphics	1	0	4	30	70	100	3
BT-1204	ES	Genetics	3	0	0	30	70	100	3
BT-1205	ES	Microbiology	3	0	0	30	70	100	3
BT-1206	ES	Workshop Lab	0	0	3	50	50	100	1.5
BT-1207	BS	Physics Lab	0	0	3	50	50	100	1.5
BT-1208	ES	Microbiology lab	0	0	3	50	50	100	1.5
Total Credits									19.5

BT-1101 : MATHEMATICS-I

Course Objectives:

- To transmit the knowledge of Partial differentiation.
- To know of getting maxima and minima of function of two variables and finding errors and approximations.
- To evaluate double and triple integrals, volumes of solids and area of curved surfaces.

- To expand a periodical function as Fourier series and half-range Fourier series.

Course Outcomes:

- Find the partial derivatives of functions of two or more variables.
- Evaluate maxima and minima, errors and approximations.
- Evaluate double and triple integrals, volumes of solids and area of curved surfaces.
- To expand a periodical function as Fourier series and half-range Fourier series.
- Have a fundamental understanding of Fourier series and be able to give Fourier expansions of a given function.

SYLLABUS

(Partial Differentiation) Introduction - Functions of two or more variables - Partial derivatives - Homogeneous functions – Euler's theorem - Total derivative - Change of variables – Jacobins. Mean value Theorems (without proofs)

(Applications of Partial Differentiation) Geometrical interpretation - Tangent plane and Normal to a surface -Taylor's theorem for functions of two variables - Errors and approximations -Total differential. Maxima and Minima of functions of two variables - Lagrange's method of undetermined multipliers - Differentiation under the integral Sign - Leibnitz's rule.

(Multiple Integrals) Introduction - Double Integrals - Change of Order of Integration - Double Integrals in Polar Coordinates - Triple Integrals - Change of Variables.

(Multiple Integrals-Applications) Area enclosed by plane curves - Volumes of solids - Area of a curved surface - Calculation of Mass - Center of gravity - Moment of inertia - product of inertia – principal axes- Beta Function - Gamma Function - Relation between Beta and Gamma Functions. Error Function or Probability Integral.

(Fourier Series) Introduction - Euler's Formulae - Conditions for a Fourier Expansion - Functions having points of discontinuity - Change of Interval - Odd and Even Functions - Expansions of Odd or Even Periodic Functions, Half-Range Series - Parseval's Formula. Practical Harmonic analysis.

TEXT BOOK:

Scope and Treatment as in "Higher Engineering Mathematics", by Dr. B.S. Grewal, 43rd Edition, Khanna publishers.

REFERENCE BOOKS:

1. Graduate Engineering Mathematics by V B Kumar Vatti., I.K.International publishing house Pvt. Ltd.

2. Advanced Engineering Mathematics by Erwin Kreyszig.
3. A text book of Engineering Mathematics, by N.P. Bali and Dr. Manish Goyal, Lakshmi Publications.
4. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.
5. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.
6. Higher Engineering Mathematics by Dr. M.K.Venkataraman.

BT-1102 : CHEMISTRY

Course Objectives:

- To apply the basic knowledge of Chemistry to the Engineering Discipline.
- To develop knowledge about water and its treatment for industrial and potable purposes.
- To develop understanding in the areas of Polymers, Mechanism of Corrosion of Metals and Corrosion Control Methods, Fuels, Lubricants and Nanomaterials for of conducting polymers, bio-degradable polymers and fiber reinforced plastics and apply the knowledge for solving existing challenges faced in various engineering and societal areas.

Course outcome:

- This course applies the basic concepts and principles studied in Chemistry to Engineering.
- It provides an application of chemistry to different branches of engineering
- The students will be able acquire knowledge in the areas of Water Chemistry, Polymers, Corrosion, Fuels and Lubricants and nanomaterials and suggest innovative solutions for existing challenges in these areas.

SYLLABUS

Water Chemistry : Sources of Water – Impurities and their influence of living systems – WHO Limits – Hardness and its Determination – Boiler Troubles and their removal – Water Softening Methods – Lime-Soda, Zeolite and Ion Exchange - Municipal Water Treatment-Break Point Chlorination – Desalination of Sea Water – Reverse Osmosis Method, Electro-dialysis.

Polymers and Plastics : **Polymers:** Definition – Types of Polymerization (Addition & Condensation) – Mechanisms of Addition Polymerization – Radical and Ionic – Thermodynamics of Polymerization Process. **Plastics:** Thermosetting and Thermoplastics – Effect of Polymer Structure on Properties of Cellulose Derivatives – Vinyl Resins – Nylon (6,6), Reinforced Plastics – Conducting Polymers.

Corrosion : **Corrosion:** Origin and Theory – Types of Corrosion: Chemical and Electrochemical; Pitting, Inter granular, Waterline, Stress – Galvanic Series – Factors Effecting Corrosion.

Corrosion Controlling Methods: Protective Coatings: Metallic Coatings, Electroplating and Electroless Plating – Chemical conversion Coatings – Phosphate, Chromate, Anodized, Organic Coatings – Paints and Special Paints.

Fuels and Lubricants : **Solid Fuels:** Wood and Coal, Ranking of Coal – Analysis (Proximate and Ultimate) Coke Manufacture – Otto Hoffmann's Process – Applications; **Liquid Fuels:** Petroleum Refining – Motor Fuels – Petrol and Diesel Oil – Knocking – Octane number – Cetane Number; **Gaseous Fuels:** Biogas, LPG and CNG – Characteristics – Applications; **Rocket Fuels:** Propellants – Classification – Characteristics

Lubricants: Classification – Mechanism – Properties of Lubricating Oils – Selection of Lubricants for Engineering Applications.

Nanomaterials : Nanomaterials, Properties and application of fullerenes, fullerals, Carbon nanotubes and nanowires. Synthesis - Top-down and Bottom-up approaches - Nanocomposites - Nanoelectronics- Applications of nanomaterials in catalysis, telecommunication and medicine.

Text Books:

1. Engineering Chemistry – PC Jain and M. Jain – Dhanpath Rai and Sons, New Delhi.
2. A Text book of Engineering Chemistry – S. S. Dara – S. Chand & Co. New Delhi.

Reference Books:

1. Engineering Chemistry – B. K. Sharma – Krishna Prakashan – Meerut.
2. Introduction to Nanoscience - S. M. Lindsay - Oxford University Press
3. Engineering Chemistry - B. L. Tembe, Kamaluddin and M. S. Krishnan, (NPTEL).

BT-1103 : ENGLISH

Course Objectives:

- To make students understand the explicit and implicit meanings of a text/topic;
- To give exposure to new words and phrases, and aid to use them in different contexts;
- To apply relevant writing formats to draft essays, letters, emails and presentations; and

- To adapt oneself to a given situation and develop a functional approach to finding solutions: adaptability and problem solving.

Course Outcomes:

- Students will be able to analyse a given text and discover the various aspects related to language and literature;
- Learn the various language structures, parts of speech and figures of speech;
- Develop one's reading and writing abilities for enhanced communication; and
- Learn to apply the topics in real-life situations for creative and critical use.

SYLLABUS

On the conduct of life: William Hazlitt

Life skills: Values and Ethics

If: Rudyard Kipling

The Brook: Alfred Tennyson

Life skills: Self-Improvement

How I Became a Public Speaker: George Bernard Shaw

The Death Trap: Saki

Life skills: Time Management

On saving Time: Seneca

Chindu Yellama

Life skills: Innovation

Muhammad Yunus

Politics and the English Language: George Orwell

Life skills: Motivation

Dancer with a White Parasol: Ranjana Dave

Grammar: Prepositions – Articles – Noun-Pronoun Agreement, Subject-Verb Agreement – Misplaced Modifiers – Clichés, Redundancies.

Vocabulary: Introduction to Word Formation – Root Words from other Languages – Prefixes and Suffixes – Synonyms, Antonyms – Common Abbreviations

Writing: Clauses and Sentences – Punctuation – Principles of Good Writing – Essay Writing – Writing a Summary

Writing: Essay Writing

Life skills: Innovation *Muhammad Yunus*

Textbook: *Language and Life: A Skills Approach* Board of Editors, Orient Blackswan Publishers, India. 2018.

References :

1. *Practical English Usage*, Michael Swan. OUP. 1995.
2. *Remedial English Grammar*, F.T. Wood. Macmillan. 2007
3. *On Writing Well*, William Zinsser. Harper Resource Book. 2001
4. *Study Writing*, Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
5. *Communication Skills*, Sanjay Kumar and PushpLata. Oxford University Press. 2011.
6. *Exercises in Spoken English*, Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

BT-1104 : CPNM

Course Objectives:

- The course is designed to provide complete knowledge of C language.
- To provide students with understanding of code organization and functional hierarchical decomposition with using complex data types.
- To provide knowledge to the Students to develop logics which will help them to create programs, applications in C.
- This course aims to identify tasks in which the numerical techniques learned are applicable and apply them to write programs, and hence use computers effectively to solve the task.
- This course provides the fundamental knowledge which is useful in understanding the other programming languages.

Course Outcomes:

- Identify basic elements of C programming structures like data types, expressions, control statements, various simple functions and Apply them in problem solving.
- Apply various operations on derived data types like arrays and strings in problem solving.
- Design and Implement of modular Programming and memory management using Functions, pointers.
- Apply Structure, Unions and File handling techniques to Design and Solve different engineering programs with minimal complexity.
- Apply Numerical methods to Solve the complex Engineering problems.

SYLLABUS

1. Introduction to C: Basic structure of C program, Constants, Variables and data types, Operators and Expressions, Arithmetic Precedence and associativity, Type Conversions. Managing Input and Output Operations Formatted Input, Formatted Output.

2. Decision Making, Branching, Looping, Arrays & Strings: Decision making with if statement, Simple if statement, The if...else statement, Nesting of if...else statement, the else..if ladder, switch statement, the (?:) operator, the GOTO statement., The while statement, the do statement, The for statement, Jumps in Loops ,One, Two-dimensional Arrays, Character Arrays. Declaration and initialization of Strings, reading and writing of strings, String handling functions, Table of strings.

3. Functions: Definition of Functions, Return Values and their Types, Function Calls, Function Declaration, Category of Functions: No Arguments and no Return Values, Arguments but no Return Values, Arguments with Return Values, No Argument but Returns a Value, Functions that Return Multiple Values. Nesting of functions, recursion, passing arrays to functions, passing strings to functions, the scope, visibility and lifetime of variables.

4. Pointers: Accessing the address of a variable, declaring pointer variables, initializing of pointer variables, accessing variables using pointers, chain of pointers, pointer expressions, pointers and arrays, pointers and character strings, array of pointers, pointers as function arguments, functions returning pointers, pointers to functions, pointers to structures-Program Applications

5. Structure and Unions: Defining a structure, declaring structure variables, accessing structure members, structure initialization, copying and comparing structure variables, arrays of structures, arrays within structures, structures within structures, structures and functions and unions, size of structures and bit-fields- Program applications.

6. File handling: Defining and opening a file, closing a file, Input/ Output operations on files, Error handling during I/O operations, random access to files and Command Line Arguments- Program Applications

7. Numerical Methods: Solutions of Algebraic and Transcendental Equations, Bisection Method, Newton Raphson Method. Newton's forward and backward Interpolation, Lagrange's Interpolation in unequal intervals. Numerical Integration: Trapezoidal rule, Simpson's 1/3 rules. Solutions of Ordinary First Order Differential Equations: Euler's Method, Modified Euler's Method and Runge-Kutta Method.

Text Book:

1. Programming in ANSI C, E Balagurusamy, 6th Edition. McGraw Hill Education (India) Private Limited.
2. Introduction to Numerical Methods, SS Sastry, Prentice Hall

Reference Books:

1. Let Us C ,YashwantKanetkar, BPB Publications, 5th Edition.
2. Computer Science, A structured programming approach using C", B.A.Forouzan and R.F.Gilberg, " 3rd Edition, Thomson, 2007.
3. The C –Programming Language' B.W. Kernighan, Dennis M. Ritchie, PHI.
4. Scientific Programming: C-Language, Algorithms and Models in Science, Luciano M. Barone (Author), Enzo Marinari (Author), Giovanni Organtini, World Scientific.

BT-1105 : BIOLOGY

Course Objectives:

- To study about the cell structure and function.
- To study about the plant structure, functions of various cells in the plants, flower structure, pollination and fertilization.
- To study about the physiological processes in the plant and various methods of plant breeding techniques.
- To study about the general characters of animals- invertebrates, vertebrates.
- To study about the general physiological processes like digestion, respiration, and excretion etc of the animals.

Course Outcomes:

- Students will obtain knowledge in the biological processes occurring in the cells.
- Students will obtain knowledge in the structure of plants, and understand the phenomena of Embryology so that they can acquire knowledge to produce new varieties of plants.
- Students will obtain knowledge in various physiological processes of the plants and they also acquire knowledge in plant breeding techniques.
- Students will obtain knowledge in the general characters of animals and understand the phenomena of reproduction and life cycle of plasmodium vival.
- Students will obtain knowledge in various physiological processes of the animals. Digestion, respiration Excretory system, Nervous system functions are understood to the student so that student can do research in their future studies.

SYLLABUS

Cell Biology: Structure and function of prokaryotic and eukaryotic cell, cell organelles, cell membrane, chloroplast, mitochondria, golgi complex,

endoplasmic reticulum, lysosomes, ribosomes and nucleus, chromosome structure, mitosis and meiosis,

Plant Biology: Parts of a flowering plant; flower-structure of a typical flower, outline description of floral parts – androecium, gynoecium,

Embryology: Structure of anther, microsporogenesis and development of male gametophyte, structure of ovule, megasporogenesis, development of embryo sac. fertilization, process of fertilization and post fertilization changes,

Anatomy: Structure and function of xylem and phloem, internal structure of dicot root, stem and leaf, monocot root, stem and leaf, secondary growth of dicot stem,

Plant Physiology: Water relations of plants, absorption of water by plants, diffusion, water potential, osmosis, plasmolysis, imbibition, active and passive absorption,

Mineral nutrition: Criteria for essentiality, macro elements (nitrogen, phosphorus and potassium) and microelements,

Photosynthesis: photosynthetic pigments, light reaction-Emerson enhancement effect, photo system I and II, photolysis of water, photophosphorylation, CO₂ fixation – C₃, C₄ and CAM pathway, photorespiration, factors affecting photosynthesis – Blackman's law of limiting factors,

Nitrogen metabolism: Introduction, nitrogen cycle, biological nitrogen fixation,

Plant Growth Regulators: Auxins, gibberellins, cytokinins, abscisic acid and ethylene,

Plant Breeding: Methods of plant breeding: selection, hybridization, hybrid vigor and mutational breeding,

Animal Biology: General characters of invertebrates, morphology, life cycle and reproduction of Plasmodium Vivax, general characters of vertebrates.

Animal Physiology: Animal nutrition- modes of nutrition, digestive system of humans and accessory digestive organs, gastrointestinal secretions, digestion, absorption and assimilation of digested products, egestion,

Respiration: Respiration in humans – respiratory system, mechanism of respiration,

Circulatory system: Blood vascular system in humans, blood and its components, heart, pumping action of heart, heart beat and pulse, important blood vessels and course of blood circulation, lymphatic system-lymph, lymph vessels, lymph nodes and lymphatic ducts and pacemakers,

Excretion: Elimination of nitrogenous waste- ammonotelic, ureotelic and uricotelic, structure of human excretory system, structure of urinary system, anatomy of kidney, and structure of nephron,

Nervous system: Structure of neuron, nerve impulse and its conduction, synapse, central nervous system- lobes of brain and its meninges, spinal cord, Peripheral nervous system- Cranial nerves and spinal nerves, autonomous nervous system, sympathetic and parasympathetic nervous system, reflex action, reflex arch of humans.

Text books:

1. 'Biology Text Book for class XI and XII', NCERT.
2. 'AP Academy Text Book for Botany and Zoology, for intermediate

BT-1106 : ENGLISH LANGUAGE LAB

Course Objectives:

- To make students recognize the sounds of English through Audio-Visual aids;
- To help students build their confidence and help them to overcome their inhibitions and self- consciousness while speaking in English;
- To familiarize the students with stress and intonation and enable them to speak English effectively; and
- To give learners exposure to and practice in speaking in both formal and informal contexts.

Course Outcomes:

- Students will be sensitized towards recognition of English sound patterns and the fluency in their speech will be enhanced;
- A study of the communicative items in the laboratory will help students become successful in the competitive world;
- Students will be able to participate in group activities like roleplays, group discussions and debates; and
- Students will be able to express themselves fluently and accurately in social as well professional context.

SYLLABUS

Introduction to Phonetics: The Sounds of English (Speech sound – vowels and consonants) - Stress and Intonation - Accent and Rhythm.

Listening Skills: Listening for gist and specific information - listening for Note taking, summarizing and for opinions - Listening to the speeches of eminent personalities.

Speaking Skills: Self-introduction - Conversation Skills (Introducing and taking leave) - Giving and asking for information - Role Play - Just A Minute (JAM) session - Telephone etiquette.

Reading and Writing skills: Reading Comprehension – Précis Writing - E-Mail writing - Punctuation.

Presentation skills: Verbal and non-verbal communication - Body Language - Making a Presentation.

Reference Books:

1. Ashraf Rizvi. *Effective Technical Communication*. Tata McGraw Hill Education Private Limited, New Delhi.
2. *Speak Well*. Orient Blackswan Publishers, Hyderabad.
3. Allan Pease. *Body Language*. Manjul Publishing House, New Delhi.

BT-1107 : CHEMISTRY LAB

Course Objectives:

- To develop the fine skills of quantitative determination of various chemical components through titrimetric analysis
- To prepare and use ion exchange / zeolite columns for the removal of hardness of water
- To develop the skill of organic synthesis through the preparation of a polymer/ drug

Course Outcomes:

- The course provides quantitative determine the amount of various chemical species in solutions by titrations and conduct the quantitative determinations with accuracy
- The course provides to develop novel materials to be used as zeolite and prepare columns for removal of hardness of water
- The course provides to synthesis a polymer or a drug

SYLLABUS

1. Determination of Sodium Hydroxide with HCl (Na_2CO_3 Primary Standard)
2. Determination of Alkalinity (Carbonate and Hydroxide) of water sample
3. Determination of Fe(II)/Mohr's Salt by Permanganometry
4. Determination of Oxalic Acid by Permanganometry
5. Determination of Chromium (VI) by Mohr's Salt Solution
6. Determination of Zinc by EDTA method
7. Determination of Hardness of Water sample by EDTA method
8. Determination of Chlorine in water by Iodometric Titration
9. Ionexchange/ Zeolite column for removal of hardness of water
10. Synthesis of Polymer/ drug

Reference Books:

1. Vogel's Quantitative Chemical Analysis – V – Edition – Longman.

2. Experiments in Applied Chemistry (For Engineering Students) – Sinita Rattan – S. K. Kataria & Sons, New Delhi

BT-1108 : CPNM LAB

Course Objectives:

- To impart writing skill of C programming to the students and solving problems.
- To write and execute programs in C to solve problems such as Modularize the problems into small modules and then convert them into programs.,
- To write and execute programs in C to solve problems such as arrays, files, strings, structures and different numerical methods.
- This reference has been prepared for the beginners to help them understand the basic to advanced concepts related to Objective-C Programming languages.

Course Outcomes:

- Understand various computer components, Installation of software. C programming development environment, compiling, debugging, and linking and executing a program using the development environment.
- Analyzing the complexity of problems, Modularize the problems into small modules and then convert them into programs.
- Construct programs that demonstrate effective use of C features including arrays, strings, structures, pointers and files.
- Apply and practice logical ability to solve the real world problems.
- Apply Numerical methods to Solve the complex Engineering problems.

SYLLABUS

1. Write a program to read x, y coordinates of 3 points and then calculate the area of a triangle formed by them and print the coordinates of the three points and the area of the triangle. What will be the output from your program if the three given points are in a straight line?
2. Write a program, which generates 100 random integers in the range of 1 to 100. Store them in an array and then print the arrays. Write 3 versions of the program using different loop constructs. (e.g. for, while, and do while).
3. Write a set of string manipulation functions e.g. for getting a sub-string from a given position, Copying one string to another, Reversing a string, adding one string to another.

4. Write a program which determines the largest and the smallest number that can be stored in different data types like short, int, long, float, and double. What happens when you add 1 to the largest possible integer number that can be stored?
5. Write a program, which generates 100 random real numbers in the range of 10.0 to 20.0, and sort them in descending order.
6. Write a function for transposing a square matrix in place (in place means that you are not allowed to have full temporary matrix).
7. First use an editor to create a file with some integer numbers. Now write a program, which reads these numbers and determines their mean and standard deviation.
8. Given two points on the surface of the sphere, write a program to determine the smallest arc length between them.
9. Implement bisection method to find the square root of a given number to a given accuracy.
10. Implement Newton Raphson method to det. a root of polynomial equation.
11. Given table of x and corresponding f(x) values, Write a program which will determine f(x) value at an intermediate x value by using Lagrange's interpolation/
12. Write a function which will invert a matrix.
13. Implement Simpson's rule for numerical integration.
14. Write a program to solve a set of linear algebraic equations.

BT-1201 : MATHEMATICS – II

Course Objectives:

- The way of obtaining rank, eigen values and eigen vectors of a matrix.
- To know the importance of Cayley-Hamilton theorem and getting canonical form from a given quadratic form.
- To solve the system of equations by using direct and indirect methods.
- To solve first order and higher order differential equations by various methods.
- To obtain the Laplace transforms and inverse Laplace transforms for a given functions and their applications.

Course Outcomes:

- Find rank, eigen values and eigen vectors of a matrix and understand the importance of Cayley-Hamilton theorem.
- Reduce quadratic form to canonical forms and solving linear systems by direct and indirect methods.

- Demonstrate solutions to first order differential equations by various methods and solve basic applications problems related to electrical circuits, orthogonal trajectories and Newton's law of cooling
- Discriminate among the structure and procedure of solving higher order differential equations with constant and variable coefficients.
- Understand Laplace transforms and its properties and finding the solution of ordinary differential equations.

SYLLABUS

(Linear Algebra) Rank of a matrix- Echelon form, Normal Form - Solution of Linear System of Equations - Consistency of Linear System of Equations - Direct & Indirect Methods: Gauss elimination method, LU Factorization method, Gauss Seidal Method. Complex Matrices: Hermitian, Skew-Hermitian and Unitary Matrices and their Properties.

(Eigen Values and Eigen Vectors) Eigen Values and Eigen Vectors of a Matrix - Cayley-Hamilton theorem - Inverse and Powers of a Matrix using Cayley-Hamilton's theorem and its applications. Diagonalization of a Matrix - Quadratic Forms - Reduction of Quadratic Form to Canonical Form - Nature of a Quadratic Form.

(Ordinary Differential Equations of First Order and its Applications) Formation of ordinary differential equations (ODEs) - Solution of an ordinary differential equation - Equations of the first order and first degree - Linear differential equation - Bernoulli's equation - Exact differential equations - Equations reducible to exact equations - Orthogonal Trajectories - Simple Electric (LR & CR) Circuits - Newton's Law of Cooling - Law of Natural growth and decay.

(Differential Equations of Higher Order) Solutions of Linear Ordinary Differential Equations with Constant Coefficients - Rules for finding the complimentary function - Rules for finding the particular integral - Method of variation of parameters - Cauchy's linear equation - Legendre's linear equation - Simultaneous linear differential equations.

(Laplace Transforms) Introduction - Existence Conditions - Transforms of Elementary Functions - Properties of Laplace Transforms - Transforms of Derivatives - Transforms of Integrals - Multiplication by t^n - Division by t - Evaluation of integrals by Laplace Transforms - Inverse Laplace Transform - Applications of Laplace Transforms to Ordinary Differential Equations - Simultaneous Linear Differential Equations with Constant Coefficients - Second Shifting Theorem - Laplace Transforms of Unit Step Function, Unit Impulse Function and Laplace Transforms of Periodic Functions.

TEXT BOOK:

Scope and Treatment as in "Higher Engineering Mathematics", by Dr. B.S. Grewal, 43rd edition, Khanna publishers.

REFERENCE BOOKS:

1. Graduate Engineering Mathematics by V B Kumar Vatti., I.K. International publishing house Pvt. Ltd.
2. Advanced Engineering Mathematics by Erwin Kreyszig.
3. A text book of Engineering Mathematics, by N.P. Bali and Dr. Manish Goyal. Lakshmi Publications.
4. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.
5. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.

BT-1202 : PHYSICS

Course Objectives:

- To impart knowledge in basic concept of physics of Thermodynamics relevant to engineering applications.
- To grasp the concepts of physics for electromagnetism and its application to engineering. Learn production of Ultrasonics and their applications in engineering.
- To Develop understanding of interference, diffraction and polarization: connect it to a few engineering applications.
- To Learn basics of lasers and optical fibers and their use in some applications.
- To Understand concepts and principles in quantum mechanics and Nanopahse Materials. Relate them to some applications.

Course Outcomes:

- Understand the fundamentals of Thermodynamics and Laws of thermodynamics. Understand the working of Carnot cycle and concept of entropy.
- Gain Knowledge on the basic concepts of electric and magnetic fields. Understand the concept of the nature of magnetic materials. Gain knowledge on electromagnetic induction and its applications .
- Understand the Theory of Superposition of waves. Understand the formation of Newton's rings and the working of Michelson's interferometer. Remember the basics of diffraction, Evaluate the path difference. Analysis of Fraunhofer Diffraction due to a single slit
- Understand the interaction of matter with radiation, Characteristics of Lasers, Principle, working schemes of Laser and Principle of Optical Fiber. Realize their role in optical fiber communication.
- Understand the intuitive ideas of the Quantum physics and understand dual nature of matter. Compute Eigen values, Eigen functions, momentum of Atomic and subatomic particles using Time independent one

Dimensional Schrodinger's wave equation. Understand the fundamentals and synthesis processes of Nanophase materials.

SYLLABUS

THERMODYNAMICS Introduction, Heat and Work, First law of thermodynamics and applications, Reversible and Irreversible process, Carnot cycle and Efficiency, Second law of thermodynamics, Carnot's Theorem, Entropy, Second law in terms of entropy, Entropy and disorder, Third law of thermodynamics (statement only).

ELECTROMAGNETISM Concept of electric flux, Gauss's law - some applications, Magnetic field - Magnetic force on current, torque on current loop, The Biot-Savart's Law, B near a long wire, B for a circular Current loop, Ampere's law, B for a solenoid, Hall effect, Faraday's law of induction, Lenz's law, Induced magnetic fields, Displacement current, Maxwell's equations (no derivation), Magnetic materials: Classification of magnetic materials and properties.

Ultrasonics : Introduction, Production of Ultrasonics – Piezoelectric and Magnetostriction methods, acoustic grating, applications of ultrasonics.

OPTICS

Interference: Principles of superposition – Young's Experiment – Coherence - Interference in thin films (reflected light), Newton's Rings, Michelson Interferometer and its applications.

Diffraction: Introduction, Differences between interference and diffraction, Fresnel and Fraunhofer diffraction, Fraunhofer diffraction at a single slit (Qualitative and quantitative treatment).

Polarisation: Polarisation by reflection, refraction and double refraction in uniaxial crystals, Nicol prism, Quarter and Half wave plate, circular and elliptical polarization.

LASERS and FIBRE OPTICS Introduction, characteristics of a laser beam, spontaneous and stimulated emission of radiation, population inversion, Ruby laser, He-Ne laser, Semiconductor laser, applications of lasers

Introduction to optical fibers, principle of propagation of light in optical fibers, Acceptance Angle and cone of a fibre, Numerical aperture, Modes of propagations, classification of fibers, Fibre optics in communications, Application of optical fibers.

MODERN PHYSICS Introduction, De Broglie concept of matter waves, Heisenberg uncertainty principle, Schrodinger time independent wave equation, application to a particle in a box. Free electron theory of metals, Kronig - Penney model (qualitative treatment), Origin of energy band formation in solids, Classification of materials into conductors, semi conductors and insulators.

Nanophase Materials : Introduction, properties, Top-down and bottom up approaches, Synthesis - Ball milling, Chemical vapour deposition method , sol-gel methods, Applications of nano materials.

TEXT BOOKS :

1. Physics by David Halliday and Robert Resnick – Part I and Part II - Wiley.
2. A textbook of Engineering Physics, Dr. M. N. Avadhanulu, Dr. P.G. Kshirsagar - S. Chand
3. Engineering Physics by R.K. Gaur and S.L. Gupta –Dhanpat Rai

Reference Books:

1. Modern Engineering Physics by A.S. Vadudeva
2. University Physics by Young and Freedman

BT-1203 : ENGINEERING GRAPHICS

Course Objectives:

- Understand the basics of Engineering Graphics and BIS conventions.
- Develop the graphical skills for communication of concepts, ideas and design of engineering products through technical drawings
- Demonstrate and practice the various profiles/curves used in engineering practice through standard procedures.
- Demonstrate and practice the orthographic projections of points, lines, planes, solids and section of solids
- Demonstrate and practice the development of surfaces of simple solids
- Familiarize the basic concept of isometric views clearly.

Course Outcomes:

- Develop simple engineering drawings by considering BIS standards.
- Able to draw different engineering curves with standard Procedures
- Comprehend the basics of orthographic projections and deduce orthographic projections of points, lines, planes and solids at different orientations in real life environment.
- Visualize clearly the sections of solids.
- Apply the concepts of development of surfaces while designing/analyzing any product.
- Recognize the significance of isometric drawing to relate 2D environment with 3D environment.

SYLLABUS

Introduction: Lines, Lettering and Dimensioning, Geometrical Constructions, and Scales.

Curves: Conic sections: General construction of ellipse, parabola and hyperbola. Construction of involutes of circle and polygons only. Normal and tangent to curves.

Projections of Points: Principal or Reference Planes, Projections of a point situated in any one of the four quadrants.

Projections of Straight Lines: Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane.

Projections of Straight Line Inclined to Both the Reference Planes: Projections of Planes: Projection of Perpendicular planes: Perpendicular to both reference planes, perpendicular to one reference plane and parallel to other reference plane and perpendicular to one reference plane and inclined to other reference plane. Projection of Oblique planes. Introduction to Auxiliary Planes.

Projections of Solids: Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to other and axes inclined to both the reference planes.

Sections of Solids: Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids (Prism, Pyramid, Cylinder and Cone) in simple position only.

Development of Surfaces: Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.

Isometric Views: Isometric projection, Isometric scale and Isometric view. Isometric view of Prisms, Pyramids, cylinder, cone, and their combinations.

Text Book:

Elementary Engineering Drawing by N.D.Bhatt, Charotar Publishing House.

Reference:

Engineering Graphics by K.L. Narayana and P. Kanniah, Tata McGraw Hill

BT-1204 : GENETICS

Objectives:

- To introduce Mendel's law of inheritance.
- To introduce interaction of Genes and inheritance.
- To introduce Gene linkage, crossing over and mapping.

- To introduce sex determination & linkage.
- To introduce chromosomes & chromosomal variation.

Outcome:

- To know inheritance, different types of inheritance.
- To know gene interaction. To know about complementary, duplicate genes and interaction between different two gene pairs.
- To know linkage patterns, different cross gene types.
- To know sex determination mechanisms and inheritance of sex linked traits.
- To know different types of cytogenetic effects and numerical changes in chromosomes.

SYLLABUS

Mendel's law of Inheritance: Mendel's experiments–Mendel's materials, crossing technique, results of Mendel's experiments, phenomenon of dominance, variation in dominance relation, incomplete dominance, co-dominance, principle of segregation-mono hybrid cross, mechanism of segregation, mono hybrid ratio, principle of independent assortment, Mendel's dihybrid cross, mechanism of independent assortment, dihybrid ratio, back cross and test cross, deviations from dihybrid phenotypic ratio,

Interaction of Genes: Interaction of genes-combs in fowls, Epistasis, complementary genes, duplicate genes, additional interactions involving two gene pairs, interaction between more than two gene pairs,

Quantitative / Multiple factor inheritance: Multiple factors, quantitative and quantitative traits, examples of quantitative inheritance, Kernel color in wheat, skin color in man, corolla length in tobacco, continuous variations,

Multiple alleles : (Based on classical concept of Allelomorphism): Multiple alleles and isoalleles, skin color in rodents, eye color in Drosophila, self sterility in Nicotiana, blood groups in humans, complementation test or cis-trans test,

Linkage, crossing over and mapping:

Linkage – coupling and repulsion hypothesis, Morgan's view on linkage, chromosome theory of linkage, kinds of linkage-complete linkage, incomplete linkage, linkage groups, significance of linkage,

Crossing over – Types of crossing over - mitotic and meiotic crossing over, mechanism - synapsis, duplication of chromosomes, crossing over by breakage and union, terminalization,

Molecular mechanism of recombination- Holiday model, cytological basis of crossing over; significance of crossing over,

Construction of a genetic mapping: Two point and three point test crosses and gene mapping, interference and coincidence,

Sex Determination :Genetically controlled sex determining mechanisms, sex chromosomal mechanism of sex determination, types-heterogenetic males, heterogenetic females, genic balance mechanism (X/A ratio in Drosophila), sex determination in man (TDF and SRY genes), sex determination in plants; Single gene control of sex; haploid males in hymenoptera; hormonal control of sex, environmental control of sex, dosage compensation (in man and Drosophila),

Sex Linkage: Inheritance of sex linked (X-linked) traits-eye color in Drosophila, haemophilia and color blindness in human and barred plumage in poultry, inheritance of Y-linked genes, inheritance of XY-linked genes, primary and secondary non-disjunction of sex chromosomes, sex influenced and sex limited traits, sex linked disorders in human beings,

Cytoplasmic Inheritance : Maternal effects-shell coiling in snails, pigment in flour moth, cytoplasmic inheritance involving dispensable heredity units, kappa particles in Paramecium, cytoplasmic inheritance by cellular organelles, plastid inheritance in variegated four-o'clock plant, mitochondrial inheritance, male sterility in plants, uniparental inheritance in Chlamydomonas,

Chromosomal variations: Origin, types and cytogenetic effects,

Structural changes in chromosomes: Duplications, translocations, inversions (paracentric and pericentric cross over suppressors),

Numerical changes in chromosomes: Aneuploidy (monosomy, nullisomy, trisomy, tetrasomy), euploidy (monoploidy, haploidy, polyploidy-autopolyploids and allopolyploids).

Text books:

1. "Genetics", by P.K.Gupta, Rastogi Publications
2. "Cell Biology, Genetics, Molecular Biology, Evolution and Ecology", by P.S. Verma & V.K. Agarwal, S. Chand & Company

Reference book:

- a. "Principles of Genetics", by E.J. Gardner, M.J. Simmons & D. Peter Snustard, John Wiley & Sons, INC Publishing Co.
3. 'Essentials of Materials Science' by A.G. Guy.
4. An introduction to corrosion science and engineering By Herbert Uhlig and R. Winston Revie, Published by John Wiley and sons, New York

BT-1205 : MICROBIOLOGY

Course objectives:

- To make the student learn about origin and evolution of microbes.
- To make the student understand structure and functioning of different microbial groups.

- To make them to acquaint the cultivation of microbes in artificial medium.

Course Outcomes:

- Students gain the knowledge and skills both theoretically and practically.
- Students are equipped with theoretical approach to study them and understand their importance in ecosystem

SYLLABUS

History and Development of Microbiology: Contributions of van Leeuwenhoek, Joseph Lister, Pasteur, Koch, Jenner, Winogradsky, Beijerinck, further developments of microbiology,

Microbial Taxonomy: Bacteria, archaea and their broad classification. Molecular approaches to microbial taxonomy, physiology of extremophiles,

Morphology and Functions of Viruses, Yeast, Molds and Bacteria: Viruses- Morphology of viruses- size, shape and symmetry, replication of viruses- Lytic and Lysogenic cycle,

Yeast and Molds: Morphology, life cycle, economic importance of yeast and Aspergillus,

Bacteria : Ultra structure of bacteria, cell wall, cell membrane, flagella, pili, capsule, endospore, and cell inclusions, differences between prokaryotic and eukaryotic cell,

Microbial growth: Definition of growth- growth curve, measurement of bacterial growth (cell number and cell mass) growth yield, continuous culture- chemostat, turbidostat, synchronous growth, effect of environmental factors on growth,

Microbial Nutrition and Control of Microorganisms: Nutritional requirements, nutritional types of bacteria, up-take of nutrients by cell, sterilization, and disinfection, effect of physical (moist and dry heat, radiation and filtration) and chemical agents, antibiotics- mode of action and resistance,

Methods in Microbiology: Culture media, synthetic and complex media, solidifying agents, types of media, isolation of pure cultures- spread plate, pour plate and streak plate, preservation of microorganisms, light (bright field only) and electron microscopy,

Applied Microbiology: Water, food and milk born contamination and remedy; basic microbial genetics- transformation, conjugation, transduction, strain improvement of industrially important micro-organisms.

Text book:

1. 'Microbiology', by Prescott L.M., Herley J.P., Klein D.A., McGraw-Hill

Reference books:

1. "Microbiology", Pelzar, M.J., Chan, E.C.S., Kreig N.R., Tata McGraw-Hill

2. "Brock biology of Microorganisms", Madigan M.T., Martinco J.M. and Parker J., Prentice Hall

BT-1206 : WORKSHOP LAB

Course Objectives:

- Get hands on experience with the working skills in Carpentry trade.
- Know how to work with Sheet Metal tools.
- Get familiar with the working skills of Metal Fitting operations.
- Get hands on experience with house hold electrical wiring.

Course Outcomes:

- Can be able to work with Wood Materials in real time applications.
- Can be able to build various parts with Sheet Metal in day-to-day life.
- Can be able to apply Metal Fitting skills in various applications.
- Can be able to apply this knowledge to basic house electrical wiring and repairs.

SYLLABUS

Carpentry: Any three jobs from – Half lap joint, Mortise and Tenon joint, Half – lap Dovetail joint, Corner Dovetail joint, Central Bridle joint.

Sheet Metal: Any three jobs from – Square tray, Taper tray(sides), Funnel, Elbow pipe joint.

Fitting: Any three jobs from – Square, Hexagon, Rectangular fit, Circular fit and Triangular fit.

House wiring: Any three jobs from – Tube light wiring, Ceiling fan wiring, Stair-case wiring, Corridor wiring.

References:

1. Elements of workshop technology, Vol.1 by S. K. and H. K. Choudary.
2. Work shop Manual / P.Kannaiah/ K.L.Narayana/ SciTech Publishers.
3. Engineering Practices Lab Manual, Jeyapoovan, Saravana Pandian, 4/e Vikas.

BT-1207 : PHYSICS LAB

Course Objectives:

- To enable the students to acquire skill, technique and utilization of the Instruments
- Draw the relevance between the theoretical knowledge and to imply it in a practical manner with respect to analyze various electronic circuits and its components.

- To impart the practical knowledge in basic concepts of Wave optics, Lasers and Fiber optics.
 - To familiarize the handling of basic physical apparatus like Vernier callipers, screw gauge, spectrometers, travelling microscope, laser device, optical fibre, etc.
- Course Outcomes:
- Ability to design and conduct experiments as well as to analyze and interpret
 - Ability to apply experimental skills to determine the physical quantities related to Heat, Electromagnetism and Optics
 - The student will learn to draw the relevance between theoretical knowledge and the means to imply it in a practical manner by performing various relative experiments.

SYLLABUS

1. Determination of Radius of Curvature of a given Convex Lens By forming Newton's Rings.
2. Determination of Wavelength of Spectral Lines in the Mercury Spectrum by Normal Incidence method.
3. Study the Intensity Variation of the Magnetic Field along axis of Current Carrying Circular Coil.
4. Determination of Cauchy's Constants of a Given Material of the Prism using Spectrometer.
5. Determination of Refractive Index of Ordinary ray m_o and Extraordinary m_e ray.
6. Determination of Thickness Given Paper Strip by Wedge Method.
7. Calibration of Low Range Voltmeter.
8. Calibration of Low Range Ammeter.
9. Determination of Magnetic Moment and Horizontal Component of Earth's Magnetic Field.
10. Lees Method - Coefficient of thermal Conductivity of a Bad Conductor.
11. Carey Foster's Bridge – Verification of laws of Resistance and Determination Of Specific Resistance.
12. Melde's Apparatus – Frequency of electrically maintained Tuning Fork.
13. Photoelectric cell-Characteristics.
14. Planks Constants.
15. Laser- Diffraction.

BT-1208 : MICROBIOLOGY LABORATORY

Course objectives:

- To provide the basic fundamental knowledge on growth of microorganisms
- To provide the basic fundamental knowledge on reaction of microorganisms with specific growth media
- To understand biochemical reactions with media used in identification.

Course outcomes:

- To evaluate the growth and reaction of microorganisms on specific media
- To Understand the staining and motility of microbes
- To differentiate the morphology of Fungi and yeast
- To evaluate quality of milk and water

List of Experiments:

1. Preparation of Nutrient broth and inoculation of Bacteria.
2. Preparation of Nutrient agar and inoculation of Bacteria
3. Isolation of pure cultures
4. Staining of Microbes- Simple staining, Gram staining, Negative staining, Capsule staining and spore staining.
5. Motility of Microbes.
6. Morphology of Fungi-(*Aspergillus niger*)
7. Morphology of Yeast-(*Saccharomyces cerevisiae*)
8. Bio-chemical tests- IMViC test, Amylase test, Hydrogen Sulphide production test
9. Testing of Microbiological quality of milk.
10. Testing of Microbiological quality of water.
11. Microbial assay of antibiotics.
12. Evaluation of disinfectant.

Text book:

'Microbiology- a Laboratory Manual' by Cappuccino T.G., Sherman N, Addison

CIVIL ENGINEERING

Scheme and Syllabus (With effect from 2020-21 admitted batch)

B.Tech I Year - I Semester

Course CreditsC code	Category	Course Title	Hours per week			Internal Marks	External Marks	Total Marks	
			L	T	P				
CV-1101	BS	Mathematics – I	3	0	0	30	70	100	3

CV-1102	BS	Chemistry	3	0	0	30	70	100	3
CV-1103	HSS	English	3	0	0	30	70	100	3
CV-1104	ES	CPNM	3	0	3	30	70	100	3
CV-1105	ES	Civil Engineering Materials	3	0	0	30	70	100	3
CV-1106	HSS	English Language Lab	0	0	2	50	50	100	1.5
CV-1107	BS	Chemistry Lab	0	0	3	50	50	100	1.5
CV-1108	ES	CPNM Lab	0	0	3	50	50	100	1.5
Total Credits									19.5

B.Tech I Year - II Semester

Course Credits code	Category	Course Title	Hours per week			Internal Marks	External Marks	Total Marks	
			L	T	P				
CV-1201	BS	Mathematics – II	3	0	0	30	70	100	3
CV-1202	BS	Physics	3	0	0	30	70	100	3
CV-1203	ES	Engineering Graphics	1	0	4	30	70	100	3
CV-1204	ES	Surveying and Geomatics	3	0	0	30	70	100	3
CV-1205	ES	Engineering Mechanics	3	0	0	30	70	100	3
CV-1206	ES	Workshop Lab	0	0	3	50	50	100	1.5
CV-1207	BS	Physics Lab	0	0	3	50	50	100	1.5
CV-1208	ES	Engineering Geology Lab	0	2	2	50	50	100	1.5
Total Credits									19.5

CV-1101 : MATHEMATICS-I

Course Objectives:

- To transmit the knowledge of Partial differentiation.
- To know of getting maxima and minima of function of two variables and finding errors and approximations.
- To evaluate double and triple integrals, volumes of solids and area of curved surfaces.
- To expand a periodical function as Fourier series and half-range Fourier series.

Course Outcomes:

- Find the partial derivatives of functions of two or more variables.
- Evaluate maxima and minima, errors and approximations.
- Evaluate double and triple integrals, volumes of solids and area of curved surfaces.
- To expand a periodical function as Fourier series and half-range Fourier series.

- Have a fundamental understanding of Fourier series and be able to give Fourier expansions of a given function.

SYLLABUS

(Partial Differentiation) Introduction - Functions of two or more variables - Partial derivatives - Homogeneous functions – Euler's theorem - Total derivative - Change of variables – Jacobins. Mean value Theorems (without proofs)

(Applications of Partial Differentiation) Geometrical interpretation - Tangent plane and Normal to a surface -Taylor's theorem for functions of two variables - Errors and approximations -Total differential. Maxima and Minima of functions of two variables - Lagrange's method of undetermined multipliers - Differentiation under the integral Sign - Leibnitz's rule.

(Multiple Integrals) Introduction - Double Integrals - Change of Order of Integration - Double Integrals in Polar Coordinates - Triple Integrals - Change of Variables.

(Multiple Integrals-Applications) Area enclosed by plane curves - Volumes of solids - Area of a curved surface - Calculation of Mass - Center of gravity - Moment of inertia - product of inertia – principal axes- Beta Function - Gamma Function - Relation between Beta and Gamma Functions. Error Function or Probability Integral.

(Fourier Series) Introduction - Euler's Formulae - Conditions for a Fourier Expansion - Functions having points of discontinuity - Change of Interval - Odd and Even Functions - Expansions of Odd or Even Periodic Functions, Half-Range Series - Parseval's Formula. Practical Harmonic analysis.

TEXT BOOK:

Scope and Treatment as in "Higher Engineering Mathematics", by Dr. B.S. Grewal, 43rd Edition, Khanna publishers.

REFERENCE BOOKS:

1. Graduate Engineering Mathematics by V B Kumar Vatti., I.K.International publishing house Pvt. Ltd.
2. Advanced Engineering Mathematics by Erwin Kreyszig.
3. A text book of Engineering Mathematics, by N.P. Bali and Dr. Manish Goyal, Lakshmi Publications.
4. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.
5. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.
6. Higher Engineering Mathematics by Dr. M.K.Venkataraman.

CV-1102 : Chemistry

Course Objectives:

- To apply the basic knowledge of Chemistry to the Engineering Discipline.
- To develop knowledge about water and its treatment for industrial and potable purposes.
- To develop understanding in the areas of Polymers, Mechanism of Corrosion of Metals and Corrosion Control Methods, Fuels, Lubricants and Nanomaterials for of conducting polymers, bio-degradable polymers and fiber reinforced plastics and apply the knowledge for solving existing challenges faced in various engineering and societal areas.

Course outcome:

- This course applies the basic concepts and principles studied in Chemistry to Engineering.
- It provides an application of chemistry to different branches of engineering
- The students will be able acquire knowledge in the areas of Water Chemistry, Polymers, Corrosion, Fuels and Lubricants and nanomaterials and suggest innovative solutions for existing challenges in these areas.

SYLLABUS

Water Chemistry : Sources of Water – Impurities and their influence of living systems – WHO Limits – Hardness and its Determination – Boiler Troubles and their removal – Water Softening Methods – Lime-Soda, Zeolite and Ion Exchange - Municipal Water Treatment-Break Point Chlorination – Desalination of Sea Water – Reverse Osmosis Method, Electro-dialysis.

Polymers and Plastics

Polymers: Definition – Types of Polymerization (Addition & Condensation) – Mechanisms of Addition Polymerization – Radical and Ionic – Thermodynamics of Polymerization Process. Plastics: Thermosetting and Thermoplastics – Effect of Polymer Structure on Properties of Cellulose Derivatives – Vinyl Resins – Nylon (6,6), Reinforced Plastics – Conducting Polymers.

Corrosion

Corrosion: Origin and Theory – Types of Corrosion: Chemical and Electrochemical; Pitting, Inter granular, Waterline, Stress – Galvanic Series – Factors Effecting Corrosion.

Corrosion Controlling Methods: Protective Coatings: Metallic Coatings, Electroplating and Electroless Plating – Chemical conversion Coatings – Phosphate, Chromate, Anodized, Organic Coatings – Paints and Special Paints.

Fuels and Lubricants

Solid Fuels: Wood and Coal, Ranking of Coal – Analysis (Proximate and Ultimate) Coke Manufacture – Otto Hoffmann's Process – Applications; Liquid Fuels: Petroleum Refining – Motor Fuels – Petrol and Diesel Oil – Knocking – Octane number – Cetane Number; Gaseous Fuels: Biogas, LPG and CNG – Characteristics – Applications; Rocket Fuels: Propellants – Classification – Characteristics

Lubricants: Classification – Mechanism – Properties of Lubricating Oils – Selection of Lubricants for Engineering Applications.

Nanomaterials

Nanomaterials, Properties and application of fullerenes, fullerols, Carbon nanotubes and nanowires. Synthesis - Top-down and Bottom-up approaches - Nanocomposites - Nanoelectronics- Applications of nanomaterials in catalysis, telecommunication and medicine.

Text Books:

1. Engineering Chemistry – PC Jain and M. Jain – Dhanpath Rai and Sons, New Delhi.
2. A Text book of Engineering Chemistry – S. S. Dara – S. Chand & Co. New Delhi.

Reference Books:

1. Engineering Chemistry – B. K. Sharma – Krishna Prakashan – Meerut.
2. Introduction to Nanoscience - S. M. Lindsay - Oxford University Press
3. Engineering Chemistry - B. L. Tembe, Kamaluddin and M. S. Krishnan, (NPTEL).

CV-1103 : ENGLISH

Course Objectives:

- To make students understand the explicit and implicit meanings of a text/topic;
- To give exposure to new words and phrases, and aid to use them in different contexts;
- To apply relevant writing formats to draft essays, letters, emails and presentations; and
- To adapt oneself to a given situation and develop a functional approach to finding solutions: adaptability and problem solving.

Course Outcomes:

- Students will be able to analyse a given text and discover the various aspects related to language and literature;

- Learn the various language structures, parts of speech and figures of speech;
- Develop one's reading and writing abilities for enhanced communication; and
- Learn to apply the topics in real-life situations for creative and critical use.

SYLLABUS

On the conduct of life: William Hazlitt

Life skills: Values and Ethics

If: Rudyard Kipling

The Brook: Alfred Tennyson

Life skills: Self-Improvement

How I Became a Public Speaker: George Bernard Shaw

The Death Trap: Saki

Life skills: Time Management

On saving Time: Seneca

Chindu Yellama

Life skills: Innovation

Muhammad Yunus

Politics and the English Language: George Orwell

Life skills: Motivation

Dancer with a White Parasol: Ranjana Dave

Grammar: Prepositions – Articles – Noun-Pronoun Agreement, Subject-Verb Agreement – Misplaced Modifiers – Clichés, Redundancies.

Vocabulary: Introduction to Word Formation – Root Words from other Languages – Prefixes and Suffixes – Synonyms, Antonyms – Common Abbreviations

Writing: Clauses and Sentences – Punctuation – Principles of Good Writing – Essay Writing – Writing a Summary

Writing: Essay Writing

Life skills: Innovation

Muhammad Yunus

Textbook: Language and Life: A Skills Approach Board of Editors, Orient Blackswan Publishers, India. 2018.

References :

1. *Practical English Usage*, Michael Swan. OUP. 1995.
2. *Remedial English Grammar*, F.T. Wood. Macmillan.2007

3. *On Writing Well*, William Zinsser. Harper Resource Book. 2001
4. *Study Writing*, Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
5. *Communication Skills*, Sanjay Kumar and PushpLata. Oxford University Press. 2011.
6. *Exercises in Spoken English*, Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

CV-1104 : CPNM

Course Objectives:

- The course is designed to provide complete knowledge of C language.
- To provide students with understanding of code organization and functional hierarchical decomposition with using complex data types.
- To provide knowledge to the Students to develop logics which will help them to create programs, applications in C.
- This course aims to identify tasks in which the numerical techniques learned are applicable and apply them to write programs, and hence use computers effectively to solve the task.
- This course provides the fundamental knowledge which is useful in understanding the other programming languages.

Course Outcomes:

- Identify basic elements of C programming structures like data types, expressions, control statements, various simple functions and Apply them in problem solving.
- Apply various operations on derived data types like arrays and strings in problem solving.
- Design and Implement of modular Programming and memory management using Functions, pointers.
- Apply Structure, Unions and File handling techniques to Design and Solve different engineering programs with minimal complexity.
- Apply Numerical methods to Solve the complex Engineering problems.

SYLLABUS

1. Introduction to C: Basic structure of C program, Constants, Variables and data types, Operators and Expressions, Arithmetic Precedence and associativity, Type Conversions. Managing Input and Output Operations Formatted Input, Formatted Output.

2. Decision Making, Branching, Looping, Arrays & Strings: Decision making with if statement, Simple if statement, The if...else statement,

Nesting of if...else statement, the else..if ladder, switch statement, the (?:) operator, the GOTO statement., The while statement, the do statement, The for statement, Jumps in Loops ,One, Two-dimensional Arrays, Character Arrays. Declaration and initialization of Strings, reading and writing of strings, String handling functions, Table of strings.

3. Functions: Definition of Functions, Return Values and their Types, Function Calls, Function Declaration, Category of Functions: No Arguments and no Return Values, Arguments but no Return Values, Arguments with Return Values, No Argument but Returns a Value, Functions that Return Multiple Values. Nesting of functions, recursion, passing arrays to functions, passing strings to functions, the scope, visibility and lifetime of variables.

4. Pointers: Accessing the address of a variable, declaring pointer variables, initializing of pointer variables, accessing variables using pointers, chain of pointers, pointer expressions, pointers and arrays, pointers and character strings, array of pointers, pointers as function arguments, functions returning pointers, pointers to functions, pointers to structures-Program Applications

5. Structure and Unions: Defining a structure, declaring structure variables, accessing structure members, structure initialization, copying and comparing structure variables, arrays of structures, arrays within structures, structures within structures, structures and functions and unions, size of structures and bit-fields- Program applications.

6. File handling: Defining and opening a file, closing a file, Input/ Output operations on files, Error handling during I/O operations, random access to files and Command Line Arguments- Program Applications

7. Numerical Methods: Solutions of Algebraic and Transcendental Equations, Bisection Method, Newton Raphson Method. Newton's forward and backward Interpolation, Lagrange's Interpolation in unequal intervals. Numerical Integration: Trapezoidal rule, Simpson's 1/3 rules. Solutions of Ordinary First Order Differential Equations: Euler's Method, Modified Euler's Method and Runge-Kutta Method.

Text Book:

1. Programming in ANSI C, E Balagurusamy, 6th Edition. McGraw Hill Education (India) Private Limited.
2. Introduction to Numerical Methods, SS Sastry, Prentice Hall

Reference Books:

1. Let Us C ,YashwantKanetkar, BPB Publications, 5th Edition.
2. Computer Science, A structured programming approach using C", B.A.Forouzan and R.F.Gilberg, " 3rd Edition, Thomson, 2007.
3. The C –Programming Language' B.W. Kernighan, Dennis M. Ritchie, PHI.

4. Scientific Programming: C-Language, Algorithms and Models in Science, Luciano M. Barone (Author), Enzo Marinari (Author), Giovanni Organtini, World Scientific.

CV1105-Department

CIVIL ENGINEERING MATERIALS

Course Objectives:

- Student can enlisting the various materials of different types of stones, cement, bricks, timber, lime products, tar, bitumen, metal, sand, paints, admixtures, etc...used in building construction
- Student will have the capability of understanding the different processes of brick and cement manufacturing, and their types and uses.

Course Outcomes:

- Student will have the capability of testing of building construction materials like cement, bricks, aggregate, etc.... to find various properties of them.
- Student will have the capability of preservation of building construction materials like cement, bricks, aggregate, etc.... from the external agencies. weather, etc
- Students will understand the design concepts of different types of windows, Doors and stair cases etc

SYLLABUS

Masonry: Different Types of Stone Masonry – Plan, Elevation, Sections of Stone Masonry Works – Brick Masonry – Different Types of Bonds – Plan, Elevation and Section of Brick Bonds up to Two-Brick Wall Thickness – Partition walls – Different Types of Block Masonry – Hollow Concrete Blocks – FAL-G Blocks, Hollow Clay Blocks.

Paints, Varnishes: Paints and Varnishes: Constituents and Characteristics of Paints, Types of Paint, their uses and preparation on Different Surfaces, Painting Defects, Causes and Remedies. Constituents of Varnishes, Uses of Varnishes, Different Kinds of Varnishes, Polishes. Painting of Interior Walls, Exterior Walls, Wooden Doors and Windows – Steel Windows – Various Types of Paints (Chemistry of Paints not included) Including Distempers; Emulsion Paints etc., Varnishes Wood Work Finishing Types.

Asbestos, Asphalt Bitumen and Tar: Availability and uses of Asbestos, Properties of Asbestos, Various Types of Asbestos, Difference Between Asphalt and Bitumen, Types, Uses and Properties of Asphalt and Bitumen, Composition of Coal Tar, Wood Tar, Mineral Tar and Naphtha.

Roofing: Mangalore Tiled Roof, RCC Roof, Madras Terrace, Hollow Tiled Roof, Asbestos Cement, Fibre Glass, Aluminium, G.I. Sheet Roofings.

Trusses: King Post and Queen Post Trusses – Steel Roof Truss for 12 m Span with details.

Wooden Doors and Windows: Parallel – Glazed – Flush Shutters, Plywood, Particle Board Shutters – Aluminum, PVC, Steel Doors, Windows and Ventilators, various types of Windows, Glazing – Different Varieties.

Stair Cases: Stair Cases or Stairway Design (Architectural Design or Planning only) various types such as, Straight Flight, Dog-legged, Quarter Landing, Open Spiral, Spiral Stairs etc.

Text Books

1. Engineering Materials [Material Science] by Rangwala, Charotar Publications.
2. Building Construction by B.C. Punmia, Laxmi Publications.
3. Civil Engineering Construction Materials, S.K. Sharma, KBP House.

Reference Books

1. Concrete: Microstructure, Properties & Materials, PK Mehta, Tata McGraw-Hill Publications.
2. Building Construction, Vol.II & III By W.B. McKay, E.L.B.S. and Longman, UK.
3. Building Materials by S.K. Duggal, New Age International Publishers.

CV-1106 : ENGLISH LANGUAGE LAB

Course Objectives:

- To make students recognize the sounds of English through Audio-Visual aids;
- To help students build their confidence and help them to overcome their inhibitions and self-consciousness while speaking in English;
- To familiarize the students with stress and intonation and enable them to speak English effectively; and
- To give learners exposure to and practice in speaking in both formal and informal contexts.

Course Outcomes:

- Students will be sensitized towards recognition of English sound patterns and the fluency in their speech will be enhanced;
- A study of the communicative items in the laboratory will help students become successful in the competitive world;
- Students will be able to participate in group activities like roleplays, group discussions and debates; and
- Students will be able to express themselves fluently and accurately in social as well professional context.

SYLLABUS

Introduction to Phonetics: The Sounds of English (Speech sound – vowels and consonants) - Stress and Intonation - Accent and Rhythm.

Listening Skills: Listening for gist and specific information - listening for Note taking, summarizing and for opinions - Listening to the speeches of eminent personalities.

Speaking Skills: Self-introduction - Conversation Skills (Introducing and taking leave) - Giving and asking for information - Role Play - Just A Minute (JAM) session - Telephone etiquette.

Reading and Writing skills: Reading Comprehension – Précis Writing - E-Mail writing - Punctuation.

Presentation skills: Verbal and non-verbal communication - Body Language - Making a Presentation.

Reference Books:

1. Ashraf Rizvi. *Effective Technical Communication*. Tata McGraw Hill Education Private Limited, New Delhi.
2. *Speak Well*. Orient Blackswan Publishers, Hyderabad.
3. Allan Pease. *Body Language*. Manjul Publishing House, New Delhi.

CV-1107 : CHEMISTRY LAB

Course Objectives:

- To develop the fine skills of quantitative determination of various chemical components through titrimetric analysis
- To prepare and use ionexchange/ zeolite columns for the removal of hardness of water
- To develop the skill of organic synthesis through the preparation of a polymer/ drug

Course Outcomes:

- The course provides quantitative determine the amount of various chemical species in solutions by titrations and conduct the quantitative determinations with accuracy
- The course provides to develop novel materials to be used as zeolite and prepare columns for removal of hardness of water
- The course provides to synthesise a polymer or a drug

SYLLABUS

1. Determination of Sodium Hydroxide with HCl (Na_2CO_3 Primary Standard)
2. Determination of Alkalinity (Carbonate and Hydroxide) of water sample

3. Determination of Fe(II)/Mohr's Salt by Permanganometry
4. Determination of Oxalic Acid by Permanganometry
5. Determination of Chromium (VI) by Mohr's Salt Solution
6. Determination of Zinc by EDTA method
7. Determination of Hardness of Water sample by EDTA method
8. Determination of Chlorine in water by Iodometric Titration
9. Ionexchange/ Zeolite column for removal of hardness of water
10. Synthesis of Polymer/ drug

Reference Books:

1. Vogel's Quantitative Chemical Analysis – V – Edition – Longman.
2. Experiments in Applied Chemistry (For Engineering Students) – Sinita Rattan – S. K. Kataria & Sons, New Delhi

CV-1108 : CPNM LAB

Course Objectives:

- To impart writing skill of C programming to the students and solving problems.
- To write and execute programs in C to solve problems such as Modularize the problems into small modules and then convert them into programs.,
- To write and execute programs in C to solve problems such as arrays, files, strings, structures and different numerical methods.
- This reference has been prepared for the beginners to help them understand the basic to advanced concepts related to Objective-C Programming languages.

Course Outcomes:

- Understand various computer components, Installation of software. C programming development environment, compiling, debugging, and linking and executing a program using the development environment.
- Analyzing the complexity of problems, Modularize the problems into small modules and then convert them into programs.
- Construct programs that demonstrate effective use of C features including arrays, strings, structures, pointers and files.
- Apply and practice logical ability to solve the real world problems.
- Apply Numerical methods to Solve the complex Engineering problems.

SYLLABUS

1. Write a program to read x, y coordinates of 3 points and then calculate the area of a triangle formed by them and print the coordinates of

the three points and the area of the triangle. What will be the output from your program if the three given points are in a straight line?

2. Write a program, which generates 100 random integers in the range of 1 to 100. Store them in an array and then print the arrays. Write 3 versions of the program using different loop constructs. (e.g. for, while, and do while).

3. Write a set of string manipulation functions e.g. for getting a sub-string from a given position, Copying one string to another, Reversing a string, adding one string to another.

4. Write a program which determines the largest and the smallest number that can be stored in different data types like short, int, long, float, and double. What happens when you add 1 to the largest possible integer number that can be stored?

5. Write a program, which generates 100 random real numbers in the range of 10.0 to 20.0, and sort them in descending order.

6. Write a function for transposing a square matrix in place (in place means that you are not allowed to have full temporary matrix).

7. First use an editor to create a file with some integer numbers. Now write a program, which reads these numbers and determines their mean and standard deviation.

8. Given two points on the surface of the sphere, write a program to determine the smallest arc length between them.

9. Implement bisection method to find the square root of a given number to a given accuracy.

10. Implement Newton Raphson method to det. a root of polynomial equation.

11. Given table of x and corresponding f(x) values, Write a program which will determine f(x) value at an intermediate x value by using Lagrange's interpolation/

12. Write a function which will invert a matrix.

13. Implement Simpson's rule for numerical integration.

14. Write a program to solve a set of linear algebraic equations.

CV-1201 : Mathematics – II

Course Objectives:

- The way of obtaining rank, eigen values and eigen vectors of a matrix.
- To know the importance of Cayley-Hamilton theorem and getting canonical form from a given quadratic form.
- To solve the system of equations by using direct and indirect methods.

- To solve first order and higher order differential equations by various methods.

- To obtain the Laplace transforms and inverse Laplace transforms for a given functions and their applications.

Course Outcomes:

- Find rank, eigen values and eigen vectors of a matrix and understand the importance of Cayley-Hamilton theorem.

- Reduce quadratic form to canonical forms and solving linear systems by direct and indirect methods.

- Demonstrate solutions to first order differential equations by various methods and solve basic applications problems related to electrical circuits, orthogonal trajectories and Newton's law of cooling

- Discriminate among the structure and procedure of solving higher order differential equations with constant and variable coefficients.

- Understand Laplace transforms and its properties and finding the solution of ordinary differential equations.

SYLLABUS

(Linear Algebra)

Rank of a matrix- Echelon form, Normal Form - Solution of Linear System of Equations - Consistency of Linear System of Equations - Direct & Indirect Methods: Gauss elimination method, LU Factorization method, Gauss Seidal Method. Complex Matrices: Hermitian, Skew-Hermitian and Unitary Matrices and their Properties.

(Eigen Values and Eigen Vectors)

Eigen Values and Eigen Vectors of a Matrix - Cayley-Hamilton theorem - Inverse and Powers of a Matrix using Cayley-Hamilton's theorem and its applications. Diagonalization of a Matrix - Quadratic Forms - Reduction of Quadratic Form to Canonical Form - Nature of a Quadratic Form.

(Ordinary Differential Equations of First Order and its Applications)

Formation of ordinary differential equations (ODEs) - Solution of an ordinary differential equation - Equations of the first order and first degree - Linear differential equation - Bernoulli's equation - Exact differential equations - Equations reducible to exact equations - Orthogonal Trajectories - Simple Electric (LR & CR) Circuits - Newton's Law of Cooling - Law of Natural growth and decay.

(Differential Equations of Higher Order)

Solutions of Linear Ordinary Differential Equations with Constant Coefficients - Rules for finding the complimentary function - Rules for finding the particular integral - Method of variation of parameters - Cauchy's linear

equation - Legendre's linear equation - Simultaneous linear differential equations.

(Laplace Transforms)

Introduction - Existence Conditions - Transforms of Elementary Functions - Properties of Laplace Transforms - Transforms of Derivatives - Transforms of Integrals - Multiplication by t^n - Division by t - Evaluation of integrals by Laplace Transforms - Inverse Laplace Transform - Applications of Laplace Transforms to Ordinary Differential Equations - Simultaneous Linear Differential Equations with Constant Coefficients - Second Shifting Theorem - Laplace Transforms of Unit Step Function, Unit Impulse Function and Laplace Transforms of Periodic Functions.

TEXT BOOK:

Scope and Treatment as in "Higher Engineering Mathematics", by Dr. B.S. Grewal, 43rd edition, Khanna publishers.

REFERENCE BOOKS:

7. Graduate Engineering Mathematics by V B Kumar Vatti., I.K. International publishing house Pvt. Ltd.

1. Advanced Engineering Mathematics by Erwin Kreyszig.

2. A text book of Engineering Mathematics, by N.P. Bali and Dr. Manish Goyal. Lakshmi Publications.

3. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.

4. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.

CV-1202 : PHYSICS

Course Objectives:

- To impart knowledge in basic concept of physics of Thermodynamics relevant to engineering applications.

- To grasp the concepts of physics for electromagnetism and its application to engineering. Learn production of Ultrasonics and their applications in engineering.

- To Develop understanding of interference, diffraction and polarization: connect it to a few engineering applications.

- To Learn basics of lasers and optical fibers and their use in some applications.

- To Understand concepts and principles in quantum mechanics and Nanopahse Materials. Relate them to some applications.

- Course Outcomes:

- Understand the fundamentals of Thermodynamics and Laws of thermodynamics. Understand the working of Carnot cycle and concept of entropy.

- Gain Knowledge on the basic concepts of electric and magnetic fields. Understand the concept of the nature of magnetic materials. Gain knowledge on electromagnetic induction and its applications .

- Understand the Theory of Superposition of waves. Understand the formation of Newton's rings and the working of Michelson's interferometer. Remember the basics of diffraction, Evaluate the path difference. Analysis of Fraunhofer Diffraction due to a single slit

- Understand the interaction of matter with radiation, Characteristics of Lasers, Principle, working schemes of Laser and Principle of Optical Fiber. Realize their role in optical fiber communication.

- Understand the intuitive ideas of the Quantum physics and understand dual nature of matter. Compute Eigen values, Eigen functions, momentum of Atomic and subatomic particles using Time independent one Dimensional Schrodinger's wave equation. Understand the fundamentals and synthesis processes of Nanophase materials.

SYLLABUS

THERMODYNAMICS Introduction, Heat and Work, First law of thermodynamics and applications, Reversible and Irreversible process, Carnot cycle and Efficiency, Second law of thermodynamics, Carnot's Theorem, Entropy, Second law in terms of entropy, Entropy and disorder, Third law of thermodynamics (statement only).

ELECTROMAGNETISM : Concept of electric flux, Gauss's law - some applications, Magnetic field - Magnetic force on current, torque on current loop, The Biot-Savart's Law, B near a long wire, B for a circular Current loop, Ampere's law, B for a solenoid, Hall effect, Faraday's law of induction, Lenz's law, Induced magnetic fields, Displacement current, Maxwell's equations (no derivation), Magnetic materials: Classification of magnetic materials and properties.

Ultrasonics : Introduction, Production of Ultrasonics – Piezoelectric and Magnetostriction methods, acoustic grating, applications of ultrasonics.

OPTICS

Interference: Principles of superposition – Young's Experiment – Coherence - Interference in thin films (reflected light), Newton's Rings, Michelson Interferometer and its applications.

Diffraction: Introduction, Differences between interference and diffraction, Fresnel and Fraunhofer diffraction, Fraunhofer diffraction at a single slit (Qualitative and quantitative treatment).

Polarisation: Polarisation by reflection, refraction and double refraction in uniaxial crystals, Nicol prism, Quarter and Half wave plate, circular and elliptical polarization.

LASERS and FIBRE OPTICS

Introduction, characteristics of a laser beam, spontaneous and stimulated emission of radiation, population inversion, Ruby laser, He-Ne laser, Semiconductor laser, applications of lasers

Introduction to optical fibers, principle of propagation of light in optical fibers, Acceptance Angle and cone of a fibre, Numerical aperture, Modes of propagations, classification of fibers, Fibre optics in communications, Application of optical fibers.

MODERN PHYSICS

Introduction, De Broglie concept of matter waves, Heisenberg uncertainty principle, Schrodinger time independent wave equation, application to a particle in a box. Free electron theory of metals, Kronig - Penney model (qualitative treatment), Origin of energy band formation in solids, Classification of materials into conductors, semi conductors and insulators.

Nanophase Materials

Introduction, properties, Top-down and bottom up approaches, Synthesis - Ball milling, Chemical vapour deposition method , sol-gel methods, Applications of nano materials.

TEXT BOOKS :

1. Physics by David Halliday and Robert Resnick – Part I and Part II - Wiley.
2. A textbook of Engineering Physics, Dr. M. N. Avadhanulu, Dr. P.G. Kshirsagar - S. Chand
3. Engineering Physics by R.K. Gaur and S.L. Gupta –Dhanpat Rai

Reference Books:

1. Modern Engineering Physics by A.S. Vadudeva
2. University Physics by Young and Freedman

CV-1203 : ENGINEERING GRAPHICS

Course Objectives:

- Understand the basics of Engineering Graphics and BIS conventions.
- Develop the graphical skills for communication of concepts, ideas and design of engineering products through technical drawings
- Demonstrate and practice the various profiles/curves used in engineering practice through standard procedures.
- Demonstrate and practice the orthographic projections of points, lines, planes, solids and section of solids

- Demonstrate and practice the development of surfaces of simple solids

- Familiarize the basic concept of isometric views clearly.

Course Outcomes:

- Develop simple engineering drawings by considering BIS standards.
- Able to draw different engineering curves with standard Procedures
- Comprehend the basics of orthographic projections and deduce orthographic projections of points, lines, planes and solids at different orientations in real life environment.
- Visualize clearly the sections of solids.
- Apply the concepts of development of surfaces while designing/analyzing any product.
- Recognize the significance of isometric drawing to relate 2D environment with 3D environment.

SYLLABUS

Introduction: Lines, Lettering and Dimensioning, Geometrical Constructions, and Scales.

Curves: Conic sections: General construction of ellipse, parabola and hyperbola. Construction of involutes of circle and polygons only. Normal and tangent to curves.

Projections of Points: Principal or Reference Planes, Projections of a point situated in any one of the four quadrants.

Projections of Straight Lines: Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane.

Projections of Straight Line Inclined to Both the Reference Planes: Projections of Planes: Projection of Perpendicular planes: Perpendicular to both reference planes, perpendicular to one reference plane and parallel to other reference plane and perpendicular to one reference plane and inclined to other reference plane. Projection of Oblique planes. Introduction to Auxiliary Planes.

Projections of Solids: Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to other and axes inclined to both the reference planes.

Sections of Solids: Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids (Prism, Pyramid, Cylinder and Cone) in simple position only.

Development of Surfaces: Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.

Isometric Views: Isometric projection, Isometric scale and Isometric view. Isometric view of Prisms, Pyramids, cylinder, cone, and their combinations.

Text Book:

Elementary Engineering Drawing by N.D.Bhatt, Charotar Publishing House.

Reference:

Engineering Graphics by K.L. Narayana and P. Kanniah, Tata McGraw Hill

CV-1204 : SURVEYING AND GEOMATICS

Course Objectives:

- To enable the student to understand the basic steps to be conducted in the field before any construction activity.
- To enhance the students ability to use different survey instruments like Compass, Levels, Theodolite, Electronic Theodolite, Total Station etc.
- To train the students in the survey of Global Positioning System and its applications.

Course Outcomes:

- The student will be in a position to use different survey instruments for identification of precise position of points on or above the Earth's surface.
- The student can conduct any extent of field survey using Total Station.
- The student will be in a position to fix the alignment of routes for highways and railways.

SYLLABUS

Introduction: Classification and Principles of Surveying, Triangulation and Trilateration – Earth as Spheroid, Datum, Geoid, Azimuth, Latitude, Longitude, Map Projections, Scales, Plans and Maps. Chain Surveying: Instrumentation for Chaining – Errors due to Incorrect Chain–Chaining on uneven and sloping Ground – Errors in Chaining –Tape Corrections – Problems: Base Line Measurement – Chain Triangulation – Check Lines, Tie Lines, Offsets. Basic Problems in Chaining – Obstacles in Chaining – Problems – Conventional Signs.

Compass Survey: (a) Introduction to Compass Survey Definitions of Bearing. True bearing, True meridian, Magnetic Meridian, Magnetic Bearing. Plane Table Surveying: Introduction – Advantages, Accessories. Theodolite – Types of Theodolites – Temporary Adjustments, Measurements of

Horizontal Angle – Method of Repetition, Method of Reiteration – Uses of Theodolites. Curves – Sample Curves – Elements of Simple Curves – Methods of Setting Simple Curves – Rankine's Method – Two Theodolite Method.

Levelling: Definitions of Terms – Methods of Levelling – Uses and Adjustments of Dumpy Level – Temporary and Permanent Adjustments of Dumpy Level Levelling Staves – Differential Levelling, Profile Levelling – Cross Sections – Reciprocal levelling. Precise Levelling – Definition of BS, IS, FS, HI, TP – Booking and Reduction of Levels, H.I. Methods – Rise and Fall Method – Checks – Related Problems – Curvature and Refraction Related Problems – Correction – Reciprocal Levelling – Related Problems – L.S & C.S Leveling – Problems in Levelling – Errors in Levelling. Contouring: Definitions – Contour Intervals, Characteristics of Contours

Total Station Surveying: Electronic Theodolite, Electronic Distance Measurements, Total Station, Errors in Measurements, Advantages, Disadvantages, Applications; Contour Mapping, Determination of Height of Remote Point, Position of Hidden Point, Free Station, Area Measurement, Volume Measurement.

Modern Surveying and Mapping: GPS Survey – Introduction, Errors in GPS, Positioning Methods, Classification of GPS Surveying, Applications, Advantages and Disadvantages, Photogrammetric Surveying; Sensors and Platforms, Aerial Photogrammetry, Satellite Images Resolution, Concept of Stereo Models, Photogrammetric Products, Rectified Images, Orthophotography, Topographic Map, Digital Maps, DEM, GIS, Advantages and Disadvantages of Photogrammetric Surveying.

Text Books

1. Surveying Vol. I, II and III by B.C.Punmia, Standard Book House.
2. Advanced Surveying -by Satheesh Gopi, Sathikumar and Madhu, Pearson India.
3. Geomatics Engineering by M.K.Arora and R.C.Badjatia, Nemchand & Bros.

Reference Books

1. Surveying Vol. I and II by S.K. Duggal, Tata McGraw-Hill Publishing Co. Ltd.
2. Surveying: Theory & Practices by James M. Anderson and Edward M. Mikhail, Tata McGraw-Hill Publishing Co. Ltd.

CV-1205 :ENGINEERING MECHANICS

Course Objectives:

- Represent and calculate force and moment vectors and their resultants
- Understand properties of areas and volumes.

- Analyse and interpret dynamic systems.

· Understand work-energy and impulse-momentum application to dynamic systems.

Course Outcomes:

- The student will be in a position to understand the Effect of forces and its components, the principle of Moments on wide variety of practical situations that are encountered by Engineers.
- The student will develop the logical orderly processes of thinking that characterized an Engineer.

SYLLABUS

Basic Concepts: Introduction to Engineering Mechanics – Scalar and Vector quantities – Forces – Characteristics of a Force – Definitions and Examples of Various Types of Force Systems – Definition of Resultant – Composition and Resolution of Forces – Moment of a Force – Principles of Moments of Force – Couples – Characteristics of a Couple – Transformations of a Couple – Resolution of a Force into a Force and Couple.

Resultants of Force Systems, Possible Resultants of Different Types of Force Systems – Resultant of a Concurrent, Coplanar Force System – Resultant of a Non-concurrent Coplanar Force System – Resultant of a Concurrent Non-coplanar Force System – Resultant of a Parallel, Non-coplanar Force System – Resultant of a System of Couples in Space – Resultant of Non-concurrent, Non-coplanar, Non-parallel Force System – Screw of Wrench.

Equilibrium: Free Body Diagrams – Equations of Equilibrium for a Concurrent Coplanar Force System – Equilibrium of Bodies Acted on by Two or Three Forces – Equilibrium of Bodies Acted on by Non-concurrent Coplanar Force System – Equilibrium of Bodies Acted on by Parallel, Non-coplanar Force System – Equilibrium of Non-concurrent, Non-coplanar Non-Parallel Force System.

Analysis of Statically Determinate Trusses by (a) Method of Joints and (b) Method of Sections.

Centroids and Centres of Gravity: Centre of Gravity of Parallel Forces in a Plane – Centre of Gravity of Parallel Forces in Space – Centroid and Centre of Gravity of Composite Bodies – Theorems of Pappus – Distributed Loads on Beams.

Moments of Inertia, Definition – Parallel Axis Theorem for Areas – Second Moments of Areas by Integration – Radius of Gyration of Areas – Moments of Inertia of Composite Areas – Parallel Axis and Parallel Plane Theorems for Masses – Moments of Inertia of Masses by Integration – Radius of Gyration of Mass – Moments of Inertia of Composite Masses.

Friction: Nature of Friction – Laws of Friction – Coefficient of Friction – Angle of Friction – Cone of Friction – Problems Involving Frictional Forces

Method of Virtual Work: Principle of Virtual Work – Equilibrium of Ideal System – Stability of Equilibrium.

Kinematics: Absolute Motion: Introduction – Recapitulation of Basic Terminology of Mechanics – Newton's Laws – Introduction to Kinematics of Absolute Motion – Rectilinear Motion of a Particle – Angular Motion – Curvilinear Motion of a Particle using Rectangular Components – Motion of Projectiles – Curvilinear Motion using Radial and Transverse Components – (Simple Problems only) – Basics of Simple Harmonic Motion (Simple Problems) – Motion of Rigid Bodies.

Kinematics: Relative Motion: Introduction to Kinematics of Relative Motion – Relative Displacement – Relative Velocity – Instantaneous Centre – Relative Acceleration.

Kinetics: Introduction to Kinetics – Newton's Laws of Motion – Equation of Motion for a Particle. Motion of the Mass Centre of a System of Particles – D'Alembert's Principle – Rectilinear Translation of a Rigid Body – Curvilinear Translation of a Rigid Body – Rotation of a Rigid Body – Plane Motion of a Rigid Body.

Kinetics: Work and Energy Approach – Work Done by a Force – Work Done by a Couple – Work Done by a Force System – Energy: Potential Energy – Kinetic Energy of a Particle – Kinetic Energy of a Rigid Body – Principle of Work – Energy and Application to Particle and Rigid Body in Planar Motion – Conservation of Energy

Impulse – Momentum Approach – Linear Impulse – Linear Momentum – Principle of Linear Impulse and Linear Momentum – Conservation of Linear Momentum – Elastic Impact - Principle of Angular Momentum.

Text Books

1. Engineering Mechanics by Ferdinand Leon Singer, B.S.Publications.
2. Applied Mechanics by I.B. Prasad, Khanna Publishers.

Reference Books

1. Engineering Mechanics by S.Timoshenko and D.H. Young, Tata McGraw-Hill Publishing Co. Ltd. India.
2. Engineering Mechanics Vol. I and Vol. II by J.L.Meriam and L.G.Kraige, Wiley Publications.
3. Mechanics for Engineers Statics and Dynamics by F.B. Beer and E.R. Johnston.
4. Engineering Mechanics by R.S.Kurmi, S.Chand Publishing.

CV-1206 : WORKSHOP LAB

Course Objectives:

- Get hands on experience with the working skills in Carpentry trade.
- Know how to work with Sheet Metal tools.
- Get familiar with the working skills of Metal Fitting operations.
- Get hands on experience with house hold electrical wiring.

Course Outcomes:

- Can be able to work with Wood Materials in real time applications.
- Can be able to build various parts with Sheet Metal in day-to-day life.
- Can be able to apply Metal Fitting skills in various applications.
- Can be able to apply this knowledge to basic house electrical wiring and repairs.

syllabus

Carpentry: Any three jobs from – Half lap joint, Mortise and Tenon joint, Half – lap Dovetail joint, Corner Dovetail joint, Central Bridle joint.

Sheet Metal: Any three jobs from – Square tray, Taper tray(sides), Funnel, Elbow pipe joint.

Fitting: Any three jobs from – Square, Hexagon, Rectangular fit, Circular fit and Triangular fit.

House wiring: Any three jobs from – Tube light wiring, Ceiling fan wiring, Stair-case wiring, Corridor wiring.

References:

1. Elements of workshop technology, Vol.1 by S. K. and H. K. Choudary.
2. Work shop Manual / P.Kannaiah/ K.L.Narayana/ SciTech Publishers.
3. Engineering Practices Lab Manual, Jeyapoovan, Saravana Pandian, 4/e Vikas.

CV-1207 : PHYSICS LAB

Course Objectives:

- To enable the students to acquire skill, technique and utilization of the Instruments
- Draw the relevance between the theoretical knowledge and to imply it in a practical manner with respect to analyze various electronic circuits and its components.
- To impart the practical knowledge in basic concepts of Wave optics, Lasers and Fiber optics.

- To familiarize the handling of basic physical apparatus like Vernier callipers, screw gauge, spectrometers, travelling microscope, laser device, optical fibre, etc.

Course Outcomes:

- Ability to design and conduct experiments as well as to analyze and interpret
- Ability to apply experimental skills to determine the physical quantities related to Heat, Electromagnetism and Optics
- The student will learn to draw the relevance between theoretical knowledge and the means to imply it in a practical manner by performing various relative experiments.

SYLLABUS

1. Determination of Radius of Curvature of a given Convex Lens By forming Newton's Rings.
2. Determination of Wavelength of Spectral Lines in the Mercury Spectrum by Normal Incidence method.
3. Study the Intensity Variation of the Magnetic Field along axis of Current Carrying Circular Coil.
4. Determination of Cauchy's Constants of a Given Material of the Prism using Spectrometer.
5. Determination of Refractive Index of Ordinary ray m_o and Extraordinary m_e ray.
6. Determination of Thickness Given Paper Strip by Wedge Method.
7. Calibration of Low Range Voltmeter.
8. Calibration of Low Range Ammeter.
9. Determination of Magnetic Moment and Horizontal Component of Earth's Magnetic Field.
10. Lees Method - Coefficient of thermal Conductivity of a Bad Conductor.
11. Carey Foster's Bridge – Verification of laws of Resistance and Determination Of Specific Resistance.
12. Melde's Apparatus – Frequency of electrically maintained Tuning Fork.
13. Photoelectric cell-Characteristics.
14. Planks Constants.
15. Laser- Diffraction.

CV-1208 : ENGINEERING GEOLOGY LAB

Course Objectives:

- To enable the students to know different types of soils.
- To enable the students to know different properties of different soils.
- To enable the students to know the application of Remote Sensing and Geo Physical Methods.

- Understand weathering process and mass movement

Course Outcomes:

- Students will understand the suitable foundation for different structures in different types of soils.
- Identify subsurface information and groundwater potential sites through geophysical investigations
- Apply geological principles for mitigation of natural hazards and select sites for dams and tunnels.

SYLLABUS

General geology:

Importance of geology from Civil Engineering point of view. Weathering and soils: soil profile, erosion, and soil formation, types of Indian soils. Landforms produced by running water, glaciers, wind, sea waves and currents.

Ground water: Origin and Occurrence of ground water. Porosity and permeability. Aquifers and ground water moment and water bearing properties of rocks.

Petrology & Mineralogy: Petrology: Definitions of rock. Rock classification, structure, texture and mineralogical composition. Types of rocks– igneous rocks and structures-dykes and sills: granite, dolerite, basalt.

Sedimentary rocks: conglomerate, sandstone, shale, limestone.

Metamorphic rocks: gneiss, khondalite, schist, marble, charnokite, engineering properties of rocks.

Mineralogy: Physical properties: form, colour, lustre, cleavage, fracture, hardness and specific gravity. Study of important rock forming minerals: feldspar, micas and clays

Stratigraphy and Structural Geology:

Stratigraphy: major geological formations of India. Archaeans. Cuddapahs, vindyana, gondwanas and deccan traps. Mineral resources of Andhra Pradesh. Structural geology: elements of structural geology–strike and dip, plunge. Clinometers compass and Brunton compass. Classification of folds, faults and joints. Geological methods of investigation: geological formations, preparations of geological maps, structural features and groundwater parameters.

Natural hazards: earthquake origin and distribution. Volcanoes, landslides and mass movement. Tsunamis.

Remote Sensing and Geo Physical Methods:

Remote sensing: Introduction, electromagnetic spectrum, aerial photo, types of aerial photos and flight planning aerial mosaics. Elements of photo interpretation. Satellite, remote sensing, Satellite, sensors and data products, principles of GIS. RS and GIS applications to Civil Engineering—town planning, dams and reservoirs,

Geophysical Methods: Principles of geophysical methods, electrical methods, seismic methods. Principles of resistivity method and configurations. Applications of resistivity method in prediction of soil profile, hard rock and ground water table. Principles of seismic refraction and reflections methods and their applications to Civil Engineering problems.

Geological applications to Civil Engineering structures: Role of engineering geologists in planning, design and construction stages in Civil Engineering works. Geological investigations for dams and reservoir; geological investigations for bridges and multi-storied structures. Geological investigation for highways. Geological investigations for tunnels and coastal structures. (sea walls, groins and bulkheads). Environmental geology.

LIST OF EXPERIMENTS

1. General study of toposheet
2. Physical properties of minerals
3. Physical properties of 3 types of rocks
4. Study of folds, faults and joints (Models)
5. Study of tunnels (models)
6. General observation of satellite data for abstraction of data
7. Integrated approach of Terrain evaluation

Text Books

1. Principles of Engineering Geology by K.V.G.K.Gokhale. B.S. Publications-2005
2. Engineering Geology by N.Chennakesavalu, Mc-Millan, Indian Ltd-2005
3. A Text Book of Geology by P.K.Mukherjee, World Press
4. Engineering and General Geology by Parbin Singh, Katson Publishing House
5. Fundamentals of Remote Sensing by George Jospeh, University Press (India) Private Ltd.

CHEMICAL ENGINEERING

Scheme and Syllabus (With effect from 2020-21 admitted batch)

B.Tech I Year - I Semester

Course CreditsC	Category	Course Title	Hours per week			Internal Marks	External Marks	Total Marks	
code			L	T	P				
CH-1101	BS	Mathematics – I	3	0	0	30	70	100	3
CH-1102	BS	Chemistry	3	0	0	30	70	100	3
CH-1103	HSS	English	3	0	0	30	70	100	3
CH-1104	ES	CPNM	3	0	3	30	70	100	3
CH-1105	ES	Basic Electrical Engineering	3	0	0	30	70	100	3
CH-1106	HSS	English Language Lab	0	0	2	50	50	100	1.5
CH-1107	BS	Chemistry Lab	0	0	3	50	50	100	1.5
CH-1108	ES	CPNM Lab	0	0	3	50	50	100	1.5
Total Credits									19.5

B.Tech I Year - II Semester

Course CreditsC	Category	Course Title	Hours per week			Internal Marks	External Marks	Total Marks	
code			L	T	P				
CH-1201	BS	Mathematics – II	3	0	0	30	70	100	3
CH-1202	BS	Physics	3	0	0	30	70	100	3
CH-1203	ES	Engineering Graphics	1	0	4	30	70	100	3
CH-1204	ES	Material Science & Engineering	3	0	0	30	70	100	3
CH-1205	ES	Mechanical Engineering	3	0	0	30	70	100	3
CH-1206	ES	Workshop Lab	0	0	3	50	50	100	1.5
CH-1207	BS	Physics Lab	0	0	3	50	50	100	1.5
CH-1208	ES	General Engineering Lab. (Mechanical Engineering/ Electrical Engineering)	0	0	3	50	50	100	1.5
Total Credits									19.5

CH-1101: MATHEMATICS-I

Course Objectives:

- To transmit the knowledge of Partial differentiation.
- To know of getting maxima and minima of function of two variables and finding errors and approximations.
- To evaluate double and triple integrals, volumes of solids and area of curved surfaces.

- To expand a periodical function as Fourier series and half-range Fourier series.

Course Outcomes:

- Find the partial derivatives of functions of two or more variables.
- Evaluate maxima and minima, errors and approximations.
- Evaluate double and triple integrals, volumes of solids and area of curved surfaces.
- To expand a periodical function as Fourier series and half-range Fourier series.
- Have a fundamental understanding of Fourier series and be able to give Fourier expansions of a given function.

SYLLABUS

(Partial Differentiation)

Introduction - Functions of two or more variables - Partial derivatives - Homogeneous functions – Euler's theorem - Total derivative - Change of variables – Jacobins. Mean value Theorems (without proofs)

(Applications of Partial Differentiation)

Geometrical interpretation -Tangent plane and Normal to a surface - Taylor's theorem for functions of two variables - Errors and approximations - Total differential. Maxima and Minima of functions of two variables - Lagrange's method of undetermined multipliers - Differentiation under the integral Sign - Leibnitz's rule.

(Multiple Integrals)

Introduction - Double Integrals - Change of Order of Integration - Double Integrals in Polar Coordinates - Triple Integrals - Change of Variables.

(Multiple Integrals-Applications)

Area enclosed by plane curves - Volumes of solids - Area of a curved surface - Calculation of Mass - Center of gravity - Moment of inertia - product of inertia – principal axes- Beta Function - Gamma Function - Relation between Beta and Gamma Functions. Error Function or Probability Integral.

(Fourier Series)

Introduction - Euler's Formulae - Conditions for a Fourier Expansion - Functions having points of discontinuity - Change of Interval - Odd and Even Functions - Expansions of Odd or Even Periodic Functions, Half-Range Series - Parseval's Formula. Practical Harmonic analysis.

TEXT BOOK:

Scope and Treatment as in "Higher Engineering Mathematics", by Dr. B.S. Grewal, 43rd Edition, Khanna publishers.

REFERENCE BOOKS:

1. Graduate Engineering Mathematics by V B Kumar Vatti., I.K.International publishing house Pvt. Ltd.
2. Advanced Engineering Mathematics by Erwin Kreyszig.
3. A text book of Engineering Mathematics, by N.P. Bali and Dr. Manish Goyal, Lakshmi Publications.
4. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.
5. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.
6. Higher Engineering Mathematics by Dr. M.K.Venkataraman.

CH-1102 : CHEMISTRY

Course Objectives:

- To apply the basic knowledge of Chemistry to the Engineering Discipline.
- To develop knowledge about water and its treatment for industrial and potable purposes.
- To develop understanding in the areas of Polymers, Mechanism of Corrosion of Metals and Corrosion Control Methods, Fuels, Lubricants and Nanomaterials for of conducting polymers, bio-degradable polymers and fiber reinforced plastics and apply the knowledge for solving existing challenges faced in various engineering and societal areas.

Course outcome:

- This course applies the basic concepts and principles studied in Chemistry to Engineering.
- It provides an application of chemistry to different branches of engineering
- The students will be able acquire knowledge in the areas of Water Chemistry, Polymers, Corrosion, Fuels and Lubricants and nanomaterials and suggest innovative solutions for existing challenges in these areas.

SYLLABUS

Water Chemistry : Sources of Water – Impurities and their influence of living systems – WHO Limits – Hardness and its Determination – Boiler Troubles and their removal – Water Softening Methods – Lime-Soda, Zeolite and Ion Exchange - Municipal Water Treatment-Break Point Chlorination – Desalination of Sea Water – Reverse Osmosis Method, Electro-dialysis.

Polymers and Plastics : Polymers: Definition – Types of Polymerization (Addition & Condensation) – Mechanisms of Addition Polymerization – Radical and Ionic – Thermodynamics of Polymerization Process. Plastics: Thermosetting and Thermoplastics – Effect of Polymer Structure on

Properties of Cellulose Derivatives – Vinyl Resins – Nylon (6,6), Reinforced Plastics – Conducting Polymers.

Corrosion : Corrosion: Origin and Theory – Types of Corrosion: Chemical and Electrochemical; Pitting, Inter granular, Waterline, Stress – Galvanic Series – Factors Effecting Corrosion.

Corrosion Controlling Methods: Protective Coatings: Metallic Coatings, Electroplating and Electroless Plating – Chemical conversion Coatings – Phosphate, Chromate, Anodized, Organic Coatings – Paints and Special Paints.

Fuels and Lubricants : Solid Fuels: Wood and Coal, Ranking of Coal – Analysis (Proximate and Ultimate) Coke Manufacture – Otto Hoffmann's Process – Applications; Liquid Fuels: Petroleum Refining – Motor Fuels – Petrol and Diesel Oil – Knocking – Octane number – Cetane Number; Gaseous Fuels: Biogas, LPG and CNG – Characteristics – Applications; Rocket Fuels: Propellants – Classification – Characteristics

Lubricants: Classification – Mechanism – Properties of Lubricating Oils – Selection of Lubricants for Engineering Applications.

Nanomaterials : Nanomaterials, Properties and application of fullerenes, fullerols, Carbon nanotubes and nanowires. Synthesis - Top-down and Bottom-up approaches - Nanocomposites - Nanoelectronics- Applications of nanomaterials in catalysis, telecommunication and medicine.

Text Books:

1. Engineering Chemistry – PC Jain and M. Jain – Dhanpath Rai and Sons, New Delhi.

2. A Text book of Engineering Chemistry – S. S. Dara – S. Chand & Co. New Delhi.

Reference Books:

1. Engineering Chemistry – B. K. Sharma – Krishna Prakashan – Meerut.

2. Introduction to Nanoscience - S. M. Lindsay - Oxford University Press

3. Engineering Chemistry - B. L. Tembe, Kamaluddin and M. S. Krishnan, (NPTEL).

CH-1103 : ENGLISH

Course Objectives:

- To make students understand the explicit and implicit meanings of a text/topic;
- To give exposure to new words and phrases, and aid to use them in different contexts;

- To apply relevant writing formats to draft essays, letters, emails and presentations; and

- To adapt oneself to a given situation and develop a functional approach to finding solutions: adaptability and problem solving.

Course Outcomes:

- Students will be able to analyse a given text and discover the various aspects related to language and literature;

- Learn the various language structures, parts of speech and figures of speech;

- Develop one's reading and writing abilities for enhanced communication; and

- Learn to apply the topics in real-life situations for creative and critical use.

SYLLABUS

On the conduct of life: William Hazlitt

Life skills: Values and Ethics

If: Rudyard Kipling

The Brook: Alfred Tennyson

Life skills: Self-Improvement

How I Became a Public Speaker: George Bernard Shaw

The Death Trap: Saki

Life skills: Time Management

On saving Time: Seneca

Chindu Yellama

Life skills: Innovation

Muhammad Yunus

Politics and the English Language: George Orwell

Life skills: Motivation

Dancer with a White Parasol: Ranjana Dave

Grammar: Prepositions – Articles – Noun-Pronoun Agreement, Subject-Verb Agreement – Misplaced Modifiers – Clichés, Redundancies.

Vocabulary: Introduction to Word Formation – Root Words from other Languages – Prefixes and Suffixes – Synonyms, Antonyms – Common Abbreviations

Writing: Clauses and Sentences – Punctuation – Principals of Good Writing – Essay Writing – Writing a Summary

Writing: Essay Writing

Life skills: Innovation

Muhammad Yunus

Textbook: *Language and Life: A Skills Approach* Board of Editors, Orient Blackswan Publishers, India. 2018.

References :

1. *Practical English Usage*, Michael Swan. OUP. 1995.
2. *Remedial English Grammar*, F.T. Wood. Macmillan.2007
3. *On Writing Well*, William Zinsser. Harper Resource Book. 2001
4. *Study Writing*, Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
5. *Communication Skills*, Sanjay Kumar and PushpLata. Oxford University Press. 2011.
6. *Exercises in Spoken English*, Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

CH-1104 : CPNM

Course Objectives:

- The course is designed to provide complete knowledge of C language.
- To provide students with understanding of code organization and functional hierarchical decomposition with using complex data types.
- To provide knowledge to the Students to develop logics which will help them to create programs, applications in C.
- This course aims to identify tasks in which the numerical techniques learned are applicable and apply them to write programs, and hence use computers effectively to solve the task.
- This course provides the fundamental knowledge which is useful in understanding the other programming languages.

Course Outcomes:

- Identify basic elements of C programming structures like data types, expressions, control statements, various simple functions and Apply them in problem solving.
- Apply various operations on derived data types like arrays and strings in problem solving.
- Design and Implement of modular Programming and memory management using Functions, pointers.
- Apply Structure, Unions and File handling techniques to Design and Solve different engineering programs with minimal complexity.
- Apply Numerical methods to **Solve** the complex Engineering problems.

SYLLABUS

1. Introduction to C: Basic structure of C program, Constants, Variables and data types, Operators and Expressions, Arithmetic Precedence and associativity, Type Conversions. Managing Input and Output Operations Formatted Input, Formatted Output.

2. Decision Making, Branching, Looping, Arrays & Strings: Decision making with if statement, Simple if statement, The if...else statement, Nesting of if...else statement, the else..if ladder, switch statement, the (?:) operator, the GOTO statement., The while statement, the do statement, The for statement, Jumps in Loops ,One, Two-dimensional Arrays, Character Arrays. Declaration and initialization of Strings, reading and writing of strings, String handling functions, Table of strings.

3. Functions: Definition of Functions, Return Values and their Types, Function Calls, Function Declaration, Category of Functions: No Arguments and no Return Values, Arguments but no Return Values, Arguments with Return Values, No Argument but Returns a Value, Functions that Return Multiple Values. Nesting of functions, recursion, passing arrays to functions, passing strings to functions, the scope, visibility and lifetime of variables.

4. Pointers: Accessing the address of a variable, declaring pointer variables, initializing of pointer variables, accessing variables using pointers, chain of pointers, pointer expressions, pointers and arrays, pointers and character strings, array of pointers, pointers as function arguments, functions returning pointers, pointers to functions, pointers to structures-Program Applications

5. Structure and Unions: Defining a structure, declaring structure variables, accessing structure members, structure initialization, copying and comparing structure variables, arrays of structures, arrays within structures, structures within structures, structures and functions and unions, size of structures and bit-fields- Program applications.

6. File handling: Defining and opening a file, closing a file, Input/ Output operations on files, Error handling during I/O operations, random access to files and Command Line Arguments- Program Applications

7. Numerical Methods: Solutions of Algebraic and Transcendental Equations, Bisection Method, Newton Raphson Method. Newton's forward and backward Interpolation, Lagrange's Interpolation in unequal intervals. Numerical Integration: Trapezoidal rule, Simpson's 1/3 rules. Solutions of Ordinary First Order Differential Equations: Euler's Method, Modified Euler's Method and Runge-Kutta Method.

Text Book:

1. Programming in ANSI C, E Balagurusamy, 6th Edition. McGraw Hill Education (India) Private Limited.
2. Introduction to Numerical Methods, SS Sastry, Prentice Hall

Reference Books:

1. Let Us C ,YashwantKanetkar, BPB Publications, 5th Edition.
2. Computer Science, A structured programming approach using C", B.A.Forouzan and R.F.Gilberg, " 3rd Edition, Thomson, 2007.
3. The C –Programming Language' B.W. Kernighan, Dennis M. Ritchie, PHI.
4. Scientific Programming: C-Language, Algorithms and Models in Science, Luciano M. Barone (Author), Enzo Marinari (Author), Giovanni Organini, World Scientific.

CH-1105 : BASIC ELECTRICAL ENGINEERING

Course Objectives:

- An understanding of basic EE abstractions depends on analysis and design of electric and magnetic circuits and its elements.
- To provide the students with knowledge of fundamental laws in electrical engineering
- To develop the ability of the students to analyze electrical and magnetic circuits using the basic laws of electrical engineering
- To expose the students to the concepts of various types of electrical machines and application of electrical machines.
- To inculcate the understanding about the AC fundamentals
- To prepare the students to have a basic knowledge of transformers
- To acknowledge about three phase induction motor and its operating principle
- To know about the fundamentals of synchronous motors and its working principle

Course Outcomes:

After the completion of the course, the student should be able

- To predict the behavior of any electrical and magnetic circuits.
- student will be able to state and explain the basic laws of electromagnetic induction.
- To impart knowledge on Constructional details, principle of operation, types of Electrical Machines performance Characteristics ,speed control methods and its applications
- Ability to conduct experiments on Ac Machines to find its characteristics.
- Abel to calculate performance characteristics of transformer like regulation and efficiency
- The ability to formulate and then analyze the working of synchronous motors

- Able to solve simple problems on synchronous motors

SYLLABUS

Magnetic circuits: Definitions of magnetic circuit, reluctance, magneto motive force (mmf), magnetic flux, simple problems on magnetic circuits, hysteresis loss (chapter 8, page nos. 155-175),

Electromagnetic induction: Faraday's laws of electromagnetic induction, induced E.M.F., dynamically induced E.M.F, statistically induced EMF, self inductance, mutual inductance (Chapter 9, page nos. 176-190),

D.C. generators: D.C generator principle, construction of D.C generator, E.M.F equation of D.C generator, types of D.C generators, armature reaction, losses in D.C generator, efficiency, characteristics of D.C generators, applications of D.C generators (chapter 10, 11, pages 208-238),

D.C. motors: D.C motor principle, working of D.C motors, significance of back, E.M.F, torque equation of D.C motors, types of D.C motors, characteristics of D.C motors, speed control methods of D.C motors, applications of D.C motor, testing of D.C machines, losses and efficiency, direct load test and Swinburne's test (Chapter 12, 13, page Nos. 239-269),

A.C. circuits: Introduction to steady state analysis of A.C circuits, single and balanced 3 phase circuits (chapter 16, page nos. 323-348),

Transformers: Transformer principle, EMF-equation of transformer, transformer on load, equivalent circuit of transformer, voltage regulation of transformer, losses in a transformer, calculation of efficiency and regulation by open circuit and short circuit tests (Chapter 20, page Nos. 423-455),

Three phase inductance motor: Induction motor working principle, construction of 3-phase induction motor, principle of operation, types of 3-phase induction motor, torque equation of induction motor, slip-torque characteristics, starting torque, torque under running condition, maximum torque equation, power stages of induction motor, efficiency calculation of induction motor by direct loading (Chapter 21, page nos. 463-489),

Alternator: Alternator working principle, EMF equation of alternator, voltage regulation by Synchronised impedance method (Chapter 23, page nos. 505-515),

Synchronous motor: Synchronous motor principle of operation, construction, methods of starting of synchronous motor, (Chapter- 24, page nos. 516-526),

Text book:

1. 'Elements of Electrical Engineering & Electronics' by V.K. Mehta, S.Chand & Co.

Reference book:

'A first course in Electrical Engineering' by Kothari.

CH-1106 : ENGLISH LANGUAGE LAB

Course Objectives:

- To make students recognize the sounds of English through Audio-Visual aids;
- To help students build their confidence and help them to overcome their inhibitions and self-consciousness while speaking in English;
- To familiarize the students with stress and intonation and enable them to speak English effectively; and
- To give learners exposure to and practice in speaking in both formal and informal contexts.

Course Outcomes:

- Students will be sensitized towards recognition of English sound patterns and the fluency in their speech will be enhanced;
- A study of the communicative items in the laboratory will help students become successful in the competitive world;
- Students will be able to participate in group activities like roleplays, group discussions and debates; and
- Students will be able to express themselves fluently and accurately in social as well professional context.

SYLLABUS

Introduction to Phonetics: The Sounds of English (Speech sound – vowels and consonants) - Stress and Intonation - Accent and Rhythm.

Listening Skills: Listening for gist and specific information - listening for Note taking, summarizing and for opinions - Listening to the speeches of eminent personalities.

Speaking Skills: Self-introduction - Conversation Skills (Introducing and taking leave) - Giving and asking for information - Role Play - Just A Minute (JAM) session - Telephone etiquette.

Reading and Writing skills: Reading Comprehension – Précis Writing - E-Mail writing - Punctuation.

Presentation skills: Verbal and non-verbal communication - Body Language - Making a Presentation.

Reference Books:

1. Ashraf Rizvi. *Effective Technical Communication*. Tata McGraw Hill Education Private Limited, New Delhi.
2. *Speak Well*. Orient Blackswan Publishers, Hyderabad.
3. Allan Pease. *Body Language*. Manjul Publishing House, New Delhi.

CH-1107 : CHEMISTRY LAB

Course Objectives:

- To develop the fine skills of quantitative determination of various chemical components through titrimetric analysis
- To prepare and use ion exchange / zeolite columns for the removal of hardness of water
- To develop the skill of organic synthesis through the preparation of a polymer/ drug

Course Outcomes:

- The course provides quantitative determine the amount of various chemical species in solutions by titrations and conduct the quantitative determinations with accuracy
- The course provides to develop novel materials to be used as zeolite and prepare columns for removal of hardness of water
- The course provides to synthesis a polymer or a drug

SYLLABUS

1. Determination of Sodium Hydroxide with HCl (Na_2CO_3 Primary Standard)
2. Determination of Alkalinity (Carbonate and Hydroxide) of water sample
3. Determination of Fe(II)/Mohr's Salt by Permanganometry
4. Determination of Oxalic Acid by Permanganometry
5. Determination of Chromium (VI) by Mohr's Salt Solution
6. Determination of Zinc by EDTA method
7. Determination of Hardness of Water sample by EDTA method
8. Determination of Chlorine in water by Iodometric Titration
9. Ionexchange/ Zeolite column for removal of hardness of water
10. Synthesis of Polymer/ drug

Reference Books:

1. Vogel's Quantitative Chemical Analysis – V – Edition – Longman.
2. Experiments in Applied Chemistry (For Engineering Students) – Sinita Rattan – S. K. Kataria & Sons, New Delhi

CH-1108 : CPNM LAB

Course Objectives:

- To impart writing skill of C programming to the students and solving problems.
- To write and execute programs in C to solve problems such as Modularize the problems into small modules and then convert them into programs.,

- To write and execute programs in C to solve problems such as arrays, files, strings, structures and different numerical methods.
- This reference has been prepared for the beginners to help them understand the basic to advanced concepts related to Objective-C Programming languages.

Course Outcomes:

- Understand various computer components, Installation of software. C programming development environment, compiling, debugging, and linking and executing a program using the development environment.
- Analyzing the complexity of problems, Modularize the problems into small modules and then convert them into programs.
- Construct programs that demonstrate effective use of C features including arrays, strings, structures, pointers and files.
- Apply and practice logical ability to solve the real world problems.
- Apply Numerical methods to Solve the complex Engineering problems.

SYLLABUS

1. Write a program to read x, y coordinates of 3 points and then calculate the area of a triangle formed by them and print the coordinates of the three points and the area of the triangle. What will be the output from your program if the three given points are in a straight line?
2. Write a program, which generates 100 random integers in the range of 1 to 100. Store them in an array and then print the arrays. Write 3 versions of the program using different loop constructs. (e.g. for, while, and do while).
3. Write a set of string manipulation functions e.g. for getting a substring from a given position, Copying one string to another, Reversing a string, adding one string to another.
4. Write a program which determines the largest and the smallest number that can be stored in different data types like short, int, long, float, and double. What happens when you add 1 to the largest possible integer number that can be stored?
5. Write a program, which generates 100 random real numbers in the range of 10.0 to 20.0, and sort them in descending order.
6. Write a function for transposing a square matrix in place (in place means that you are not allowed to have full temporary matrix).
7. First use an editor to create a file with some integer numbers. Now write a program, which reads these numbers and determines their mean and standard deviation.

8. Given two points on the surface of the sphere, write a program to determine the smallest arc length between them.

9. Implement bisection method to find the square root of a given number to a given accuracy.

10. Implement Newton Raphson method to det. a root of polynomial equation.

11. Given table of x and corresponding f(x) values, Write a program which will determine f(x) value at an intermediate x value by using Lagrange's interpolation/

12. Write a function which will invert a matrix.

13. Implement Simpson's rule for numerical integration.

14. Write a program to solve a set of linear algebraic equations.

CH-1201 : MATHEMATICS – II

Course Objectives:

- The way of obtaining rank, eigen values and eigen vectors of a matrix.
- To know the importance of Cayley-Hamilton theorem and getting canonical form from a given quadratic form.
- To solve the system of equations by using direct and indirect methods.
- To solve first order and higher order differential equations by various methods.
- To obtain the Laplace transforms and inverse Laplace transforms for a given functions and their applications.

Course Outcomes:

- Find rank, eigen values and eigen vectors of a matrix and understand the importance of Cayley-Hamilton theorem.
- Reduce quadratic form to canonical forms and solving linear systems by direct and indirect methods.
- Demonstrate solutions to first order differential equations by various methods and solve basic applications problems related to electrical circuits, orthogonal trajectories and Newton's law of cooling
- Discriminate among the structure and procedure of solving higher order differential equations with constant and variable coefficients.
- Understand Laplace transforms and its properties and finding the solution of ordinary differential equations.

SYLLABUS

(Linear Algebra) Rank of a matrix- Echelon form, Normal Form - Solution of Linear System of Equations - Consistency of Linear System of Equations - Direct & Indirect Methods: Gauss elimination method, LU

Factorization method, Gauss Seidal Method. Complex Matrices: Hermitian, Skew-Hermitian and Unitary Matrices and their Properties.

(Eigen Values and Eigen Vectors) Eigen Values and Eigen Vectors of a Matrix - Cayley-Hamilton theorem - Inverse and Powers of a Matrix using Cayley-Hamilton's theorem and its applications. Diagonalization of a Matrix - Quadratic Forms - Reduction of Quadratic Form to Canonical Form - Nature of a Quadratic Form.

(Ordinary Differential Equations of First Order and its Applications) Formation of ordinary differential equations (ODEs) - Solution of an ordinary differential equation - Equations of the first order and first degree - Linear differential equation - Bernoulli's equation - Exact differential equations - Equations reducible to exact equations - Orthogonal Trajectories - Simple Electric (LR & CR) Circuits - Newton's Law of Cooling - Law of Natural growth and decay.

(Differential Equations of Higher Order) Solutions of Linear Ordinary Differential Equations with Constant Coefficients - Rules for finding the complimentary function - Rules for finding the particular integral - Method of variation of parameters - Cauchy's linear equation - Legendre's linear equation - Simultaneous linear differential equations.

(Laplace Transforms) Introduction - Existence Conditions - Transforms of Elementary Functions - Properties of Laplace Transforms - Transforms of Derivatives - Transforms of Integrals - Multiplication by t^n - Division by t - Evaluation of integrals by Laplace Transforms - Inverse Laplace Transform - Applications of Laplace Transforms to Ordinary Differential Equations - Simultaneous Linear Differential Equations with Constant Coefficients - Second Shifting Theorem - Laplace Transforms of Unit Step Function, Unit Impulse Function and Laplace Transforms of Periodic Functions.

TEXT BOOK:

Scope and Treatment as in "Higher Engineering Mathematics", by Dr. B.S. Grewal, 43rd edition, Khanna publishers.

REFERENCE BOOKS:

1. Graduate Engineering Mathematics by V B Kumar Vatti., I.K. International publishing house Pvt. Ltd.
2. Advanced Engineering Mathematics by Erwin Kreyszig.
3. A text book of Engineering Mathematics, by N.P. Bali and Dr. Manish Goyal. Lakshmi Publications.
4. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.
5. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.

CH-1202 : PHYSICS

Course Objectives:

- To impart knowledge in basic concept of physics of Thermodynamics relevant to engineering applications.
- To grasp the concepts of physics for electromagnetism and its application to engineering. Learn production of Ultrasonics and their applications in engineering.
- To Develop understanding of interference, diffraction and polarization: connect it to a few engineering applications.
- To Learn basics of lasers and optical fibers and their use in some applications.
- To Understand concepts and principles in quantum mechanics and Nanophase Materials. Relate them to some applications.

Course Outcomes:

- Understand the fundamentals of Thermodynamics and Laws of thermodynamics. Understand the working of Carnot cycle and concept of entropy.
- Gain Knowledge on the basic concepts of electric and magnetic fields. Understand the concept of the nature of magnetic materials. Gain knowledge on electromagnetic induction and its applications .
- Understand the Theory of Superposition of waves. Understand the formation of Newton's rings and the working of Michelson's interferometer. Remember the basics of diffraction, Evaluate the path difference. Analysis of Fraunhofer Diffraction due to a single slit
- Understand the interaction of matter with radiation, Characteristics of Lasers, Principle, working schemes of Laser and Principle of Optical Fiber. Realize their role in optical fiber communication.
- Understand the intuitive ideas of the Quantum physics and understand dual nature of matter. Compute Eigen values, Eigen functions, momentum of Atomic and subatomic particles using Time independent one Dimensional Schrodinger's wave equation. Understand the fundamentals and synthesis processes of Nanophase materials.

SYLLABUS

THERMODYNAMICS Introduction, Heat and Work, First law of thermodynamics and applications, Reversible and Irreversible process, Carnot cycle and Efficiency, Second law of thermodynamics, Carnot's Theorem, Entropy, Second law in terms of entropy, Entropy and disorder, Third law of thermodynamics (statement only).

ELECTROMAGNETISM Concept of electric flux, Gauss's law - some applications, Magnetic field - Magnetic force on current, torque on current

loop, The Biot-Savart's Law, B near a long wire, B for a circular Current loop, Ampere's law, B for a solenoid, Hall effect, Faraday's law of induction, Lenz's law, Induced magnetic fields, Displacement current, Maxwell's equations (no derivation), Magnetic materials: Classification of magnetic materials and properties.

Ultrasonics : Introduction, Production of Ultrasonics – Piezoelectric and Magnetostriction methods, acoustic grating, applications of ultrasonics.

OPTICS

Interference: Principles of superposition – Young's Experiment – Coherence - Interference in thin films (reflected light), Newton's Rings, Michelson Interferometer and its applications.

Diffraction: Introduction, Differences between interference and diffraction, Fresnel and Fraunhofer diffraction, Fraunhofer diffraction at a single slit (Qualitative and quantitative treatment).

Polarisation: Polarisation by reflection, refraction and double refraction in uniaxial crystals, Nicol prism, Quarter and Half wave plate, circular and elliptical polarization.

LASERS and FIBRE OPTICS

Introduction, characteristics of a laser beam, spontaneous and stimulated emission of radiation, population inversion, Ruby laser, He-Ne laser, Semiconductor laser, applications of lasers

Introduction to optical fibers, principle of propagation of light in optical fibers, Acceptance Angle and cone of a fibre, Numerical aperture, Modes of propagations, classification of fibers, Fibre optics in communications, Application of optical fibers.

MODERN PHYSICS

Introduction, De Broglie concept of matter waves, Heisenberg uncertainty principle, Schrodinger time independent wave equation, application to a particle in a box. Free electron theory of metals, Kronig - Penney model (qualitative treatment), Origin of energy band formation in solids, Classification of materials into conductors, semi conductors and insulators.

Nanophase Materials

Introduction, properties, Top-down and bottom up approaches, Synthesis - Ball milling, Chemical vapour deposition method, sol-gel methods, Applications of nano materials.

TEXT BOOKS :

1. Physics by David Halliday and Robert Resnick – Part I and Part II - Wiley.

2. A textbook of Engineering Physics, Dr. M. N. Avadhanulu, Dr. P.G. Kshirsagar - S. Chand

3. Engineering Physics by R.K. Gaur and S.L. Gupta –Dhanpat Rai

Reference Books:

1. Modern Engineering Physics by A.S. Vadudeva

2. University Physics by Young and Freedman

CH-1203 : ENGINEERING GRAPHICS

Course Objectives:

- Understand the basics of Engineering Graphics and BIS conventions.
- Develop the graphical skills for communication of concepts, ideas and design of engineering products through technical drawings
- Demonstrate and practice the various profiles/curves used in engineering practice through standard procedures.
- Demonstrate and practice the orthographic projections of points, lines, planes, solids and section of solids
- Demonstrate and practice the development of surfaces of simple solids
- Familiarize the basic concept of isometric views clearly.

Course Outcomes:

- Develop simple engineering drawings by considering BIS standards.
- Able to draw different engineering curves with standard Procedures
- Comprehend the basics of orthographic projections and deduce orthographic projections of points, lines, planes and solids at different orientations in real life environment.
- Visualize clearly the sections of solids.
- Apply the concepts of development of surfaces while designing/analyzing any product.
- Recognize the significance of isometric drawing to relate 2D environment with 3D environment.

SYLLABUS

Introduction: Lines, Lettering and Dimensioning, Geometrical Constructions, and Scales.

Curves: Conic sections: General construction of ellipse, parabola and hyperbola. Construction of involutes of circle and polygons only. Normal and tangent to curves.

Projections of Points: Principal or Reference Planes, Projections of a point situated in any one of the four quadrants.

Projections of Straight Lines: Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to

other reference plane, inclined to one reference plane and parallel to the other reference plane.

Projections of Straight Line Inclined to Both the Reference Planes: Projections of Planes: Projection of Perpendicular planes: Perpendicular to both reference planes, perpendicular to one reference plane and parallel to other reference plane and perpendicular to one reference plane and inclined to other reference plane. Projection of Oblique planes. Introduction to Auxiliary Planes.

Projections of Solids: Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to other and axes inclined to both the reference planes.

Sections of Solids: Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids (Prism, Pyramid, Cylinder and Cone) in simple position only.

Development of Surfaces: Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.

Isometric Views: Isometric projection, Isometric scale and Isometric view. Isometric view of Prisms, Pyramids, cylinder, cone, and their combinations.

Text Book:

Elementary Engineering Drawing by N.D.Bhatt, Charotar Publishing House.

Reference:

Engineering Graphics by K.L. Narayana and P. Kanniah, Tata McGraw Hill

CH-1204 : MATERIALS SCIENCE & ENGINEERING

Course Objectives:

Materials science and engineering is an important subject to every engineer to understand about the materials' behavior in different environments. Main objectives of the study are as follows:

1. To understand the structure of atoms
2. To learn something about the crystalline nature of the materials
3. To know about the influence of atoms controlling the properties of materials
4. To know the equivalency of the materials for replacement
5. To learn to prepare alloys, composites for conventional materials

6. To find the relation between arrangement and thermodynamic properties of materials

Course Outcomes:

1. To know about the appropriate utility of materials based on their nature.
2. To know the behavior of the materials w.r.t their directions.
3. To know the behaviour of materials exposed to different conditions in different phases.
4. To calculate the stability materials and know the importance of crystallinity.
5. Selectivity of the materials for suitable design to manufacture the machines
6. To improve the properties choosing alternative materials such as alloys, composites instead of conventional materials (to minimize fractures, wear and tear).
7. Leads to prepare some new semiconductors for important purposes.

An introduction to materials, classification of engineering materials, brief review of atomic structure, calculation of energy of electron of Bohr's atomic model, Bonds in materials – classification, properties of ionic, covalent and metallic solids, variation in bonding character and properties. Crystal Geometry and crystal structure – solids- crystalline solids and amorphous solids (non-crystalline), differences between crystalline and non-crystalline materials. Ideal crystal, space Lattice, unit cell, primitive cell, non-primitive cell, lattice co-ordinates, Bravais lattices for crystal systems, crystal systems and their properties, symmetry and elements of symmetry, Atomic packing fraction and packing efficiency (SC, BCC, FCC, Diamond cubic and HCP structures), c/a ratio for HCP structure. Miller indices for directions and linear density calculation, planes in crystals and their representation, planar density calculation, coordination number. Determination of crystal Structure by X-ray diffraction method – Debye method, numerical problems for different cubic structures (SC, BCC and FCC).

Fundamentals of thermodynamics – stability and meta-stability of materials, internal energy (E), enthalpy (H), Gibbs free Energy (G), and thermal entropy and configurational entropy (S). solid solutions-types, crystal imperfections – classification, point defects- classification and estimation of point defects in the crystals; Imperfections (dislocations) – classification (edge and screw); Burger circuits and Burgers Vector, planar defects, volume defects, dislocation reactions, role of dislocations in determining crystal properties; surface defects - types

Mechanical Properties: Stress –types of stresses; Strain-types of strain; true stress and true strain, engineering stress and engineering strain of the

materials, relation between engineering strain and true strain, relation between engineering stress and true stress; Hooke's Law; Poisson's Ratio, stress-strain diagram and its uses; different moduli of elasticity – Young's modulus, shear modulus, and bulk modulus; relation between different moduli of elasticity, strain vs stress relationship diagrams for different materials (metals, non-metals, rubbers and plastics and polymers); elastic deformation and plastic deformation and their differences. Critical Resolved shear stress (CRSS). Fracture – types, ductile fracture and its mechanism, brittle fracture and its mechanism (Griffith's criteria), fatigue factors affecting the fatigue, creep and creep failure mechanisms, creep resistance materials. Composite materials – classification, advantages of composite materials over conventional materials, Limitations of composite materials, factors affecting the performance of fibrous composites, factors affecting the performance of matrix in composites,

Phase- time scale for phase changes, Phase diagrams- phase rule, single component systems, Binary phase changes, the lever rule and numerical problems, advantages of phase diagrams, advantages of alloying of metals on the properties of steels, Iron-iron carbide ($\text{Fe-Fe}_3\text{C}$) phase diagram, limitations of plain carbon steels, types of steels used in chemical industries,

Corrosion and prevention: Principles and mechanism of corrosion, types of corrosion cells: composition cell, concentration cell, stress cells, Different forms of corrosion, prevention and control of corrosion: proper selection of materials, proper design and fabrication procedure, application of protective coatings.

Text books:

1. 'Materials Science & Engineering' by V.Raghavan, Prentice Hall of India Ltd, New Delhi
2. 'Elements of Materials Science & Engineering', 5th Edition, Lawrence H.VanVlack, Addison-Wiley Publishing Company

Reference books:

1. 'Science of Engineering Materials', Vols.1-3, by Manas Chanda, McMillan Company of India, Delhi
2. 'Principles of Materials Science & Engineering', William F.Smith, McGraw-Hill Publishing Co.
3. 'Essentials of Materials Science' by A.G. Guy.
4. A textbook of Engineering physics, by Dr.M.N.Avadhanulu and Dr.P.G.Kshirsagar; S.Chand and company pvt Ltd. Chapters 26 and 27.
- 5.. An introduction to corrosion science and engineering By Herbert Uhlig and R. Winston Revie, Published by John Wiley and sons, New York.
6. Corrosion Engineering by Mars.G.Fontana, McGraw-Hill, publication

CH-1205 : MECHANICAL ENGINEERING

Course Objectives:

- § To be aware of the basics in Thermodynamics
- § To get knowledge on applications of steam tables
- § To understand the principles and applications of IC engines, compressors and turbines
- § To comprehend the principles of belts, chain drives and gears

Course Outcomes:

- To Know the thermodynamic laws and various processes
- To make out the applications of steam in boilers and turbines
- To derive the various performance parameters related to IC engines and of air compressors
- To arrive basic needs of working of belts, chain drives and gears

SYLLABUS

Thermodynamics: Definitions, systems, classification of thermodynamic systems, cycles and zeroth law of thermodynamics, first law of thermodynamics, closed system, flow processes, open systems with steady flow process, applications of steady flow energy equation to engineering systems.

Second law of thermodynamics: Carnot cycle, inequality of Clausius-reversible Carnot cycle, entropy, relation between heat and entropy, general expression for entropy change, entropy change of a perfect gas during various thermodynamic processes, air standard cycles, Otto, diesel, dual combustion cycles,

Properties of steam and use of steam tables: Boilers, classification steam boilers, simple vertical, Cochran, locomotive boiler, Babcock and Wilcox boiler, steam generation, Rankine cycle.

Impulse and reaction turbine: Classification of steam turbines, velocity diagram and power produced in impulse turbine, performance of steam turbines, reduction of rotor speed,

IC engines: Classification-main composition of IC engines, carburettor, fuel pump injector, cooling systems for IC engines, working of 2-stroke and 4-stroke petrol and diesel engines, power and efficiency of IC engines.

Reciprocating air-compressors: Single stage, work done during cycle, effect of clearance, two stage compressors, condition for minimum work, effect of inter-cooling, efficiency.

Drives: Belts, expression for the ratios of tension on the slack and tight side, power transmitted – V-belts, chain drives, gears – spur, helical, bevel gear, trains simple and compound.

Text books:

1. A Text Book of Thermal Engineering by R. S. Khurmi and J. K. Gupta
2. 'Theory of Machines' by R. S. Khurmi

Reference books:

1. 'Engineering Thermodynamics' by P.K.Nag
2. 'Engineering Thermodynamics' by J.B.Jones and R.E.Dugar
3. 'Engineering Thermodynamics' by R.K.Rajput
4. 'Theory of Machines' by Balani

CH-1206 : WORKSHOP LAB

Course Objectives:

- Get hands on experience with the working skills in Carpentry trade.
- Know how to work with Sheet Metal tools.
- Get familiar with the working skills of Metal Fitting operations.
- Get hands on experience with house hold electrical wiring.

Course Outcomes:

- Can be able to work with Wood Materials in real time applications.
- Can be able to build various parts with Sheet Metal in day-to-day life.
- Can be able to apply Metal Fitting skills in various applications.
- Can be able to apply this knowledge to basic house electrical wiring and repairs.

SYLLABUS

Carpentry: Any three jobs from – Half lap joint, Mortise and Tenon joint, Half – lap Dovetail joint, Corner Dovetail joint, Central Bridle joint.

Sheet Metal: Any three jobs from – Square tray, Taper tray(sides), Funnel, Elbow pipe joint.

Fitting: Any three jobs from – Square, Hexagon, Rectangular fit, Circular fit and Triangular fit.

House wiring: Any three jobs from – Tube light wiring, Ceiling fan wiring, Stair-case wiring, Corridor wiring.

References:

1. Elements of workshop technology, Vol.1 by S. K. and H. K. Choudary.

2. Work shop Manual / P.Kannaiah/ K.L.Narayana/ SciTech Publishers.

3. Engineering Practices Lab Manual, Jeyapoovan, Saravana Pandian, 4/e Vikas.

CH-1207 : PHYSICS LAB

Course Objectives:

- To enable the students to acquire skill, technique and utilization of the Instruments
- Draw the relevance between the theoretical knowledge and to imply it in a practical manner with respect to analyze various electronic circuits and its components.
- To impart the practical knowledge in basic concepts of Wave optics, Lasers and Fiber optics.
- To familiarize the handling of basic physical apparatus like Vernier callipers, screw gauge, spectrometers, travelling microscope, laser device, optical fibre, etc.

Course Outcomes:

- Ability to design and conduct experiments as well as to analyze and interpret
- Ability to apply experimental skills to determine the physical quantities related to Heat, Electromagnetism and Optics
- The student will learn to draw the relevance between theoretical knowledge and the means to imply it in a practical manner by performing various relative experiments.

SYLLABUS

1. Determination of Radius of Curvature of a given Convex Lens By forming Newton's Rings.

2. Determination of Wavelength of Spectral Lines in the Mercury Spectrum by Normal Incidence method.

3. Study the Intensity Variation of the Magnetic Field along axis of Current Carrying Circular Coil.

4. Determination of Cauchy's Constants of a Given Material of the Prism using Spectrometer.

5. Determination of Refractive Index of Ordinary ray $m_{\text{---}}$ and Extraordinary $m_{\text{---}}$ ray.

6. Determination of Thickness Given Paper Strip by Wedge Method.

7. Calibration of Low Range Voltmeter.

8. Calibration of Low Range Ammeter.

9. Determination of Magnetic Moment and Horizontal Component of Earth's Magnetic Field.

10. Lees Method - Coefficient of thermal Conductivity of a Bad Conductor.

11. Carey Foster's Bridge – Verification of laws of Resistance and Determination Of Specific Resistance.

12. Melde's Apparatus – Frequency of electrically maintained Tuning Fork.

13. Photoelectric cell-Characteristics.

14. Planks Constants.

15. Laser- Diffraction.

CH-1208 : GENERAL ENGINEERING LABORATORY

MECHANICAL ENGINEERING LABORATORY

Course Objectives:

§ To be aware of the viscosity, flash point of oil samples and calorific value of a gas

§ To get knowledge on calibration of pressure gauge, flywheel and torsional pendulum

§ To understand the principles and applications of Air compressors and IC engines

Course Outcomes:

§ To determine the viscosity, flash point and calorific value of fluids

§ To make out the applications of pressure gauge, flywheel and torsional pendulum

· To derive performance parameters related to IC engines and efficiencies of air compressor Experiments

1. Find the viscosity of the given sample of oil using Redwood viscometer-1

2. Find the viscosity of the given sample of oil using Redwood viscometer-II

3. Find the flash point of the given sample of oil using Abel's flash point tester

4. To calibrate pressure gauge using standard pressure and standard weights

5. Draw the valve timing diagram of a 4-stroke diesel engine and port timing diagram of a 2-stroke petrol engine

6. Perform load test at full load, half load, $\frac{1}{4}$ th load on a 4-stroke Ruston engine and draw the performance curves

7. Find the volumetric efficiency, isothermal efficiency of the given compressor

8. To determine the moment of inertia of a fly-wheel and shaft experimentally and compare the values with the calculated values

9. To determine experimentally the calorific value of a gaseous fuel by using Junkers gas calorimeter

10. To determine the modulus of rigidity of the material of the wire by torsional oscillators

ELECTRICAL ENGINEERING LABORATORY

Course Objectives

This course provides

· Insight of fundamental laws in electrical engineering.

· Deals with the constructional and operational details of DC and AC machines.

· Analyze electrical and magnetic circuits using basic laws of electrical engineering

Course Outcomes

After the completion of the course, the student should be able to

· Understand the basic laws of electrical and magnetic circuits.

· Analyze the characteristics of DC generator and motors.

· Design of equivalent circuit of transformer.

· Apply the basic knowledge to solve problems on synchronous machines.

Experiments

1. Study and calibration of ammeter

2. Study and calibration of voltmeter

3. Study and calibration of wattmeter

4. Study and calibration of energy meter

5. Measurement of low resistance (armature)

6. Measurement of medium resistance (field)

7. Measurement of insulation resistance

8. Measurement of filament resistance

9. Verification of KCL and KVC

10. Superposition theorem.

11. Parameters of a choke coil

12. OC and SC tests on transformer

13. Load test D.C. shunt machine

14. OC test on DC,. separately excited machine

15. Swinburne's test
16. 3-phase induction motor (No load and rotor block tests)
17. Alternator regulation by Syn. impedance method

Computer Science and Engineering

Scheme and Syllabus (With effect from 2020-21 admitted batch)

B.Tech I Year - I Semester

Course Credits code	Category	Course Title	Hours per week			Internal Marks	External Marks	Total Marks	
			L	T	P				
CS-1101	BS	Mathematics – I	3	0	0	30	70	100	3
CS-1102	BS	Chemistry	3	0	0	30	70	100	3
CS-1103	HSS	English	3	0	0	30	70	100	3
CS-1104	ES	CPNM	3	0	3	30	70	100	3
CS-1105	ES	Discrete Mathematical Structures	3	0	0	30	70	100	3
CS-1106	HSS	English Language Lab	0	0	2	50	50	100	1.5
CS-1107	BS	Chemistry Lab	0	0	3	50	50	100	1.5
CS-1108	ES	CPNM Lab	0	0	3	50	50	100	1.5
Total Credits									19.5

B.Tech I Year - II Semester

Course Credits code	Category	Course Title	Hours per week			Internal Marks	External Marks	Total Marks	
			L	T	P				
CS-1201	BS	Mathematics – II	3	0	0	30	70	100	3
CS-1202	BS	Physics	3	0	0	30	70	100	3
CS-1203	ES	Engineering Graphics	1	0	4	30	70	100	3
CS-1204	ES	Data Structures	3	0	0	30	70	100	3
CS-1205	ES	Digital Logic Design	3	0	0	30	70	100	3
CS-1206	ES	Workshop Lab	0	0	3	50	50	100	1.5
CS-1207	BS	Physics Lab	0	0	3	50	50	100	1.5
CS-1208	ES	Data Structures Lab	0	0	3	50	50	100	1.5
Total Credits									19.5

CS-1101 : MATHEMATICS-I

Course Objectives:

- To transmit the knowledge of Partial differentiation.
- To know of getting maxima and minima of function of two variables and finding errors and approximations.

· To evaluate double and triple integrals, volumes of solids and area of curved surfaces.

· To expand a periodical function as Fourier series and half-range Fourier series.

Course Outcomes:

- Find the partial derivatives of functions of two or more variables.
- Evaluate maxima and minima, errors and approximations.
- Evaluate double and triple integrals, volumes of solids and area of curved surfaces.
- To expand a periodical function as Fourier series and half-range Fourier series.
- Have a fundamental understanding of Fourier series and be able to give Fourier expansions of a given function.

SYLLABUS

(Partial Differentiation) Introduction - Functions of two or more variables - Partial derivatives - Homogeneous functions – Euler's theorem - Total derivative - Change of variables – Jacobins. Mean value Theorems (without proofs)

(Applications of Partial Differentiation) Geometrical interpretation - Tangent plane and Normal to a surface - Taylor's theorem for functions of two variables - Errors and approximations - Total differential. Maxima and Minima of functions of two variables - Lagrange's method of undetermined multipliers - Differentiation under the integral Sign - Leibnitz's rule.

(Multiple Integrals) Introduction - Double Integrals - Change of Order of Integration - Double Integrals in Polar Coordinates - Triple Integrals - Change of Variables.

(Multiple Integrals-Applications) Area enclosed by plane curves - Volumes of solids - Area of a curved surface - Calculation of Mass - Center of gravity - Moment of inertia - product of inertia – principal axes- Beta Function - Gamma Function - Relation between Beta and Gamma Functions. Error Function or Probability Integral.

(Fourier Series) Introduction - Euler's Formulae - Conditions for a Fourier Expansion - Functions having points of discontinuity - Change of Interval - Odd and Even Functions - Expansions of Odd or Even Periodic Functions, Half-Range Series - Parseval's Formula. Practical Harmonic analysis.

TEXT BOOK:

Scope and Treatment as in "Higher Engineering Mathematics", by Dr. B.S. Grewal, 43rd Edition, Khanna publishers.

REFERENCE BOOKS:

1. Graduate Engineering Mathematics by V B Kumar Vatti., I.K. International publishing house Pvt. Ltd.
2. Advanced Engineering Mathematics by Erwin Kreyszig.
3. A text book of Engineering Mathematics, by N.P. Bali and Dr. Manish Goyal, Lakshmi Publications.
4. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.
5. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.
6. Higher Engineering Mathematics by Dr. M.K. Venkataraman.

CS-1102 : Chemistry

Course Objectives:

- To apply the basic knowledge of Chemistry to the Engineering Discipline.
- To develop knowledge about water and its treatment for industrial and potable purposes.
- To develop understanding in the areas of Polymers, Mechanism of Corrosion of Metals and Corrosion Control Methods, Fuels, Lubricants and Nanomaterials for conducting polymers, bio-degradable polymers and fiber reinforced plastics and apply the knowledge for solving existing challenges faced in various engineering and societal areas.

Course outcome:

- This course applies the basic concepts and principles studied in Chemistry to Engineering.
- It provides an application of chemistry to different branches of engineering
- The students will be able to acquire knowledge in the areas of Water Chemistry, Polymers, Corrosion, Fuels and Lubricants and nanomaterials and suggest innovative solutions for existing challenges in these areas.

SYLLABUS

Water Chemistry : Sources of Water – Impurities and their influence of living systems – WHO Limits – Hardness and its Determination – Boiler Troubles and their removal – Water Softening Methods – Lime-Soda, Zeolite and Ion Exchange - Municipal Water Treatment-Break Point Chlorination – Desalination of Sea Water – Reverse Osmosis Method, Electro-dialysis.

Polymers and Plastics Polymers: Definition – Types of Polymerization (Addition & Condensation) – Mechanisms of Addition Polymerization – Radical and Ionic – Thermodynamics of Polymerization Process. Plastics: Thermosetting and Thermoplastics – Effect of Polymer Structure on

Properties of Cellulose Derivatives – Vinyl Resins – Nylon (6,6), Reinforced Plastics – Conducting Polymers.

Corrosion

Corrosion: Origin and Theory – Types of Corrosion: Chemical and Electrochemical; Pitting, Inter granular, Waterline, Stress – Galvanic Series – Factors Effecting Corrosion.

Corrosion Controlling Methods: Protective Coatings: Metallic Coatings, Electroplating and Electroless Plating – Chemical conversion Coatings – Phosphate, Chromate, Anodized, Organic Coatings – Paints and Special Paints.

Fuels and Lubricants : Solid Fuels: Wood and Coal, Ranking of Coal – Analysis (Proximate and Ultimate) Coke Manufacture – Otto Hoffmann's Process – Applications; Liquid Fuels: Petroleum Refining – Motor Fuels – Petrol and Diesel Oil – Knocking – Octane number – Cetane Number; Gaseous Fuels: Biogas, LPG and CNG – Characteristics – Applications; Rocket Fuels: Propellants – Classification – Characteristics Lubricants: Classification – Mechanism – Properties of Lubricating Oils – Selection of Lubricants for Engineering Applications.

Nanomaterials : Nanomaterials, Properties and application of fullerenes, fullerenes, Carbon nanotubes and nanowires. Synthesis - Top-down and Bottom-up approaches - Nanocomposites - Nanoelectronics- Applications of nanomaterials in catalysis, telecommunication and medicine.

Text Books:

1. Engineering Chemistry – PC Jain and M. Jain – Dhanpath Rai and Sons, New Delhi.
2. A Text book of Engineering Chemistry – S. S. Dara – S. Chand & Co. New Delhi.

Reference Books:

1. Engineering Chemistry – B. K. Sharma – Krishna Prakashan – Meerut.
2. Introduction to Nanoscience - S. M. Lindsay - Oxford University Press
3. Engineering Chemistry - B. L. Tembe, Kamaluddin and M. S. Krishnan, (NPTEL).

CS-1103 : ENGLISH

Course Objectives:

- To make students understand the explicit and implicit meanings of a text/topic;
- To give exposure to new words and phrases, and aid to use them in different contexts;

- To apply relevant writing formats to draft essays, letters, emails and presentations; and

- To adapt oneself to a given situation and develop a functional approach to finding solutions: adaptability and problem solving.

Course Outcomes:

- Students will be able to analyse a given text and discover the various aspects related to language and literature;

- Learn the various language structures, parts of speech and figures of speech;

- Develop one's reading and writing abilities for enhanced communication; and

- Learn to apply the topics in real-life situations for creative and critical use.

SYLLABUS

On the conduct of life: William Hazlitt

Life skills: Values and Ethics

If: Rudyard Kipling

The Brook: Alfred Tennyson

Life skills: Self-Improvement

How I Became a Public Speaker: George Bernard Shaw

The Death Trap: Saki

Life skills: Time Management

On saving Time: Seneca ChinduYellama

Life skills: Innovation

Muhammad Yunus

Politics and the English Language: George Orwell

Life skills: Motivation

Dancer with a White Parasol: Ranjana Dave

Grammar: Prepositions – Articles – Noun-Pronoun Agreement, Subject-Verb Agreement – Misplaced Modifiers – Clichés, Redundancies.

Vocabulary: Introduction to Word Formation – Root Words from other Languages – Prefixes and Suffixes – Synonyms, Antonyms – Common Abbreviations

Writing: Clauses and Sentences – Punctuation – Principals of Good Writing – Essay Writing – Writing a Summary

Writing: Essay Writing

Life skills: Innovation

Muhammad Yunus

Textbook:

Language and Life: A Skills Approach Board of Editors, Orient Blackswan Publishers, India. 2018.

References :

1. *Practical English Usage*, Michael Swan. OUP. 1995.

2. *Remedial English Grammar*, F.T. Wood. Macmillan.2007

3. *On Writing Well*, William Zinsser. Harper Resource Book. 2001

4. *Study Writing*, Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.

5. *Communication Skills*, Sanjay Kumar and PushpLata. Oxford University Press. 2011.

6. *Exercises in Spoken English*, Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

CS-1104 : CPNM

Course Objectives:

- The course is designed to provide complete knowledge of C language.

- To provide students with understanding of code organization and functional hierarchical decomposition with using complex data types.

- To provide knowledge to the Students to develop logics which will help them to create programs, applications in C.

- This course aims to identify tasks in which the numerical techniques learned are applicable and apply them to write programs, and hence use computers effectively to solve the task.

- This course provides the fundamental knowledge which is useful in understanding the other programming languages.

Course Outcomes:

- Identify basic elements of C programming structures like data types, expressions, control statements, various simple functions and Apply them in problem solving.

- Apply various operations on derived data types like arrays and strings in problem solving.

- Design and Implement of modular Programming and memory management using Functions, pointers.

- Apply Structure, Unions and File handling techniques to Design and Solve different engineering programs with minimal complexity.

- Apply Numerical methods to Solve the complex Engineering problems.

SYLLABUS

1. Introduction to C: Basic structure of C program, Constants, Variables and data types, Operators and Expressions, Arithmetic Precedence and associativity, Type Conversions. Managing Input and Output Operations Formatted Input, Formatted Output.

2. Decision Making, Branching, Looping, Arrays & Strings: Decision making with if statement, Simple if statement, The if...else statement, Nesting of if...else statement, the else..if ladder, switch statement, the (?:) operator, the GOTO statement., The while statement, the do statement, The for statement, Jumps in Loops ,One, Two-dimensional Arrays, Character Arrays. Declaration and initialization of Strings, reading and writing of strings, String handling functions, Table of strings.

3. Functions: Definition of Functions, Return Values and their Types, Function Calls, Function Declaration, Category of Functions: No Arguments and no Return Values, Arguments but no Return Values, Arguments with Return Values, No Argument but Returns a Value, Functions that Return Multiple Values. Nesting of functions, recursion, passing arrays to functions, passing strings to functions, the scope, visibility and lifetime of variables.

4. Pointers: Accessing the address of a variable, declaring pointer variables, initializing of pointer variables, accessing variables using pointers, chain of pointers, pointer expressions, pointers and arrays, pointers and character strings, array of pointers, pointers as function arguments, functions returning pointers, pointers to functions, pointers to structures-Program Applications

5. Structure and Unions: Defining a structure, declaring structure variables, accessing structure members, structure initialization, copying and comparing structure variables, arrays of structures, arrays within structures, structures within structures, structures and functions and unions, size of structures and bit-fields- Program applications.

6. File handling: Defining and opening a file, closing a file, Input/ Output operations on files, Error handling during I/O operations, random access to files and Command Line Arguments- Program Applications

7. Numerical Methods: Solutions of Algebraic and Transcendental Equations, Bisection Method, Newton Raphson Method. Newton's forward and backward Interpolation, Lagrange's Interpolation in unequal intervals. Numerical Integration: Trapezoidal rule, Simpson's 1/3 rules. Solutions of Ordinary First Order Differential Equations: Euler's Method, Modified Euler's Method and Runge-Kutta Method.

Text Book:

1. Programming in ANSI C, E Balagurusamy, 6th Edition. McGraw Hill Education (India) Private Limited.
2. Introduction to Numerical Methods, SS Sastry, Prentice Hall

Reference Books:

1. Let Us C ,YashwantKanetkar, BPB Publications, 5th Edition.
2. Computer Science, A structured programming approach using C", B.A.Forouzan and R.F.Gilberg, " 3rd Edition, Thomson, 2007.
3. The C –Programming Language' B.W. Kernighan, Dennis M. Ritchie, PHI.
4. Scientific Programming: C-Language, Algorithms and Models in Science, Luciano M. Barone (Author), EnzoMarinari (Author), Giovanni Organtini, World Scientific.

CS-1105 : DISCRETE MATHEMATICAL STRUCTURES

Course Objectives:

- To understand mathematical arguments using logical connectives and quantifiers and verify the validity of logical flow of arguments using propositional ,predicate logic and truth tables.
- To understand about permutations and combinations.
- To understand various types of relations and discuss various properties of the relations.
- To study the graphs, graph isomorphism and spanning trees.
- To study about Boolean algebra and Finite State Machines.

Course Outcomes:

At the end of the course student will be able to

- Rewrite mathematical arguments using logical connectives and quantifiers and verify the validity of logical flow of arguments using propositional, predicate logic.
- Identify and give examples of various types of relations and describe various properties of the relations.
- Ability to solve problems using permutations and combinations.
- Determine isomorphism of graphs and spanning tree of a given graph using BFS/DFS algorithms. Also determine minimal spanning tree of a given graph.

SYLLABUS

1. The Foundations-Logic and Proofs: Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers Rules of Inference, Introduction to Proofs, Proof Methods and Strategy, Basic Structures-Sets, Functions, Sequences and Sums: Sets, Set Operations, Functions, Sequences and Summations.

2. The Fundamentals-Algorithms, the Integers and Matrices: Algorithms, The Growth of Functions, Complexity of Algorithms, The Integers and Division, Primes and Greatest Common Divisors, Integers and Algorithms, Applications of Number Theory, Matrices.

3. Induction and Recursion: Mathematical Induction, Strong Induction and Well-Ordering, Recursive Definitions and Structural Induction, Recursive Algorithms, Program Correctness. Counting: The Basics of Counting, The Pigeonhole Principle, Permutations and Combinations, Binomial Coefficients, Generalized Permutations and Combinations, Generating Permutations and Combinations.

4. Advanced Counting Techniques: Recurrence Relations, Solving Linear Recurrence Relations, Divide-and-Conquer Algorithms and Recursion Relations, Generating Functions, Inclusion-Exclusion, and Applications of Inclusion-Exclusion.

5. Relations: Relations and their properties, n-ary relations, applications, Representation, closure, equivalence relations, Partial orderings.

Graphs: Graphs and Graph Models, Graph Terminology and Special Types of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest-Path Problems, Planar Graphs, Graph Coloring

6. Trees: Introduction to Trees, Applications of Trees, Tree Traversal, Spanning Trees, Minimum Spanning Trees,

7. Boolean Algebra: Boolean Functions, Representing Boolean Functions, Logic Gates, Minimization of Circuits

Modeling Computation: Languages and Grammars, Finite-State Machines with Output, Finite-State Machines with No Output, Language Recognition, Turing Machines

Text Book:

1. Discrete Mathematics & Its Applications with Combinatorics and Graph Theory by Kenneth H Rosen, Tata McGraw-Hill Publishing Company Ltd., New Delhi.

Reference Books:

1. Discrete Mathematics for Computer Scientists & Mathematicians by Joe L. Mott, Abraham Kandel, Theodore P. Baker, Prentice-Hall, India.

2. Discrete Mathematics by Richard Johnson Baug, Pearson Education, New Delhi.

3. Discrete and Combinatorial Mathematics by Ralph. G. Grimaldi, Pearson Education, New Delhi.

CS-1106 : ENGLISH LANGUAGE LAB

Course Objectives:

- To make students recognize the sounds of English through Audio-Visual aids;

- To help students build their confidence and help them to overcome their inhibitions and self-consciousness while speaking in English;

- To familiarize the students with stress and intonation and enable them to speak English effectively; and

- To give learners exposure to and practice in speaking in both formal and informal contexts.

Course Outcomes:

- Students will be sensitized towards recognition of English sound patterns and the fluency in their speech will be enhanced;

- A study of the communicative items in the laboratory will help students become successful in the competitive world;

- Students will be able to participate in group activities like roleplays, group discussions and debates; and

- Students will be able to express themselves fluently and accurately in social as well professional context.

SYLLABUS

Introduction to Phonetics: The Sounds of English (Speech sound – vowels and consonants) - Stress and Intonation - Accent and Rhythm.

Listening Skills: Listening for gist and specific information - listening for Note taking, summarizing and for opinions - Listening to the speeches of eminent personalities.

Speaking Skills: Self-introduction - Conversation Skills (Introducing and taking leave) - Giving and asking for information - Role Play - Just A Minute (JAM) session - Telephone etiquette.

Reading and Writing skills: Reading Comprehension – Précis Writing - E-Mail writing - Punctuation.

Presentation skills: Verbal and non-verbal communication - Body Language - Making a Presentation.

Reference Books:

1. Ashraf Rizvi. *Effective Technical Communication*. Tata McGraw Hill Education Private Limited, New Delhi.

2. *Speak Well*. Orient Blackswan Publishers, Hyderabad.

3. Allan Pease. *Body Language*. Manjul Publishing House, New Delhi.

CS-1107 : CHEMISTRY LAB

Course Objectives:

- To develop the fine skills of quantitative determination of various chemical components through titrimetric analysis

- To prepare and use ionexchange/ zeolite columns for the removal of water

- To develop the skill of organic synthesis through the preparation of a polymer/ drug

Outcomes:

- The course provides quantitative determine the amount of various chemical species in solutions by titrations and conduct the quantitative determinations with accuracy
- The course provides to develop novel materials to be used as zeolite and prepare columns for removal of hardness of water
- The course provides to synthesise a polymer or a drug

SYLLABUS

1. Determination of Sodium Hydroxide with HCl (Na_2CO_3 Primary Standard)
2. Determination of Alkalinity (Carbonate and Hydroxide) of water sample
3. Determination of Fe(II)/Mohr's Salt by Permanganometry
4. Determination of Oxalic Acid by Permanganometry
5. Determination of Chromium (VI) by Mohr's Salt Solution
6. Determination of Zinc by EDTA method
7. Determination of Hardness of Water sample by EDTA method
8. Determination of Chlorine in water by Iodometric Titration
9. Ionexchange/ Zeolite column for removal of hardness of water
10. Synthesis of Polymer/ drug

Reference Books:

1. Vogel's Quantitative Chemical Analysis – V – Edition – Longman.
2. Experiments in Applied Chemistry (For Engineering Students) – Sinita Rattan – S. K. Kataria & Sons, New Delhi

CS-1108 : CPNM LAB

Course Objectives:

- To impart writing skill of C programming to the students and solving problems.
- To write and execute programs in C to solve problems such as Modularize the problems into small modules and then convert them into programs.,
- To write and execute programs in C to solve problems such as arrays, files, strings, structures and different numerical methods.
- This reference has been prepared for the beginners to help them understand the basic to advanced concepts related to Objective-C Programming languages.

Course Outcomes:

- Understand various computer components, Installation of software. C programming development environment, compiling, debugging, and linking and executing a program using the development environment.

- Analyzing the complexity of problems, Modularize the problems into small modules and then convert them into programs.
- Construct programs that demonstrate effective use of C features including arrays, strings, structures, pointers and files.
- Apply and practice logical ability to solve the real world problems.
- Apply Numerical methods to Solve the complex Engineering problems.

SYLLABUS

1. Write a program to read x, y coordinates of 3 points and then calculate the area of a triangle formed by them and print the coordinates of the three points and the area of the triangle. What will be the output from your program if the three given points are in a straight line?
2. Write a program, which generates 100 random integers in the range of 1 to 100. Store them in an array and then print the arrays. Write 3 versions of the program using different loop constructs. (e.g. for, while, and do while).
3. Write a set of string manipulation functions e.g. for getting a substring from a given position, Copying one string to another, Reversing a string, adding one string to another.
4. Write a program which determines the largest and the smallest number that can be stored in different data types like short, int, long, float, and double. What happens when you add 1 to the largest possible integer number that can be stored?
5. Write a program, which generates 100 random real numbers in the range of 10.0 to 20.0, and sort them in descending order.
6. Write a function for transposing a square matrix in place (in place means that you are not allowed to have full temporary matrix).
7. First use an editor to create a file with some integer numbers. Now write a program, which reads these numbers and determines their mean and standard deviation.
8. Given two points on the surface of the sphere, write a program to determine the smallest arc length between them.
9. Implement bisection method to find the square root of a given number to a given accuracy.
10. Implement Newton Raphson method to det. a root of polynomial equation.
11. Given table of x and corresponding f(x) values, Write a program which will determine f(x) value at an intermediate x value by using Lagrange's interpolation/

12. Write a function which will invert a matrix.
13. Implement Simpson's rule for numerical integration.
14. Write a program to solve a set of linear algebraic equations.

CS-1201 : Mathematics – II

Course Objectives:

- The way of obtaining rank, eigen values and eigen vectors of a matrix.
- To know the importance of Cayley-Hamilton theorem and getting canonical form from a given quadratic form.
- To solve the system of equations by using direct and indirect methods.
- To solve first order and higher order differential equations by various methods.
- To obtain the Laplace transforms and inverse Laplace transforms for a given functions and their applications.

Course Outcomes:

- Find rank, eigen values and eigen vectors of a matrix and understand the importance of Cayley-Hamilton theorem.
- Reduce quadratic form to canonical forms and solving linear systems by direct and indirect methods.
- Demonstrate solutions to first order differential equations by various methods and solve basic applications problems related to electrical circuits, orthogonal trajectories and Newton's law of cooling
- Discriminate among the structure and procedure of solving higher order differential equations with constant and variable coefficients.
- Understand Laplace transforms and its properties and finding the solution of ordinary differential equations.

SYLLABUS

(Linear Algebra) Rank of a matrix- Echelon form, Normal Form - Solution of Linear System of Equations - Consistency of Linear System of Equations - Direct & Indirect Methods: Gauss elimination method, LU Factorization method, Gauss Seidal Method. Complex Matrices: Hermitian, Skew-Hermitian and Unitary Matrices and their Properties.

(Eigen Values and Eigen Vectors) Eigen Values and Eigen Vectors of a Matrix - Cayley-Hamilton theorem - Inverse and Powers of a Matrix using Cayley-Hamilton's theorem and its applications. Diagonalization of a Matrix - Quadratic Forms - Reduction of Quadratic Form to Canonical Form - Nature of a Quadratic Form.

(Ordinary Differential Equations of First Order and its Applications) Formation of ordinary differential equations (ODEs) - Solution of an ordinary differential equation - Equations of the first order and first degree - Linear differential equation - Bernoulli's equation - Exact differential equations -

Equations reducible to exact equations - Orthogonal Trajectories - Simple Electric (LR & CR) Circuits - Newton's Law of Cooling - Law of Natural growth and decay.

(Differential Equations of Higher Order) Solutions of Linear Ordinary Differential Equations with Constant Coefficients - Rules for finding the complimentary function - Rules for finding the particular integral - Method of variation of parameters - Cauchy's linear equation - Legendre's linear equation - Simultaneous linear differential equations.

(Laplace Transforms) Introduction - Existence Conditions - Transforms of Elementary Functions - Properties of Laplace Transforms - Transforms of Derivatives - Transforms of Integrals - Multiplication by t^n - Division by t - Evaluation of integrals by Laplace Transforms - Inverse Laplace Transform - Applications of Laplace Transforms to Ordinary Differential Equations - Simultaneous Linear Differential Equations with Constant Coefficients - Second Shifting Theorem - Laplace Transforms of Unit Step Function, Unit Impulse Function and Laplace Transforms of Periodic Functions.

TEXT BOOK:

Scope and Treatment as in "Higher Engineering Mathematics", by Dr. B.S. Grewal, 43rd edition, Khanna publishers.

REFERENCE BOOKS:

7. Graduate Engineering Mathematics by V B Kumar Vatti., I.K. International publishing house Pvt. Ltd.

1. Advanced Engineering Mathematics by Erwin Kreyszig.

2. A text book of Engineering Mathematics, by N.P. Bali and Dr. Manish Goyal. Lakshmi Publications.

3. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.

4. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.

CS-1202 : PHYSICS

Course Objectives:

- To impart knowledge in basic concept of physics of Thermodynamics relevant to engineering applications.
- To grasp the concepts of physics for electromagnetism and its application to engineering. Learn production of Ultrasonics and their applications in engineering.
- To Develop understanding of interference, diffraction and polarization: connect it to a few engineering applications.
- To Learn basics of lasers and optical fibers and their use in some applications.

- To Understand concepts and principles in quantum mechanics and Nanophase Materials. Relate them to some applications.

Course Outcomes:

- Understand the fundamentals of Thermodynamics and Laws of thermodynamics. Understand the working of Carnot cycle and concept of entropy.

- Gain Knowledge on the basic concepts of electric and magnetic fields. Understand the concept of the nature of magnetic materials. Gain knowledge on electromagnetic induction and its applications .

- Understand the Theory of Superposition of waves. Understand the formation of Newton's rings and the working of Michelson's interferometer. Remember the basics of diffraction, Evaluate the path difference. Analysis of Fraunhofer Diffraction due to a single slit

- Understand the interaction of matter with radiation, Characteristics of Lasers, Principle, working schemes of Laser and Principle of Optical Fiber. Realize their role in optical fiber communication.

- Understand the intuitive ideas of the Quantum physics and understand dual nature of matter. Compute Eigen values, Eigen functions, momentum of Atomic and subatomic particles using Time independent one Dimensional Schrodinger's wave equation. Understand the fundamentals and synthesis processes of Nanophase materials.

SYLLABUS

THERMODYNAMICS Introduction, Heat and Work, First law of thermodynamics and applications, Reversible and Irreversible process, Carnot cycle and Efficiency, Second law of thermodynamics, Carnot's Theorem, Entropy, Second law in terms of entropy, Entropy and disorder, Third law of thermodynamics (statement only).

ELECTROMAGNETISM Concept of electric flux, Gauss's law - some applications, Magnetic field - Magnetic force on current, torque on current loop, The Biot-Savart's Law, B near a long wire, B for a circular Current loop, Ampere's law, B for a solenoid, Hall effect, Faraday's law of induction, Lenz's law, Induced magnetic fields, Displacement current, Maxwell's equations (no derivation), Magnetic materials: Classification of magnetic materials and properties.

Ultrasonics : Introduction, Production of Ultrasonics – Piezoelectric and Magnetostriction methods, acoustic grating, applications of ultrasonics.

OPTICS

Interference: Principles of superposition – Young's Experiment – Coherence - Interference in thin films (reflected light), Newton's Rings, Michelson Interferometer and its applications.

Diffraction: Introduction, Differences between interference and diffraction, Fresnel and Fraunhofer diffraction, Fraunhofer diffraction at a single slit (Qualitative and quantitative treatment).

Polarisation: Polarisation by reflection, refraction and double refraction in uniaxial crystals, Nicol prism, Quarter and Half wave plate, circular and elliptical polarization.

LASERS and FIBRE OPTICS : Introduction, characteristics of a laser beam, spontaneous and stimulated emission of radiation, population inversion, Ruby laser, He-Ne laser, Semiconductor laser, applications of lasers

Introduction to optical fibers, principle of propagation of light in optical fibers, Acceptance Angle and cone of a fibre, Numerical aperture, Modes of propagations, classification of fibers, Fibre optics in communications, Application of optical fibers.

MODERN PHYSICS : Introduction, De Broglie concept of matter waves, Heisenberg uncertainty principle, Schrodinger time independent wave equation, application to a particle in a box. Free electron theory of metals, Kronig - Penney model (qualitative treatment), Origin of energy band formation in solids, Classification of materials into conductors, semi conductors and insulators.

Nanophase Materials

Introduction, properties, Top-down and bottom up approaches, Synthesis - Ball milling, Chemical vapour deposition method , sol-gel methods, Applications of nano materials.

TEXT BOOKS :

1. Physics by David Halliday and Robert Resnick – Part I and Part II - Wiley.
2. A textbook of Engineering Physics, Dr. M. N. Avadhanulu, Dr. P.G. Kshirsagar - S. Chand
3. Engineering Physics by R.K. Gaur and S.L. Gupta –Dhanpat Rai

Reference Books:

1. Modern Engineering Physics by A.S. Vadudeva
2. University Physics by Young and Freedman

CS-1203 : ENGINEERING GRAPHICS

Course Objectives:

- Understand the basics of Engineering Graphics and BIS conventions.
- Develop the graphical skills for communication of concepts, ideas and design of engineering products through technical drawings
- Demonstrate and practice the various profiles/curves used in engineering practice through standard procedures.

- Demonstrate and practice the orthographic projections of points, lines, planes, solids and section of solids

- Demonstrate and practice the development of surfaces of simple solids

- Familiarize the basic concept of isometric views clearly.

Course Outcomes:

- Develop simple engineering drawings by considering BIS standards.

- Able to draw different engineering curves with standard Procedures

- Comprehend the basics of orthographic projections and deduce orthographic projections of points, lines, planes and solids at different orientations in real life environment.

- Visualize clearly the sections of solids.

- Apply the concepts of development of surfaces while designing/analyzing any product.

- Recognize the significance of isometric drawing to relate 2D environment with 3D environment.

SYLLABUS

Introduction: Lines, Lettering and Dimensioning, Geometrical Constructions, and Scales.

Curves: Conic sections: General construction of ellipse, parabola and hyperbola. Construction of involutes of circle and polygons only. Normal and tangent to curves.

Projections of Points: Principal or Reference Planes, Projections of a point situated in any one of the four quadrants.

Projections of Straight Lines: Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane.

Projections of Straight Line Inclined to Both the Reference Planes: Projections of Planes: Projection of Perpendicular planes: Perpendicular to both reference planes, perpendicular to one reference plane and parallel to other reference plane and perpendicular to one reference plane and inclined to other reference plane. Projection of Oblique planes. Introduction to Auxiliary Planes.

Projections of Solids: Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to other and axes inclined to both the reference planes.

Sections of Solids: Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids (Prism, Pyramid, Cylinder and Cone) in simple position only.

Development of Surfaces: Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.

Isometric Views: Isometric projection, Isometric scale and Isometric view. Isometric view of Prisms, Pyramids, cylinder, cone, and their combinations.

Text Book:

Elementary Engineering Drawing by N.D.Bhatt, Charotar Publishing House.

Reference:

Engineering Graphics by K.L. Narayana and P. Kanniah, Tata McGraw Hill

CS-1204 : DATA STRUCTURES

Course Objectives:

- Assess how the choice of data structures and algorithm design methods impacts the performance of programs.

- Choose the appropriate data structure and algorithm design method for a specified application.

- Solve problems using data structures such as linear lists, stacks, queues, binary trees, heaps, binary search trees, and graphs and writing programs for these solutions.

Course Outcomes:

- Describe how arrays, records, linked structures, stacks, queues, trees, and graphs are represented in memory and used by algorithm.

- Demonstrate different methods for traversing trees.

- Compare alternative implementations of data structures with respect to performance.

- Discuss the computational efficiency of the principal algorithms for sorting and searching

SYLLABUS

1. Introduction to Data Structures: Review of C Programming, Recursive Definition and Processes, Recursion in C, Simulation of Recursion, Efficiency of Recursion, Abstract Data Types, Meaning and Definition of Data Structures, Arrays

2. Stacks: Stack as an Abstract Data Type, Primitive Operations, Implementing Stack Operations using Arrays, Infix, Postfix and Prefix:

Definitions, Evaluation and Conversions. Queues: Queue as an Abstract Data Type, Sequential Representation, Types of Queues, Operations, Implementation using Arrays.

3. Linked List: Operations, Implementation of Stacks, Queues and priority Queues using Linked Lists, Circular Lists: Insertion, Deletion and Concatenation Operations, Stacks and Queues as Circular Lists, Doubly Linked Lists.

4. Trees: Binary Trees - Definitions and Operations, Binary Tree Representation: Node Representation, Implicit array Representation, Binary Tree Traversal, Threaded Binary Trees and their Traversal, Trees and their Applications; Tree Searching: Insertion and Deletion of a node from a Binary Search Tree, Efficiency of Binary Search Tree operations.

5. Searching: Basic Searching Techniques: Dictionary as an Abstract Data Type, Algorithmic Notation, Sequential Searching and its Efficiency, Binary Search, Interpolation Search.

6. Sorting: General Background: Efficiency, Asymptotic Notations, Efficiency of Sorting, Bubble Sort and Quick Sort and their Efficiency, Selection Sorting, Binary Tree Sort, Heap Sort, Insertion Sorts, Shell Sort, Address calculation Sort, Merge and Radix Sorts.

7. Graphs and Their Application: Definition of Graphs, Representation of Graphs, Transitive closure, Linked Representation of Graphs, Topological Ordering of nodes, Graph Traversal and Spanning Forests, Undirected Graphs and their Traversals, Applications of Graphs, Minimal Spanning Trees.

Textbooks:

1. Data Structures Using C and C++ Yddish Langsam, Moshe J. Augenstein and Aaron M. Tanenbaum, Prentice Hall Of India (2nd Edition)

2. Data Structures, Algorithms and Applications with C++, Sahani McGraw Hill.

CS-1205 : DIGITAL LOGIC DESIGN

Course Objectives:

- To introduce the basic principles for design of combinational circuit and sequential circuits.

- To learn simple digital circuits in preparation for computer engineering.

Course Outcomes:

A student who successfully fulfills the course requirements will have demonstrated:

- An ability to define different number systems, binary addition and subtraction, 2's complement representation and operations with this representation.

- An ability to understand the different Boolean algebra theorems and apply them for logic functions.

- An ability to define the Karnaugh map for a few variables and perform an algorithmic reduction of logic functions.

- An ability to define the following combinational circuits: multiplexer, de-multiplexers encoders/decoders, comparators, arithmetic-logic units; and to be able to build simple circuits.

- An ability to understand asynchronous and synchronous sequential circuits, like counters and shift registers.

- An ability to understand memories like RAM and ROM, Programmable Logic Array and Programmable Array Logic.

SYLLABUS

1. Binary Systems: Digital Systems. Binary Numbers. Number Base Conversions. Octal and Hexadecimal Numbers. Complements. Signed Binary Numbers. Binary Codes. Binary Storage and Registers. Binary Logic

2. Boolean Algebra and Logic Gates: Basic Definitions. Axiomatic Definition of Boolean Algebra. Basic Theorems and Properties of Boolean Algebra. Boolean Functions. Canonical and Standard Forms. Other Logic Operations. Digital Logic Gates. Integrated Circuits.

3. Combinational Logic Design, Gate-Level Minimization: The Map Method. Four- Variable Map. Five-Variable Map. Product of Sums Simplification. Don't-Care Conditions. NAND and NOR Implementation. Other Two- Level Implementations. Exclusive-OR Function. Hardware Description Language (HDL).

4. Combinational Logic: Combinational Circuits. Analysis Procedure. Design Procedure. Binary Adder Subtractor. Decimal Adder. Binary Multiplier. Magnitude Comparator. Decoders. Encoders. Multiplexers. HDL For Combinational Circuits.

5. Sequential Logic Design, Synchronous Sequential Logic: Sequential Circuits. Latches Flip Flops. Analysis of Clocked Sequential Circuits. HDL For Sequential Circuits. State Reduction and Assignment. Design Procedure.

6. Registers and Counters: Registers. Shift Registers. Ripple Counters. Synchronous Counters. Other Counters. HDL for Registers and Counters.

7. Memory and Programmable Logic: Introduction. Random-Access Memory. Memory Decoding, Error Detection and Correction. Read-Only Memory. Programmable Logic Array. Programmable Array Logic. Sequential Programmable Devices.

TEXTBOOK:

1. Digital Design, 3rd Edition, M. Morris Mano, Pearson Education.

REFERENCEBOOKS:

1. Digital Logic Design Principles, Norman Balabanian & Bradley Carlson, John Wiley & Sons (Asia) Pvt. Ltd., 2002
2. Fundamentals of Digital Logic with VHDL Design, Stephen Brown and Zvonko Vranesic, Tata McGraw-Hill Edition, 2002

CS-1206 : WORKSHOP LAB

Course Objectives:

- Get hands on experience with the working skills in Carpentry trade.
- Know how to work with Sheet Metal tools.
- Get familiar with the working skills of Metal Fitting operations.
- Get hands on experience with house hold electrical wiring.

Course Outcomes:

- Can be able to work with Wood Materials in real time applications.
- Can be able to build various parts with Sheet Metal in day-to-day life.
- Can be able to apply Metal Fitting skills in various applications.
- Can be able to apply this knowledge to basic house electrical wiring and repairs.

SYLLABUS

Carpentry: Any three jobs from – Half lap joint, Mortise and Tenon joint, Half – lap Dovetail joint, Corner Dovetail joint, Central Bridle joint.

Sheet Metal: Any three jobs from – Square tray, Taper tray(sides), Funnel, Elbow pipe joint.

Fitting: Any three jobs from – Square, Hexagon, Rectangular fit, Circular fit and Triangular fit.

House wiring: Any three jobs from – Tube light wiring, Ceiling fan wiring, Stair-case wiring, Corridor wiring.

References:

1. Elements of workshop technology, Vol.1 by S. K. and H. K. Choudary.
2. Work shop Manual / P.Kannaiah/ K.L.Narayana/ SciTech Publishers.
3. Engineering Practices Lab Manual, Jeyapoovan, Saravana Pandian, 4/e Vikas.

CS-1207: PHYSICS LAB

Course Objectives:

- To enable the students to acquire skill, technique and utilization of the Instruments
- Draw the relevance between the theoretical knowledge and to imply it in a practical manner with respect to analyze various electronic circuits and its components.

- To impart the practical knowledge in basic concepts of Wave optics, Lasers and Fiber optics.

- To familiarize the handling of basic physical apparatus like Vernier callipers, screw gauge, spectrometers, travelling microscope, laser device, optical fibre, etc.

Course Outcomes:

- Ability to design and conduct experiments as well as to analyze and interpret
- Ability to apply experimental skills to determine the physical quantities related to Heat, Electromagnetism and Optics
- The student will learn to draw the relevance between theoretical knowledge and the means to imply it in a practical manner by performing various relative experiments.

SYLLABUS

1. Determination of Radius of Curvature of a given Convex Lens By forming Newton's Rings.
2. Determination of Wavelength of Spectral Lines in the Mercury Spectrum by Normal Incidence method.
3. Study the Intensity Variation of the Magnetic Field along axis of Current Carrying Circular Coil.
4. Determination of Cauchy's Constants of a Given Material of the Prism using Spectrometer.
5. Determination of Refractive Index of Ordinary ray m_o and Extraordinary ray m_e .
6. Determination of Thickness Given Paper Strip by Wedge Method.
7. Calibration of Low Range Voltmeter.
8. Calibration of Low Range Ammeter.
9. Determination of Magnetic Moment and Horizontal Component of Earth's Magnetic Field.
10. Lees Method - Coefficient of thermal Conductivity of a Bad Conductor.
11. Carey Foster's Bridge – Verification of laws of Resistance and Determination Of Specific Resistance.

12. Melde's Apparatus – Frequency of electrically maintained Tuning Fork.

13. Photoelectric cell-Characteristics.

14. Planks Constants.

15. Laser- Diffraction.

CS-1208 : DATA STRUCTURES LAB

Course Objectives:

- To implement stacks and queues using arrays and linked lists.
- To develop programs for searching and sorting algorithms.
- To write programs using concepts of various trees.
- To implement programs using graphs.

Course Outcomes:

- Student will be able to write programs to implement stacks and queues.
- Ability to implement various searching and sorting techniques.
- Ability to implement programs using trees and graphs.

SYLLABUS

List of Programs:

1. Write a C program for sorting a list using Bubble sort and then apply binary search.
2. Write a C program to implement the operations on stacks.
3. Write a C program to implement the operations on circular queues.
4. Write a C program for evaluating a given postfix expression using stack.
5. Write a C program for converting a given infix expression to postfix form using stack.
6. Write a C program for implementing the operations of a queue.
7. Write a C program for the representation of polynomials using circular linked list and for the addition of two such polynomials.
8. Write a C program for quicksort.
9. Write a C program for Mergesort.
10. Write a C program for Heapsort.
11. Write a C program to create a binary search tree and for implementing the in order, preorder, post order traversal using recursion.
12. a) Write a C program for finding the transitive closure of a digraph.
b) Write a C program for finding the shortest path from a given source to any vertex in a digraph using Dijkstra's algorithm.
13. a) Write a C program for finding the Depth First Search of a graph.
b) Write a C program for finding the Breadth First Search of a graph.

Electronics and Communication Engineering

Scheme and Syllabus (With effect from 2020-21 admitted batch)

B.Tech I Year - I Semester

Course Credits	Category	Course Title	Hours per week			Internal	External	Total	
code			L	T	P	Marks	Marks	Marks	
EC-1101	BS	Maths – I	3	0	0	30	70	100	
EC-1102	BS	Physics	3	0	0	30	70	100	
EC-1103	ES	Engg .Graphics	1	0	4	30	70	100	
EC-1104	ES	Electronic Devices and Circuits	3	0	0	30	70	100	
EC-1105	ES	Network Theory Analysis	3	0	0	30	70	100	
EC-1106	ES	Workshop Lab	0	0	3	50	50	100	
EC-1107	BS	Physics Lab	0	0	3	50	50	100	
EC-1108	ES	Electronic Devices and Circuits Lab	0	0	3	50	50	100	
Total Credits								19.5	

B.Tech I Year - II Semester

Course Credits	Category	Course Title	Hours per week			Internal	External	Total	
code			L	T	P	Marks	Marks	Marks	
EC-1201	BS	Maths – II	3	0	0	30	70	100	
EC-1202	BS	Chemistry	3	0	0	30	70	100	
EC-1203	HSS	English	3	0	0	30	70	100	
EC-1204	ES	CPNM	3	0	3	30	70	100	
EC-1205	ES	Switching Theory and Logic Design	3	0	0	30	70	100	
EC-1206	HSS	English Language Lab	0	0	2	50	50	100	
EC-1207	BS	Chemistry Lab	0	0	3	50	50	100	
EC-1208	ES	CPNM Lab	0	0	3	50	50	100	
Total Credits								19.5	

EC-1101 : MATHEMATICS-I

Course Objectives:

- To transmit the knowledge of Partial differentiation.
- To know of getting maxima and minima of function of two variables and finding errors and approximations.
- To evaluate double and triple integrals, volumes of solids and area of curved surfaces.

- To expand a periodical function as Fourier series and half-range Fourier series.

Course Outcomes:

- Find the partial derivatives of functions of two or more variables.
- Evaluate maxima and minima, errors and approximations.
- Evaluate double and triple integrals, volumes of solids and area of curved surfaces.
- To expand a periodical function as Fourier series and half-range Fourier series.
- Have a fundamental understanding of Fourier series and be able to give Fourier expansions of a given function.

SYLLABUS

Partial Differentiation : Introduction - Functions of two or more variables - Partial derivatives - Homogeneous functions – Euler's theorem - Total derivative - Change of variables – Jacobins. Mean value Theorems (without proofs)

Applications of Partial Differentiation Geometrical interpretation - Tangent plane and Normal to a surface -Taylor's theorem for functions of two variables - Errors and approximations -Total differential. Maxima and Minima of functions of two variables - Lagrange's method of undetermined multipliers - Differentiation under the integral Sign - Leibnitz's rule. Multiple Integrals Introduction - Double Integrals - Change of Order of Integration - Double Integrals in Polar Coordinates - Triple Integrals - Change of Variables.

Multiple Integrals-Applications Area enclosed by plane curves - Volumes of solids - Area of a curved surface - Calculation of Mass - Center of gravity - Moment of inertia - product of inertia – principal axes- Beta Function - Gamma Function - Relation between Beta and Gamma Functions. Error Function or Probability Integral.

Fourier Series Introduction - Euler's Formulae - Conditions for a Fourier Expansion - Functions having points of discontinuity - Change of Interval - Odd and Even Functions - Expansions of Odd or Even Periodic Functions, Half-Range Series - Parseval's Formula. Practical Harmonic analysis.

TEXT BOOK:

Scope and Treatment as in "Higher Engineering Mathematics", by Dr. B.S. Grewal, 43rd Edition, Khanna publishers.

REFERENCE BOOKS:

1. Graduate Engineering Mathematics by V B Kumar Vatti., I.K.International publishing house Pvt. Ltd.

2. Advanced Engineering Mathematics by Erwin Kreyszig.
3. A text book of Engineering Mathematics, by N.P. Bali and Dr. Manish Goyal, Lakshmi Publications.
4. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.
5. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.
6. Higher Engineering Mathematics by Dr. M.K.Venkataraman.

EC-1102 : PHYSICS

Course Objectives:

- To impart knowledge in basic concept of physics of Thermodynamics relevant to engineering applications.
- To grasp the concepts of physics for electromagnetism and its application to engineering. Learn production of Ultrasonics and their applications in engineering.
- To Develop understanding of interference, diffraction and polarization: connect it to a few engineering applications.
- To Learn basics of lasers and optical fibers and their use in some applications.
- To Understand concepts and principles in quantum mechanics and Nanophase Materials. Relate them to some applications.

Course Outcomes:

- Understand the fundamentals of Thermodynamics and Laws of thermodynamics. Understand the working of Carnot cycle and concept of entropy.
- Gain Knowledge on the basic concepts of electric and magnetic fields. Understand the concept of the nature of magnetic materials. Gain knowledge on electromagnetic induction and its applications .
- Understand the Theory of Superposition of waves. Understand the formation of Newton's rings and the working of Michelson's interferometer. Remember the basics of diffraction, Evaluate the path difference. Analysis of Fraunhofer Diffraction due to a single slit
- Understand the interaction of matter with radiation, Characteristics of Lasers, Principle, working schemes of Laser and Principle of Optical Fiber. Realize their role in optical fiber communication.
- Understand the intuitive ideas of the Quantum physics and understand dual nature of matter. Compute Eigen values, Eigen functions, momentum of Atomic and subatomic particles using Time independent one Dimensional Schrodinger's wave equation. Understand the fundamentals and synthesis processes of Nanophase materials.

SYLLABUS

THERMODYNAMICS : Introduction, Heat and Work, First law of thermodynamics and applications, Reversible and Irreversible process, Carnot cycle and Efficiency, Second law of thermodynamics, Carnot's Theorem, Entropy, Second law in terms of entropy, Entropy and disorder, Third law of thermodynamics (statement only).

ELECTROMAGNETISM : Concept of electric flux, Gauss's law - some applications, Magnetic field - Magnetic force on current, torque on current loop, The Biot-Savart's Law, B near a long wire, B for a circular Current loop, Ampere's law, B for a solenoid, Hall effect, Faraday's law of induction, Lenz's law, Induced magnetic fields, Displacement current, Maxwell's equations (no derivation), Magnetic materials: Classification of magnetic materials and properties.

Ultrasonics : Introduction, Production of Ultrasonics – Piezoelectric and Magnetostriction methods, acoustic grating, applications of ultrasonics.

OPTICS

Interference: Principles of superposition – Young's Experiment – Coherence - Interference in thin films (reflected light), Newton's Rings, Michelson Interferometer and its applications.

Diffraction: Introduction, Differences between interference and diffraction, Fresnel and Fraunhofer diffraction, Fraunhofer diffraction at a single slit (Qualitative and quantitative treatment).

Polarisation: Polarisation by reflection, refraction and double refraction in uniaxial crystals, Nicol prism, Quarter and Half wave plate, circular and elliptical polarization.

LASERS and FIBRE OPTICS

Introduction, characteristics of a laser beam, spontaneous and stimulated emission of radiation, population inversion, Ruby laser, He-Ne laser, Semiconductor laser, applications of lasers

Introduction to optical fibers, principle of propagation of light in optical fibers, Acceptance Angle and cone of a fibre, Numerical aperture, Modes of propagations, classification of fibers, Fibre optics in communications, Application of optical fibers.

MODERN PHYSICS

Introduction, De Broglie concept of matter waves, Heisenberg uncertainty principle, Schrodinger time independent wave equation, application to a particle in a box. Free electron theory of metals, Kronig - Penney model (qualitative treatment), Origin of energy band formation in solids, Classification of materials into conductors, semi conductors and insulators.

Nanophase Materials

Introduction, properties, Top-down and bottom up approaches, Synthesis - Ball milling, Chemical vapour deposition method, sol-gel methods, Applications of nano materials.

TEXT BOOKS :

1. Physics by David Halliday and Robert Resnick – Part I and Part II - Wiley.

2. A textbook of Engineering Physics, Dr. M. N. Avadhanulu, Dr. P.G. Kshirsagar - S. Chand

3. Engineering Physics by R.K. Gaur and S.L. Gupta –Dhanpat Rai

Reference Books:

1. Modern Engineering Physics by A.S. Vadudeva

2. University Physics by Young and Freedman

EC-1103 : ENGINEERING GRAPHICS

Course Objectives:

- Understand the basics of Engineering Graphics and BIS conventions.
- Develop the graphical skills for communication of concepts, ideas and design of engineering products through technical drawings
- Demonstrate and practice the various profiles/curves used in engineering practice through standard procedures.
- Demonstrate and practice the orthographic projections of points, lines, planes, solids and section of solids
- Demonstrate and practice the development of surfaces of simple solids
- Familiarize the basic concept of isometric views clearly.

Course Outcomes:

- Develop simple engineering drawings by considering BIS standards.
- Able to draw different engineering curves with standard Procedures
- Comprehend the basics of orthographic projections and deduce orthographic projections of points, lines, planes and solids at different orientations in real life environment.
- Visualize clearly the sections of solids.
- Apply the concepts of development of surfaces while designing/analyzing any product.
- Recognize the significance of isometric drawing to relate 2D environment with 3D environment.

SYLLABUS

Introduction: Lines, Lettering and Dimensioning, Geometrical Constructions, and Scales.

Curves: Conic sections: General construction of ellipse, parabola and hyperbola. Construction of involutes of circle and polygons only. Normal and tangent to curves.

Projections of Points: Principal or Reference Planes, Projections of a point situated in any one of the four quadrants.

Projections of Straight Lines: Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane.

Projections of Straight Line Inclined to Both the Reference Planes: Projections of Planes: Projection of Perpendicular planes: Perpendicular to both reference planes, perpendicular to one reference plane and parallel to other reference plane and perpendicular to one reference plane and inclined to other reference plane. Projection of Oblique planes. Introduction to Auxiliary Planes.

Projections of Solids: Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to other and axes inclined to both the reference planes.

Sections of Solids: Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids (Prism, Pyramid, Cylinder and Cone) in simple position only.

Development of Surfaces: Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.

Isometric Views: Isometric projection, Isometric scale and Isometric view. Isometric view of Prisms, Pyramids, cylinder, cone, and their combinations.

Text Book:

Elementary Engineering Drawing by N.D.Bhatt, Charotar Publishing House.

Reference:

Engineering Graphics by K.L. Narayana and P. Kanniah, Tata McGraw Hill

EC-1104 : ELECTRONIC DEVICES AND CIRCUITS

Course Objectives:

- The principles of Electronics Engineering.
- The operation of semiconductor devices.
- DC analysis and AC models of semiconductor devices.
- How to apply concepts for the design of Filters, Regulators, Oscillators and Amplifiers for different applications.
- The theoretical concepts through laboratory and simulation experiments.
- How to implement mini projects using electronic circuit concepts.

Course Outcomes:

- State the operating principles of major electronic devices and circuit models.
- Analyze dc circuits and relate ac models of semiconductor devices with practical Operation.
- Design and analyze electronic circuits.
- Apply this knowledge to the analysis and design of basic circuits.

SYLLABUS

Energy band theory of solids and transport phenomenon in semiconductors

Energy Band Theory of Solids Intrinsic and Extrinsic Semiconductors Doping, Doping Materials, Carrier Mobility, Conductivity, Diffusion and continuity equation, Hall – Effect and its Application.

Junction diode characteristics Semiconductor Diodes Band structure of PN Junction, Quantitative Theory of PN Diode, Volt – Amp. Characteristics, Temperature Dependence, Transition and Diffusion Capacitance of PN Junction, Zener and Avalanche Breakdowns, Tunnel Diode, LED, Schottky Barrier Diode, Varactor Diode, Photo Diode, PIN Diode, Point Contact Diode.

Rectifier Circuits Diode Rectifiers Half-wave, Full-wave and Bridge Rectifiers with and without Filters, Ripple Factor and Regulation Characteristics.

Transistor characteristics and transistor biasing Bipolar Junction Transistor NPN and PNP junction Transistor, Characteristics of Current Flow across the Base Regions, Minority and Majority Carrier Profiles, CB, CE and CC Configurations and their Input and Output Characteristics. Comparison of CE, CB and CC Configurations. Junction Biasing for Saturation, Cutoff and Active Region, α and β Parameters and the relation between them, Photo Transistor, various Biasing circuits, stabilizations, thermal runaway, thermal stability, Transistor series and shunt voltage regulators.

Field effect transistors JFET JFET and its characteristics, Pinch off Voltage, Drain Saturation Current, JFET biasing, MOSFET –Enhancement and Depletion Modes, Small signal models of FET.

The transistor at low frequencies Small Signal – Low Frequency Transistor Amplifier Circuits Transistor as an Amplifier, h – parameter model, Analysis of Transistor Amplifier Circuits using h –parameters. CB, CE and CC Amplifier configurations and performance factors. Analysis of Single Stage Amplifier, RC Coupled Amplifiers. Effects of Bypass and Coupling Capacitors. Frequency Response of CE Amplifier, Emitter – Follower, Cascaded Amplifier.

Text Books:

1. Integrated Electronics, Analog Digital Circuits and systems, Jacob Millman and D. Halkias, McGraw Hill.
2. Electronic Devices and Circuits, G.S.N. Raju, I.K. International Publications, New Delhi, 2006.

Reference Books:

1. Electronic Devices and Circuits 2nd Edition, B. V. Rao and K. Raja Rajeswari, Pearson Education
2. Electronic Devices and Circuits, K. Venkat Rao, K. Rama Sudha, McGraw Hill education, Edition-2015.
3. Electronic Devices and Circuits Theory, Boylsted and Nashelsky, Prentice Hall Publications.

EC-1105 : NETWORK THEORY ANALYSIS

Course Objectives:

- The Principles of Electrical Network Analysis.
- The basic concepts and laws of DC and AC electrical networks and solve them using mesh and nodal analysis techniques.
- How to analyze circuits in time and frequency domain.
- The concepts of open circuit, short circuit, transmission, hybrid parameters and their interrelationship.
- How to synthesize the network using passive elements.

Course Outcomes:

- Apply concepts of electric network topology, nodes, branches, loops to solve circuit problems.
- Apply time and frequency concepts of analysis.
- Synthesize the network using passive elements.
- Distinguish various parameters and their interrelationship.
- Solve numerical problems with series, parallel and cascade connections using two port networks.
- Analyze and design simple electrical networks.

SYLLABUS

Analysis of DC Circuits Active elements, Passive elements, Reference directions for current and voltage, Kirchhoff's Laws, Voltage and Current Division Nodal Analysis, Mesh analysis, Linearity and superposition, Thevenin's theorem and Norton's theorem, Reciprocity theorem, Z,Y,H,Sparameters.

DC transients Inductor, Capacitor, source free RL, RC and RLC response, Evaluation of Initial conditions, Application of unit-step function to RL, RC and RLC circuits, concepts of Natural, Forced and Complete response.

Sinusoidal Steady State Analysis The sinusoidal forcing function, Phasor Concept, Average and Effective value of Voltage and Current, instantaneous and Average Power, Complex Power, Steady State Analysis using mesh and node analysis, application of network theorems to AC circuits, resonance, Concept of Duality.

Network functions Network functions for single port and two port, Calculation of Network functions for Ladder and General Networks, Poles and Zeroes, Restriction of Poles and Zeroes for Driving point and Transfer functions, Time Domain Behavior from Pole Zero plot, Transfer Functions in terms of Y and Z functions, Scaling Network Functions.

Positive Real Functions: Positive real function and other properties, Herwitz polynomials, Computation of residues, even and Odd functions, Test for Positive Real Functions.

Text Books:

1. Engineering Circuit Analysis, William H. Hayt Jr. and Jack E. Kemmerley, 5th Edition, McGraw Hill International Edition.
2. Network Analysis, M. E. Van Valkenburg, 3rd Edition, PHI.
3. Modern Network Synthesis, M. E. Van Valkenburg, Wiley Eastern.

EC-1106 : WORKSHOP LAB

Course Objectives:

- Get hands on experience with the working skills in Carpentry trade.
- Know how to work with Sheet Metal tools.
- Get familiar with the working skills of Metal Fitting operations.
- Get hands on experience with house hold electrical wiring.

Course Outcomes:

- Can be able to work with Wood Materials in real time applications.
- Can be able to build various parts with Sheet Metal in day-to-day life.
- Can be able to apply Metal Fitting skills in various applications.

· Can be able to apply this knowledge to basic house electrical wiring and repairs.

SYLLABUS

Carpentry: Any three jobs from – Half lap joint, Mortise and Tenon joint, Half – lap Dovetail joint, Corner Dovetail joint, Central Bridle joint.

Sheet Metal: Any three jobs from – Square tray, Taper tray(sides), Funnel, Elbow pipe joint.

Fitting: Any three jobs from – Square, Hexagon, Rectangular fit, Circular fit and Triangular fit.

House wiring: Any three jobs from – Tube light wiring, Ceiling fan wiring, Stair-case wiring, Corridor wiring.

References:

1. Elements of workshop technology, Vol.1 by S. K. and H. K. Choudary.
2. Work shop Manual / P.Kannaiah/ K.L.Narayana/ SciTech Publishers.
3. Engineering Practices Lab Manual, Jeyapoovan, Saravana Pandian, 4/e Vikas.

EC-1107 : PHYSICS LAB

Course Objectives:

- To enable the students to acquire skill, technique and utilization of the Instruments
- Draw the relevance between the theoretical knowledge and to imply it in a practical manner with respect to analyze various electronic circuits and its components.
- To impart the practical knowledge in basic concepts of Wave optics, Lasers and Fiber optics.
- To familiarize the handling of basic physical apparatus like Vernier callipers, screw gauge, spectrometers, travelling microscope, laser device, optical fibre, etc.

Course Outcomes:

- Ability to design and conduct experiments as well as to analyze and interpret
- Ability to apply experimental skills to determine the physical quantities related to Heat, Electromagnetism and Optics
- The student will learn to draw the relevance between theoretical knowledge and the means to imply it in a practical manner by performing various relative experiments.

SYLLABUS

1. Determination of Radius of Curvature of a given Convex Lens By forming Newton's Rings.
2. Determination of Wavelength of Spectral Lines in the Mercury Spectrum by Normal Incidence method.
3. Study the Intensity Variation of the Magnetic Field along axis of Current Carrying Circular Coil.
4. Determination of Cauchy's Constants of a Given Material of the Prism using Spectrometer.
5. Determination of Refractive Index of Ordinary ray $m_{\text{---}}$ and Extraordinary $m_{\text{---}}$ ray.
6. Determination of Thickness Given Paper Strip by Wedge Method.
7. Calibration of Low Range Voltmeter.
8. Calibration of Low Range Ammeter.
9. Determination of Magnetic Moment and Horizontal Component of Earth's Magnetic Field.
10. Lees Method - Coefficient of thermal Conductivity of a Bad Conductor.
11. Carey Foster's Bridge – Verification of laws of Resistance and Determination Of Specific Resistance.
12. Melde's Apparatus – Frequency of electrically maintained Tuning Fork.
13. Photoelectric cell-Characteristics.
14. Planks Constants.
15. Laser- Diffraction.

EC-1108 : ELECTRONIC DEVICES AND CIRCUITS LAB

Course Objectives:

- Study semiconductor diodes, verify their characteristics and applications of diodes as regulators, rectifiers.
- Measure the V-I characteristics of various devices that are used in the electronic equipment.
- Verify functionality through V-I characteristics of active devices like BJT, JFET, MOSFETS and their applications.

Course Outcomes:

- Comprehend the depth of semiconductor devices like diodes, transistor, JFET, MOSFETs characteristics.
- Measure voltage, frequency and phase of any waveform using CRO.

- Generate sine, square and triangular waveforms with required frequency and amplitude using function generator.
- Gain hands on experience in handling electronic components and devices.
- Study and verify various amplifier designs with calculation of impedance and band width.

LIST OF EXPERIMENTS

1. Study of CRO and Applications
2. V-I Characteristics of PN Junction Diode
3. V-I Characteristics of Zener Diode and Zener regulator characteristics.
4. V-I Characteristics of LED
5. V-I characteristics of Photo diode
6. Half-wave and full-wave rectifiers
7. Half-wave and full-wave rectifiers with capacitor filter
8. CE characteristics of BJT, h-parameters
9. CB characteristics of BJT, h-parameters
10. Voltage gain, input impedance and output impedance of emitter follower
11. Drain and transfer characteristics of JFET
12. Frequency response of CE amplifier

EC-1201 : Mathematics – II

Course Objectives:

- The way of obtaining rank, eigen values and eigen vectors of a matrix.
- To know the importance of Cayley-Hamilton theorem and getting canonical form from a given quadratic form.
- To solve the system of equations by using direct and indirect methods.
- To solve first order and higher order differential equations by various methods.
- To obtain the Laplace transforms and inverse Laplace transforms for a given functions and their applications.

Course Outcomes:

- Find rank, eigen values and eigen vectors of a matrix and understand the importance of Cayley-Hamilton theorem.
- Reduce quadratic form to canonical forms and solving linear systems by direct and indirect methods.

- Demonstrate solutions to first order differential equations by various methods and solve basic applications problems related to electrical circuits, orthogonal trajectories and Newton's law of cooling
- Discriminate among the structure and procedure of solving higher order differential equations with constant and variable coefficients.
- Understand Laplace transforms and its properties and finding the solution of ordinary differential equations.

SYLLABUS

Linear Algebra Rank of a matrix- Echelon form, Normal Form - Solution of Linear System of Equations - Consistency of Linear System of Equations - Direct & Indirect Methods: Gauss elimination method, LU Factorization method, Gauss Seidal Method. Complex Matrices: Hermitian, Skew-Hermitian and Unitary Matrices and their Properties.

Eigen Values and Eigen Vectors Eigen Values and Eigen Vectors of a Matrix - Cayley-Hamilton theorem - Inverse and Powers of a Matrix using Cayley-Hamilton's theorem and its applications. Diagonalization of a Matrix - Quadratic Forms - Reduction of Quadratic Form to Canonical Form - Nature of a Quadratic Form.

Ordinary Differential Equations of First Order and its Applications Formation of ordinary differential equations (ODEs) - Solution of an ordinary differential equation - Equations of the first order and first degree - Linear differential equation - Bernoulli's equation - Exact differential equations - Equations reducible to exact equations - Orthogonal Trajectories - Simple Electric (LR & CR) Circuits - Newton's Law of Cooling - Law of Natural growth and decay.

Differential Equations of Higher Order Solutions of Linear Ordinary Differential Equations with Constant Coefficients - Rules for finding the complimentary function - Rules for finding the particular integral - Method of variation of parameters - Cauchy's linear equation - Legendre's linear equation - Simultaneous linear differential equations.

Laplace Transforms Introduction - Existence Conditions - Transforms of Elementary Functions - Properties of Laplace Transforms - Transforms of Derivatives - Transforms of Integrals - Multiplication by t^n - Division by t - Evaluation of integrals by Laplace Transforms - Inverse Laplace Transform - Applications of Laplace Transforms to Ordinary Differential Equations - Simultaneous Linear Differential Equations with Constant Coefficients - Second Shifting Theorem - Laplace Transforms of Unit Step Function, Unit Impulse Function and Laplace Transforms of Periodic Functions.

TEXT BOOK:

Scope and Treatment as in "Higher Engineering Mathematics", y Dr. B.S. Grewal, 43rd edition, Khanna publishers.

REFERENCE BOOKS:

1. Graduate Engineering Mathematics by V B Kumar Vatti., I.K. International publishing house Pvt. Ltd.
2. Advanced Engineering Mathematics by Erwin Kreyszig.
3. A text book of Engineering Mathematics, by N.P. Bali and Dr. Manish Goyal. Lakshmi Publications.
4. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.
5. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.

EC-1202 : Chemistry

Course Objectives:

- To apply the basic knowledge of Chemistry to the Engineering Discipline.
- To develop knowledge about water and its treatment for industrial and potable purposes.
- To develop understanding in the areas of Polymers, Mechanism of Corrosion of Metals and Corrosion Control Methods, Fuels, Lubricants and Nanomaterials for conducting polymers, bio-degradable polymers and fiber reinforced plastics and apply the knowledge for solving existing challenges faced in various engineering and societal areas.

Course outcome:

- This course applies the basic concepts and principles studied in Chemistry to Engineering.
- It provides an application of chemistry to different branches of engineering
- The students will be able to acquire knowledge in the areas of Water Chemistry, Polymers, Corrosion, Fuels and Lubricants and nanomaterials and suggest innovative solutions for existing challenges in these areas.

SYLLABUS

Water Chemistry Sources of Water – Impurities and their influence of living systems – WHO Limits – Hardness and its Determination – Boiler Troubles and their removal – Water Softening Methods – Lime-Soda, Zeolite and Ion Exchange - Municipal Water Treatment-Break Point Chlorination – Desalination of Sea Water – Reverse Osmosis Method, Electro-dialysis.

Polymers and Plastics Polymers: Definition – Types of Polymerization (Addition & Condensation) – Mechanisms of Addition Polymerization – Radical and Ionic – Thermodynamics of Polymerization Process. Plastics: Thermosetting and Thermoplastics – Effect of Polymer Structure on Properties of Cellulose Derivatives – Vinyl Resins – Nylon (6,6), Reinforced Plastics – Conducting Polymers.

Corrosion Corrosion: Origin and Theory – Types of Corrosion: Chemical and Electrochemical; Pitting, Inter granular, Waterline, Stress – Galvanic Series – Factors Effecting Corrosion.

Corrosion Controlling Methods: Protective Coatings: Metallic Coatings, Electroplating and Electroless Plating – Chemical conversion Coatings – Phosphate, Chromate, Anodized, Organic Coatings – Paints and Special Paints.

Fuels and Lubricants Solid Fuels: Wood and Coal, Ranking of Coal – Analysis (Proximate and Ultimate) Coke Manufacture – Otto Hoffmann's Process – Applications; Liquid Fuels: Petroleum Refining – Motor Fuels – Petrol and Diesel Oil – Knocking – Octane number – Cetane Number; Gaseous Fuels: Biogas, LPG and CNG – Characteristics – Applications; Rocket Fuels: Propellants – Classification – Characteristics

Lubricants: Classification – Mechanism – Properties of Lubricating Oils – Selection of Lubricants for Engineering Applications. Nanomaterials Nanomaterials, Properties and application of fullerenes, fullerenes, Carbon nanotubes and nanowires. Synthesis - Top-down and Bottom-up approaches - Nanocomposites - Nanoelectronics- Applications of nanomaterials in catalysis, telecommunication and medicine.

Text Books:

1. Engineering Chemistry – PC Jain and M. Jain – Dhanpath Rai and Sons, New Delhi.
2. A Text book of Engineering Chemistry – S. S. Dara – S. Chand & Co. New Delhi.

Reference Books:

1. Engineering Chemistry – B. K. Sharma – Krishna Prakashan – Meerut.
2. Introduction to Nanoscience - S. M. Lindsay - Oxford University Press
3. Engineering Chemistry - B. L. Tembe, Kamaluddin and M. S. Krishnan, (NPTEL).

EC-1203 : ENGLISH

Course Objectives:

- To make students understand the explicit and implicit meanings of a text/topic;
- To give exposure to new words and phrases, and aid to use them in different contexts;
- To apply relevant writing formats to draft essays, letters, emails and presentations; and
- To adapt oneself to a given situation and develop a functional approach to finding solutions: adaptability and problem solving.

Course Outcomes:

- Students will be able to analyse a given text and discover the various aspects related to language and literature;
- Learn the various language structures, parts of speech and figures of speech;
- Develop one's reading and writing abilities for enhanced communication; and
- Learn to apply the topics in real-life situations for creative and critical use.

SYLLABUS

On the conduct of life: William Hazlitt

Life skills: Values and Ethics

If: Rudyard Kipling

The Brook: Alfred Tennyson

Life skills: Self-Improvement

How I Became a Public Speaker: George Bernard Shaw

The Death Trap: Saki

Life skills: Time Management

On saving Time: Seneca

Chindu Yellama

Life skills: Innovation

Muhammad Yunus

Politics and the English Language: George Orwell

Life skills: Motivation

Dancer with a White Parasol: Ranjana Dave

Grammar: Prepositions – Articles – Noun-Pronoun Agreement, Subject-Verb Agreement – Misplaced Modifiers – Clichés, Redundancies.

Vocabulary: Introduction to Word Formation – Root Words from other Languages – Prefixes and Suffixes – Synonyms, Antonyms – Common Abbreviations

Writing: Clauses and Sentences – Punctuation – Principles of Good Writing – Essay Writing – Writing a Summary

Writing: Essay Writing

Life skills: Innovation

Muhammad Yunus

Textbook: Language and Life: A Skills Approach Board of Editors, Orient Blackswan Publishers, India. 2018.

References :

1. *Practical English Usage*, Michael Swan. OUP. 1995.
2. *Remedial English Grammar*, F.T. Wood. Macmillan.2007
3. *On Writing Well*, William Zinsser. Harper Resource Book. 2001
4. *Study Writing*, Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
5. *Communication Skills*, Sanjay Kumar and PushpLata. Oxford University Press. 2011.
6. *Exercises in Spoken English*, Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

EC-1204 : CPNM

Course Objectives:

- The course is designed to provide complete knowledge of C language.
- To provide students with understanding of code organization and functional hierarchical decomposition with using complex data types.
- To provide knowledge to the Students to develop logics which will help them to create programs, applications in C.
- This course aims to identify tasks in which the numerical techniques learned are applicable and apply them to write programs, and hence use computers effectively to solve the task.
- This course provides the fundamental knowledge which is useful in understanding the other programming languages.

Course Outcomes:

- Identify basic elements of C programming structures like data types, expressions, control statements, various simple functions and Apply them in problem solving.
- Apply various operations on derived data types like arrays and strings in problem solving.
- Design and Implement of modular Programming and memory management using Functions, pointers.
- Apply Structure, Unions and File handling techniques to Design and Solve different engineering programs with minimal complexity.
- Apply Numerical methods to Solve the complex Engineering problems.

SYLLABUS

1. Introduction to C: Basic structure of C program, Constants, Variables and data types, Operators and Expressions, Arithmetic Precedence and associativity, Type Conversions. Managing Input and Output Operations Formatted Input, Formatted Output.

2. Decision Making, Branching, Looping, Arrays & Strings: Decision making with if statement, Simple if statement, The if...else statement, Nesting of if...else statement, the else..if ladder, switch statement, the (?:) operator, the GOTO statement., The while statement, the do statement, The for statement, Jumps in Loops ,One, Two-dimensional Arrays, Character Arrays. Declaration and initialization of Strings, reading and writing of strings, String handling functions, Table of strings.

3. Functions: Definition of Functions, Return Values and their Types, Function Calls, Function Declaration, Category of Functions: No Arguments and no Return Values, Arguments but no Return Values, Arguments with Return Values, No Argument but Returns a Value, Functions that Return Multiple Values. Nesting of functions, recursion, passing arrays to functions, passing strings to functions, the scope, visibility and lifetime of variables.

4. Pointers: Accessing the address of a variable, declaring pointer variables, initializing of pointer variables, accessing variables using pointers, chain of pointers, pointer expressions, pointers and arrays, pointers and character strings, array of pointers, pointers as function arguments, functions returning pointers, pointers to functions, pointers to structures-Program Applications

5. Structure and Unions: Defining a structure, declaring structure variables, accessing structure members, structure initialization, copying and comparing structure variables, arrays of structures, arrays within structures, structures within structures, structures and functions and unions, size of structures and bit-fields- Program applications.

6. File handling: Defining and opening a file, closing a file, Input/ Output operations on files, Error handling during I/O operations, random access to files and Command Line Arguments- Program Applications

7. Numerical Methods: Solutions of Algebraic and Transcendental Equations, Bisection Method, Newton Raphson Method. Newton's forward and backward Interpolation, Lagrange's Interpolation in unequal intervals. Numerical Integration: Trapezoidal rule, Simpson's 1/3 rules. Solutions of Ordinary First Order Differential Equations: Euler's Method, Modified Euler's Method and Runge-Kutta Method.

Text Book:

1. Programming in ANSI C, E Balagurusamy, 6th Edition. McGraw Hill Education (India) Private Limited.

2. Introduction to Numerical Methods, SS Sastry, Prentice Hall

Reference Books:

1. Let Us C ,YashwantKanetkar, BPB Publications, 5th Edition.

2. Computer Science, A structured programming approach using C", B.A.Forouzan and R.F.Gilberg, " 3rd Edition, Thomson, 2007.

3. The C –Programming Language' B.W. Kernighan, Dennis M. Ritchie, PHI.

4. Scientific Programming: C-Language, Algorithms and Models in Science, Luciano M. Barone (Author), Enzo Marinari (Author), Giovanni Organtini, World Scientific.

EC-1205 : SWITCHING THEORY AND LOGIC DESIGN

Course Objectives:

- Different number systems, digital logic, simplification and minimization of Boolean functions.
- How to analyze logic processes and implement logical operations using combinational logic circuits.
- The characteristics of memory and their classification.
- How to design combinational & sequential digital circuits and state machines.

· About programmable logic devices.

Course Outcomes:

- Analyze, design and implement combinational logic circuits.
- Analyze, design and implement sequential logic circuits.
- Develop a digital logic and apply it to solve real life problems.

SYLLABUS

Number systems and codes

Number systems, Base conversion methods, Complement of numbers, Codes: Binary, Non binary, Decimal, Alphanumeric, Gray, Error detecting and error correcting codes. Logic Gates: AND, OR, NOT, NAND, NOR, XOR, EX-NOR and Universal Gates

Minimization of Boolean Functions Fundamental postulates of Boolean algebra, Basic theorems, Simplification of Boolean equations, Min terms, Max terms, Standard form of Boolean functions. Simplification of functions: Karnaugh map method and Quine-McClusky methods (up to six variables), Multiple Output functions, incomplete specified functions.

Combinational Logic-Circuit Design-1 Logic design of combinational circuits: Adders and Subtractors: Binary, BCD, Excess -3 and Look –ahead-carry adder, Code converters, Multiplexers, De multiplexers, Encoders, Decoders and priority encoders, Realization of Boolean functions using multiplexers, De multiplexers and Decoders.

Combinational Logic-Circuit Design-11 Design of 4-bit comparator, Parity checker/Generator, Seven segment decoders, Hazards in combinational circuits, Hazard free realizations. Basics of PLDs: Basic structure of PROM, PAL, PLA, CPLD, FPGAs, Realization of Boolean functions with PLDs and their merits and demerits.

Sequential circuits Classification of sequential circuits, SR-latch, Gated latches, Flip flops: RS, JK, D, T and Master slave flip flops, Excitation tables, flip flop conversion from one type to another. Design of counters: Ripple counters, Synchronous counters, asynchronous counters, up-down counters, Johnson counter, ring counter. Design of registers: Buffer registers, Shift registers, Bi directional shift registers, Universal shift register

Analysis and design of finite state machines State assignment, State tables, Equivalent states, Elimination of Redundant states, Determination of state equivalence, Reduction using implication table, reducing incompletely specified state tables.

Text Books:

1. Switching and finite Automatic theory, ZuiKohari, TMH
2. Switching theory and logic design by Frederick.J.Hill and Gerald.R.Peterson
3. Switching theory and logic design, Anandakumar, PHI.

Reference Books:

1. Fundamentals of Logic Design, Charles.R.Roth, Thomson Publications.
2. Digital Design by Morris Mano, PHI. ECE:

EC-1206 :ENGLISH LANGUAGE LAB

Course Objectives:

- To make students recognize the sounds of English through Audio-Visual aids;
- To help students build their confidence and help them to overcome their inhibitions and self-consciousness while speaking in English;
- To familiarize the students with stress and intonation and enable them to speak English effectively; and
- To give learners exposure to and practice in speaking in both formal and informal contexts.

Course Outcomes:

- Students will be sensitized towards recognition of English sound patterns and the fluency in their speech will be enhanced;
- A study of the communicative items in the laboratory will help students become successful in the competitive world;
- Students will be able to participate in group activities like roleplays, group discussions and debates; and
- Students will be able to express themselves fluently and accurately in social as well professional context.

SYLLABUS

Introduction to Phonetics: The Sounds of English (Speech sound – vowels and consonants) - Stress and Intonation - Accent and Rhythm.

Listening Skills: Listening for gist and specific information - listening for Note taking, summarizing and for opinions - Listening to the speeches of eminent personalities.

Speaking Skills: Self-introduction - Conversation Skills (Introducing and taking leave) - Giving and asking for information - Role Play - Just A Minute (JAM) session - Telephone etiquette.

Reading and Writing skills: Reading Comprehension – Précis Writing - E-Mail writing - Punctuation.

Presentation skills: Verbal and non-verbal communication - Body Language - Making a Presentation.

Reference Books:

1. Ashraf Rizvi. *Effective Technical Communication*. Tata McGraw Hill Education Private Limited, New Delhi.
2. *Speak Well*. Orient Blackswan Publishers, Hyderabad.
3. Allan Pease. *Body Language*. Manjul Publishing House, New Delhi.

EC-1207 : CHEMISTRY LAB

Course Objectives:

- To develop the fine skills of quantitative determination of various chemical components through titrimetric analysis
- To prepare and use ionexchange/ zeolite columns for the removal of hardness of water
- To develop the skill of organic synthesis through the preparation of a polymer/ drug

Course Outcomes:

- The course provides quantitative determine the amount of various chemical species in solutions by titrations and conduct the quantitative determinations with accuracy
- The course provides to develop novel materials to be used as zeolite and prepare columns for removal of hardness of water
- The course provides to synthesise a polymer or a drug

SYLLABUS

1. Determination of Sodium Hydroxide with HCl (Na_2CO_3 Primary Standard)
2. Determination of Alkalinity (Carbonate and Hydroxide) of water sample

3. Determination of Fe(II)/Mohr's Salt by Permanganometry
4. Determination of Oxalic Acid by Permanganometry
5. Determination of Chromium (VI) by Mohr's Salt Solution
6. Determination of Zinc by EDTA method
7. Determination of Hardness of Water sample by EDTA method
8. Determination of Chlorine in water by Iodometric Titration
9. Ionexchange/ Zeolite column for removal of hardness of water
10. Synthesis of Polymer/ drug

Reference Books:

1. Vogel's Quantitative Chemical Analysis – V – Edition – Longman.
2. Experiments in Applied Chemistry (For Engineering Students) – Sinita Rattan – S. K. Kataria & Sons, New Delhi

EC-1208 : CPNM LAB

Course Objectives:

- To impart writing skill of C programming to the students and solving problems.
- To write and execute programs in C to solve problems such as Modularize the problems into small modules and then convert them into programs.,
- To write and execute programs in C to solve problems such as arrays, files, strings, structures and different numerical methods.
- This reference has been prepared for the beginners to help them understand the basic to advanced concepts related to Objective-C Programming languages.

Course Outcomes:

- Understand various computer components, Installation of software. C programming development environment, compiling, debugging, and linking and executing a program using the development environment.
- Analyzing the complexity of problems, Modularize the problems into small modules and then convert them into programs.
- Construct programs that demonstrate effective use of C features including arrays, strings, structures, pointers and files.
- Apply and practice logical ability to solve the real world problems.
- Apply Numerical methods to Solve the complex Engineering problems.

SYLLABUS

1. Write a program to read x, y coordinates of 3 points and then calculate the area of a triangle formed by them and print the coordinates of

the three points and the area of the triangle. What will be the output from your program if the three given points are in a straight line?

2. Write a program, which generates 100 random integers in the range of 1 to 100. Store them in an array and then print the arrays. Write 3 versions of the program using different loop constructs. (e.g. for, while, and do while).

3. Write a set of string manipulation functions e.g. for getting a sub-string from a given position, Copying one string to another, Reversing a string, adding one string to another.

4. Write a program which determines the largest and the smallest number that can be stored in different data types like short, int, long, float, and double. What happens when you add 1 to the largest possible integer number that can be stored?

5. Write a program, which generates 100 random real numbers in the range of 10.0 to 20.0, and sort them in descending order.

6. Write a function for transposing a square matrix in place (in place means that you are not allowed to have full temporary matrix).

7. First use an editor to create a file with some integer numbers. Now write a program, which reads these numbers and determines their mean and standard deviation.

8. Given two points on the surface of the sphere, write a program to determine the smallest arc length between them.

9. Implement bisection method to find the square root of a given number to a given accuracy.

10. Implement Newton Raphson method to det. a root of polynomial equation.

11. Given table of x and corresponding f(x) values, Write a program which will determine f(x) value at an intermediate x value by using Lagrange's interpolation/

12. Write a function which will invert a matrix.

13. Implement Simpson's rule for numerical integration.

14. Write a program to solve a set of linear algebraic equations.

Electrical and Electronics Engineering

Scheme and Syllabus (With effect from 2020-21 admitted batch)

B.Tech I Year - I Semester

Course CreditsC code	Category	Course Title	Hours per week			Internal	External	Total
			L	T	P	Marks	Marks	Marks
EE-1101	BS	Maths – I	3	0	0	30	70	100
								3

EE-1102	BS	Physics	3	0	0	30	70	100	3
EE-1103	ES	Engineering Graphics	1	0	4	30	70	100	3
EE-1104	ES	Fundamentals of Electrical Engineering	3	0	0	30	70	100	3
EE-1105	ES	Basic Electronics Engineering	3	0	0	30	70	100	3
EE-1106	ES	Workshop Lab	0	0	3	50	50	100	1.5
EE-1107	BS	Physics Lab	0	0	3	50	50	100	1.5
EE-1108	ES	Electrical Engineeringworkshop	0	0	3	50	50	100	1.5
Total Credits									19.5

B.Tech I Year - II Semester

Course Code	Category	Course Title	Hours per week			Internal Marks	External Marks	Total Marks	Credits
			L	T	P				
EE-1201	BS	Maths – II	3	0	0	30	70	100	3
EE-1202	BS	Chemistry	3	0	0	30	70	100	3
EE-1203	HSS	English	3	0	0	30	70	100	3
EE-1204	ES	CPNM	3	0	3	30	70	100	3
EE-1205	ES	Computational Methods in Electrical Engineering	3	0	0	30	70	100	3
EE-1206	HSS	English Language Lab	0	0	2	50	50	100	1.5
EE-1207	BS	Chemistry Lab	0	0	3	50	50	100	1.5
EE-1208	ES	CPNM Lab	0	0	3	50	50	100	1.5
Total Credits									19.5

EE-1101 : MATHEMATICS-I

Course Objectives:

- To transmit the knowledge of Partial differentiation.
- To know of getting maxima and minima of function of two variables and finding errors and approximations.
- To evaluate double and triple integrals, volumes of solids and area of curved surfaces.
- To expand a periodical function as Fourier series and half-range Fourier series.

Course Outcomes:

- Find the partial derivatives of functions of two or more variables.
- Evaluate maxima and minima, errors and approximations.
- Evaluate double and triple integrals, volumes of solids and area of curved surfaces.

To expand a periodical function as Fourier series and half-range Fourier series.

Have a fundamental understanding of Fourier series and be able to give Fourier expansions of a given function.

SYLLABUS

(Partial Differentiation) Introduction - Functions of two or more variables - Partial derivatives - Homogeneous functions – Euler's theorem - Total derivative - Change of variables – Jacobins. Mean value Theorems (without proofs)

(Applications of Partial Differentiation) Geometrical interpretation - Tangent plane and Normal to a surface -Taylor's theorem for functions of two variables - Errors and approximations -Total differential. Maxima and Minima of functions of two variables - Lagrange's method of undetermined multipliers - Differentiation under the integral Sign - Leibnitz's rule.

(Multiple Integrals) Introduction - Double Integrals - Change of Order of Integration - Double Integrals in Polar Coordinates - Triple Integrals - Change of Variables.

(Multiple Integrals-Applications) Area enclosed by plane curves - Volumes of solids - Area of a curved surface - Calculation of Mass - Center of gravity - Moment of inertia - product of inertia – principal axes- Beta Function - Gamma Function - Relation between Beta and Gamma Functions. Error Function or Probability Integral.

(Fourier Series) Introduction - Euler's Formulae - Conditions for a Fourier Expansion - Functions having points of discontinuity - Change of Interval - Odd and Even Functions - Expansions of Odd or Even Periodic Functions, Half-Range Series - Parseval's Formula. Practical Harmonic analysis.

TEXT BOOK:

Scope and Treatment as in "Higher Engineering Mathematics", by Dr. B.S. Grewal, 43rd Edition, Khanna publishers.

REFERENCE BOOKS:

- Graduate Engineering Mathematics by V B Kumar Vatti., I.K.International publishing house Pvt. Ltd.
- Advanced Engineering Mathematics by Erwin Kreyszig.
- A text book of Engineering Mathematics, by N.P. Bali and Dr. Manish Goyal, Lakshmi Publications.
- Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.
- Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.
- Higher Engineering Mathematics by Dr. M.K.Venkataraman.

EE-1102 : PHYSICS

Course Objectives:

- To impart knowledge in basic concept of physics of Thermodynamics relevant to engineering applications.
- To grasp the concepts of physics for electromagnetism and its application to engineering. Learn production of Ultrasonics and their applications in engineering.
- To Develop understanding of interference, diffraction and polarization: connect it to a few engineering applications.
- To Learn basics of lasers and optical fibers and their use in some applications.
- To Understand concepts and principles in quantum mechanics and Nanophase Materials. Relate them to some applications.

Course Outcomes:

- Understand the fundamentals of Thermodynamics and Laws of thermodynamics. Understand the working of Carnot cycle and concept of entropy.
- Gain Knowledge on the basic concepts of electric and magnetic fields. Understand the concept of the nature of magnetic materials. Gain knowledge on electromagnetic induction and its applications .
- Understand the Theory of Superposition of waves. Understand the formation of Newton's rings and the working of Michelson's interferometer. Remember the basics of diffraction, Evaluate the path difference. Analysis of Fraunhofer Diffraction due to a single slit
- Understand the interaction of matter with radiation, Characteristics of Lasers, Principle, working schemes of Laser and Principle of Optical Fiber. Realize their role in optical fiber communication.
- Understand the intuitive ideas of the Quantum physics and understand dual nature of matter. Compute Eigen values, Eigen functions, momentum of Atomic and subatomic particles using Time independent one Dimensional Schrodinger's wave equation. Understand the fundamentals and synthesis processes of Nanophase materials.

SYLLABUS

THERMODYNAMICS Introduction, Heat and Work, First law of thermodynamics and applications, Reversible and Irreversible process, Carnot cycle and Efficiency, Second law of thermodynamics, Carnot's Theorem, Entropy, Second law in terms of entropy, Entropy and disorder, Third law of thermodynamics (statement only).

ELECTROMAGNETISM Concept of electric flux, Gauss's law - some applications, Magnetic field - Magnetic force on current, torque on current loop, The Biot-Savart's Law, B near a long wire, B for a circular Current loop,

Ampere's law, B for a solenoid, Hall effect, Faraday's law of induction, Lenz's law, Induced magnetic fields, Displacement current, Maxwell's equations (no derivation), Magnetic materials: Classification of magnetic materials and properties.

Ultrasonics : Introduction, Production of Ultrasonics – Piezoelectric and Magnetostriction methods, acoustic grating, applications of ultrasonics.

OPTICS

Interference: Principles of superposition – Young's Experiment – Coherence - Interference in thin films (reflected light), Newton's Rings, Michelson Interferometer and its applications.

Diffraction: Introduction, Differences between interference and diffraction, Fresnel and Fraunhofer diffraction, Fraunhofer diffraction at a single slit (Qualitative and quantitative treatment).

Polarisation: Polarisation by reflection, refraction and double refraction in uniaxial crystals, Nicol prism, Quarter and Half wave plate, circular and elliptical polarization.

LASERS and FIBRE OPTICS Introduction, characteristics of a laser beam, spontaneous and stimulated emission of radiation, population inversion, Ruby laser, He-Ne laser, Semiconductor laser, applications of lasers

Introduction to optical fibers, principle of propagation of light in optical fibers, Acceptance Angle and cone of a fibre, Numerical aperture, Modes of propagations, classification of fibers, Fibre optics in communications, Application of optical fibers.

MODERN PHYSICS Introduction, De Broglie concept of matter waves, Heisenberg uncertainty principle, Schrodinger time independent wave equation, application to a particle in a box. Free electron theory of metals, Kronig - Penney model (qualitative treatment), Origin of energy band formation in solids, Classification of materials into conductors, semi conductors and insulators.

Nanophase Materials Introduction, properties, Top-down and bottom up approaches, Synthesis - Ball milling, Chemical vapour deposition method , sol-gel methods, Applications of nano materials.

TEXT BOOKS :

1. Physics by David Halliday and Robert Resnick – Part I and Part II - Wiley.
2. A textbook of Engineering Physics, Dr. M. N. Avadhanulu, Dr. P.G. Kshirsagar - S. Chand
3. Engineering Physics by R.K. Gaur and S.L. Gupta –Dhanpat Rai

Reference Books:

1. Modern Engineering Physics by A.S. Vadudeva
2. University Physics by Young and Freedman

EE-1103 : ENGINEERING GRAPHICS

Course Objectives:

- Understand the basics of Engineering Graphics and BIS conventions.
- Develop the graphical skills for communication of concepts, ideas and design of engineering products through technical drawings
- Demonstrate and practice the various profiles/curves used in engineering practice through standard procedures.
- Demonstrate and practice the orthographic projections of points, lines, planes, solids and section of solids
- Demonstrate and practice the development of surfaces of simple solids
- Familiarize the basic concept of isometric views clearly.

Course Outcomes:

- Develop simple engineering drawings by considering BIS standards.
- Able to draw different engineering curves with standard Procedures
- Comprehend the basics of orthographic projections and deduce orthographic projections of points, lines, planes and solids at different orientations in real life environment.
- Visualize clearly the sections of solids.
- Apply the concepts of development of surfaces while designing/analyzing any product.
- Recognize the significance of isometric drawing to relate 2D environment with 3D environment.

SYLLABUS

Introduction: Lines, Lettering and Dimensioning, Geometrical Constructions, and Scales.

Curves: Conic sections: General construction of ellipse, parabola and hyperbola. Construction of involutes of circle and polygons only. Normal and tangent to curves.

Projections of Points: Principal or Reference Planes, Projections of a point situated in any one of the four quadrants.

Projections of Straight Lines: Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane.

Projections of Straight Line Inclined to Both the Reference Planes: Projections of Planes: Projection of Perpendicular planes: Perpendicular to both reference planes, perpendicular to one reference plane and parallel to other reference plane and perpendicular to one reference plane and inclined to other reference plane. Projection of Oblique planes. Introduction to Auxiliary Planes.

Projections of Solids: Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to other and axes inclined to both the reference planes.

Sections of Solids: Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids (Prism, Pyramid, Cylinder and Cone) in simple position only.

Development of Surfaces: Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.

Isometric Views: Isometric projection, Isometric scale and Isometric view. Isometric view of Prisms, Pyramids, cylinder, cone, and their combinations.

Text Book:

Elementary Engineering Drawing by N.D.Bhatt, Charotar Publishing House.

Reference:

Engineering Graphics by K.L. Narayana and P. Kannaiah, Tata McGraw Hill

EE-1104 : FUNDAMENTALS OF ELECTRICAL ENGINEERING

Course objectives:

- To familiarize the basic laws in Electrical engineering.
- To brief the components of electrical engineering.
- To explain the principles of various measuring instruments.
- To illustrate fundamentals of AC and DC networks.
- A brief introduction to electrical wiring.
- To analyze the behavior of electrical circuits.

Course outcomes:

- Demonstrate the basic principles of electrical components.
- Outline electric circuits using network laws and reduction techniques.

- Illustrate the behavior of basic circuit elements for an AC excitation.
- Outline the working principle and construction of the measuring instruments.
- Choose appropriate wiring schemes.

SYLLABUS

Electrical Engineering Fundamentals: Electrical circuit elements and sources, Ohm's law, effect of temperature on resistance, resistance temperature coefficient, insulation resistance, Series-parallel connection of inductors, rise and decay of current in inductive circuit, Concepts of mutual inductance, Concept of Potential difference. Charging and discharging of capacitor, Concepts of induced emfs, comparison between electric and magnetic circuit, Kirchhoff's laws, star-delta conversion.

Fundamental Laws of Electrical Engineering: Coulombs law of Electrostatics (1st law and 2nd), Faradays laws of Electromagnetic induction, Fleming Left hand and Right hand rules, Lenz's law, Biot-Savart's law, Ampere circuital law, Maxwell's corkscrew rule.

Alternating Current Fundamentals: Sinusoidal voltage and currents, their mathematical and graphical representation, concept of cycle, period, frequency, instantaneous value, peak value, average value, RMS value, Peak factor and Form factor; Phase difference, lagging, leading and in phase quantities; and phasor representation, Rectangular and polar representation of phasors, study of A.C circuits (RL, RC and RLC series circuits), Phasor diagrams, voltage, current, powers and power factor, Introduction to poly-phase systems.

Fundamentals of Electrical Measurements: (no need to explain errors and compensations)

Classification of instruments, various forces in indicating instruments (deflection, control and damping), construction and operation of MI and MC type instruments for voltage and current measurement, Construction and operation of dynamometer type wattmeter, Construction and operation of single phase induction type energy meter.

Electrical Wiring: Symbols for various electrical equipment, Service mains, meter board and distribution board, Types of wirings and their Installations, Various types of conductors, conductor sizes and current ratings, Examples of house wiring (one lamp-one switch, Stair case, Corridor wiring, Power wiring), Elementary discussion on Circuit protective devices: fuse and Miniature Circuit Breaker (MCB's), significance of various parameters on name plates of equipment.

Note: The syllabus is prepared to give basic concepts of Electrical Engineering to First year students. Hence, in the evaluation, problems need to be avoided.

Text Books:

1. Basic Electrical Engineering D. C. Kulshreshtha TMH 1st Edition.
2. S L Uppal and G C Garg, "Electrical Wiring, Estimating & Costing", Khanna Publishers, 2015.

Reference Books:

1. Fundamentals of Electrical Engineering Rajendra Prasad PHI Third Edition 2014.
2. V. N. Mittal and Arvind Mittal;, " Basic Electrical Engineering" McGraw Hill.
3. A.K.Sawhney, A Course in Electrical and Electronics Measurements and Instruments- DhanpatRai and Sons, Delhi, 2005.

EE-1105 : BASIC ELECTRONICS ENGINEERING

Course objectives:

- To brief evolution and impact of electronics.
- To illustrate principles and characteristics of semiconductor devices.
- To familiarize about various applications of electronic devices.
- To expose basic concepts and applications of op-amps.

Course outcomes:

- Imparts the basic idea about types, specifications and common attributes of electronic components
- Familiarity in working with diodes, transistors, MOSFETs etc.,

SYLLABUS

Introduction: Evolution and Impact of Electronics in industries and in society, Familiarization of Resistors, Capacitors, Inductors, Transformers and Electro mechanical components

Semiconductor Diodes: Semiconductor materials- intrinsic and extrinsic types , Ideal Diode , Terminal characteristics of diodes: p-n junction under open circuit condition p-n junction under forward bias and reverse bias conditions p-n junction in breakdown region , Diode small signal model , Zener diode and applications , Rectifier Circuits , Clipping and Clamping circuits

Bipolar Junction Transistors (BJTs): Physical structure and operation modes , Active region operation of transistor , D.C. analysis of transistor circuits , Transistor as an amplifier , Biasing the BJT: fixed bias, emitter feedback bias, collector feedback bias and voltage divider bias , Basic BJT amplifier configuration: common emitter, common base and common collector amplifiers , Transistor as a switch: cut-off and saturation modes , High frequency model of BJT amplifier

Field Effect Transistor (FET): Enhancement-type MOSFET: structure and physical operation, current-voltage characteristics , Depletion-type MOSFET , D.C. operation of MOSFET circuits , MOSFET as an amplifier , Biasing in MOSFET amplifiers , Basic MOSFET amplifier configuration: common source, common gate and common drain types , High frequency model of MOSFET amplifier , Junction Field-Effect Transistor (JFET).

Operation Amplifier (Op-amps): Ideal Op-amp , Differential amplifier: differential and common mode operation common mode rejection ratio (CMRR) , Practical op-amp circuits: inverting amplifier, non -inverting amplifier, weighted summer, integrator, differentiator , Other applications of op-amps: instrumentation circuits, active filters, controlled sources.

Text Books:

- Bell, D. A., Electronic Devices and Circuits, Oxford University Press
- Principles of Electronics, V.K.Mehta, S.Chand Publications.

References Books:

- Boylested, R. L. and Nashelsky, L., Electronic Devices and Circuit Theory, Pearson Education

EE-1106 : WORKSHOP LAB

Course Objectives:

- Get hands on experience with the working skills in Carpentry trade.
- Know how to work with Sheet Metal tools.
- Get familiar with the working skills of Metal Fitting operations.
- Get hands on experience with house hold electrical wiring.

Course Outcomes:

- Can be able to work with Wood Materials in real time applications.
- Can be able to build various parts with Sheet Metal in day-to-day life.
- Can be able to apply Metal Fitting skills in various applications.
- Can be able to apply this knowledge to basic house electrical wiring and repairs.

SYLLABUS

Carpentry: Any three jobs from – Half lap joint, Mortise and Tenon joint, Half – lap Dovetail joint, Corner Dovetail joint, Central Bridle joint.

Sheet Metal: Any three jobs from – Square tray, Taper tray(sides), Funnel, Elbow pipe joint.

Fitting: Any three jobs from – Square, Hexagon, Rectangular fit, Circular fit and Triangular fit.

House wiring: Any three jobs from – Tube light wiring, Ceiling fan wiring, Stair-case wiring, Corridor wiring.

References:

1. Elements of workshop technology, Vol.1 by S. K. and H. K. Choudary.

2. Work shop Manual / P.Kannaiah/ K.L.Narayana/ SciTech Publishers.

3. Engineering Practices Lab Manual, Jeyapoovan, Saravana Pandian, 4/e Vikas.

EE-1107 : PHYSICS LAB

Course Objectives:

- To enable the students to acquire skill, technique and utilization of the Instruments
- Draw the relevance between the theoretical knowledge and to imply it in a practical manner with respect to analyze various electronic circuits and its components.
- To impart the practical knowledge in basic concepts of Wave optics, Lasers and Fiber optics.
- To familiarize the handling of basic physical apparatus like Vernier callipers, screw gauge, spectrometers, travelling microscope, laser device, optical fibre, etc.

Course Outcomes:

- Ability to design and conduct experiments as well as to analyze and interpret
- Ability to apply experimental skills to determine the physical quantities related to Heat, Electromagnetism and Optics
- The student will learn to draw the relevance between theoretical knowledge and the means to imply it in a practical manner by performing various relative experiments.

SYLLABUS

1. Determination of Radius of Curvature of a given Convex Lens By forming Newton's Rings.

2. Determination of Wavelength of Spectral Lines in the Mercury Spectrum by Normal Incidence method.

3. Study the Intensity Variation of the Magnetic Field along axis of Current Carrying Circular Coil.

4. Determination of Cauchy's Constants of a Given Material of the Prism using Spectrometer.

5. Determination of Refractive Index of Ordinary ray m_{ord} and Extraordinary ray m_{ex} .

6. Determination of Thickness Given Paper Strip by Wedge Method.

7. Calibration of Low Range Voltmeter.

8. Calibration of Low Range Ammeter.
9. Determination of Magnetic Moment and Horizontal Component of Earth's Magnetic Field.
10. Lees Method - Coefficient of thermal Conductivity of a Bad Conductor.
11. Carey Foster's Bridge – Verification of laws of Resistance and Determination Of Specific Resistance.
12. Melde's Apparatus – Frequency of electrically maintained Tuning Fork.
13. Photoelectric cell-Characteristics.
14. Planks Constants.
15. Laser- Diffraction.

EE-1108 : ELECTRICAL ENGINEERING WORKSHOP

Course objectives:

- To familiarize with different types of basic electrical circuits.
- To learn how to work with common electrical wiring components.
- To get hands on experience with house hold wiring.
- To familiarize with the working skills of electrical house hold items.

Course outcomes:

- Can be able to work with electrical wiring components in real time applications.
- Can be able to build various parts with electrical wiring in day-to-day life.

SYLLABUS

List of experiments: Ten experiments on electrical wiring of domestic and industrial applications, electrical testing of cables, earth resistance testing etc.

EE-1201 : Mathematics – II

Course Objectives:

- The way of obtaining rank, eigen values and eigen vectors of a matrix.
- To know the importance of Cayley-Hamilton theorem and getting canonical form from a given quadratic form.
- To solve the system of equations by using direct and indirect methods.
- To solve first order and higher order differential equations by various methods.
- To obtain the Laplace transforms and inverse Laplace transforms for a given functions and their applications.

Course Outcomes:

- Find rank, eigen values and eigen vectors of a matrix and understand the importance of Cayley-Hamilton theorem.
- Reduce quadratic form to canonical forms and solving linear systems by direct and indirect methods.
- Demonstrate solutions to first order differential equations by various methods and solve basic applications problems related to electrical circuits, orthogonal trajectories and Newton's law of cooling
- Discriminate among the structure and procedure of solving higher order differential equations with constant and variable coefficients.
- Understand Laplace transforms and its properties and finding the solution of ordinary differential equations.

SYLLABUS

(Linear Algebra) Rank of a matrix- Echelon form, Normal Form - Solution of Linear System of Equations - Consistency of Linear System of Equations - Direct & Indirect Methods: Gauss elimination method, LU Factorization method, Gauss Seidal Method. Complex Matrices: Hermitian, Skew-Hermitian and Unitary Matrices and their Properties.

(Eigen Values and Eigen Vectors) Eigen Values and Eigen Vectors of a Matrix - Cayley-Hamilton theorem - Inverse and Powers of a Matrix using Cayley-Hamilton's theorem and its applications. Diagonalization of a Matrix - Quadratic Forms - Reduction of Quadratic Form to Canonical Form - Nature of a Quadratic Form.

(Ordinary Differential Equations of First Order and its Applications) Formation of ordinary differential equations (ODEs) - Solution of an ordinary differential equation - Equations of the first order and first degree - Linear differential equation - Bernoulli's equation - Exact differential equations - Equations reducible to exact equations - Orthogonal Trajectories - Simple Electric (LR & CR) Circuits - Newton's Law of Cooling - Law of Natural growth and decay.

(Differential Equations of Higher Order) Solutions of Linear Ordinary Differential Equations with Constant Coefficients - Rules for finding the complementary function - Rules for finding the particular integral - Method of variation of parameters - Cauchy's linear equation - Legendre's linear equation - Simultaneous linear differential equations.

(Laplace Transforms) Introduction - Existence Conditions - Transforms of Elementary Functions - Properties of Laplace Transforms - Transforms of Derivatives - Transforms of Integrals - Multiplication by t^n - Division by t - Evaluation of integrals by Laplace Transforms - Inverse Laplace Transform - Applications of Laplace Transforms to Ordinary Differential Equations - Simultaneous Linear Differential Equations with Constant Coefficients - Second Shifting Theorem - Laplace Transforms of Unit Step Function, Unit Impulse Function and Laplace Transforms of Periodic Functions.

TEXT BOOK:

Scope and Treatment as in “Higher Engineering Mathematics”, by Dr. B.S. Grewal, 43rd edition, Khanna publishers.

REFERENCE BOOKS:

7. Graduate Engineering Mathematics by V B Kumar Vatti., I.K. International publishing house Pvt. Ltd.

1. Advanced Engineering Mathematics by Erwin Kreyszig.

2. A text book of Engineering Mathematics, by N.P. Bali and Dr. Manish Goyal. Lakshmi Publications.

3. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.

4. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.

EE-1202 : Chemistry

Course Objectives:

- To apply the basic knowledge of Chemistry to the Engineering Discipline.
- To develop knowledge about water and its treatment for industrial and potable purposes.
- To develop understanding in the areas of Polymers, Mechanism of Corrosion of Metals and Corrosion Control Methods, Fuels, Lubricants and Nanomaterials for of conducting polymers, bio-degradable polymers and fiber reinforced plastics and apply the knowledge for solving existing challenges faced in various engineering and societal areas.

Course outcome:

- This course applies the basic concepts and principles studied in Chemistry to Engineering.
- It provides an application of chemistry to different branches of engineering
- The students will be able acquire knowledge in the areas of Water Chemistry, Polymers, Corrosion, Fuels and Lubricants and nanomaterials and suggest innovative solutions for existing challenges in these areas.

SYLLABUS

Water Chemistry : Sources of Water – Impurities and their influence of living systems – WHO Limits – Hardness and its Determination – Boiler Troubles and their removal – Water Softening Methods – Lime-Soda, Zeolite and Ion Exchange - Municipal Water Treatment-Break Point Chlorination – Desalination of Sea Water – Reverse Osmosis Method, Electro-dialysis.

Polymers and Plastics : Polymers: Definition – Types of Polymerization (Addition & Condensation) – Mechanisms of Addition Polymerization – Radical and Ionic – Thermodynamics of Polymerization Process. Plastics: Thermosetting and Thermoplastics – Effect of Polymer Structure on Properties of Cellulose Derivatives – Vinyl Resins – Nylon (6,6), Reinforced Plastics – Conducting Polymers.

Corrosion : Corrosion: Origin and Theory – Types of Corrosion: Chemical and Electrochemical; Pitting, Inter granular, Waterline, Stress – Galvanic Series – Factors Effecting Corrosion.

Corrosion Controlling Methods: Protective Coatings: Metallic Coatings, Electroplating and Electroless Plating – Chemical conversion Coatings – Phosphate, Chromate, Anodized, Organic Coatings – Paints and Special Paints.

Fuels and Lubricants : Solid Fuels: Wood and Coal, Ranking of Coal – Analysis (Proximate and Ultimate) Coke Manufacture – Otto Hoffmann's Process – Applications; Liquid Fuels: Petroleum Refining – Motor Fuels – Petrol and Diesel Oil – Knocking – Octane number – Cetane Number; Gaseous Fuels: Biogas, LPG and CNG – Characteristics – Applications; Rocket Fuels: Propellants – Classification – Characteristics

Lubricants: Classification – Mechanism – Properties of Lubricating Oils – Selection of Lubricants for Engineering Applications.

Nanomaterials : Nanomaterials, Properties and application of fullerenes, fullerols, Carbon nanotubes and nanowires. Synthesis - Top-down and Bottom-up approaches - Nanocomposites - Nanoelectronics- Applications of nanomaterials in catalysis, telecommunication and medicine.

Text Books:

1. Engineering Chemistry – PC Jain and M. Jain – Dhanpath Rai and Sons, New Delhi.

2. A Text book of Engineering Chemistry – S. S. Dara – S. Chand & Co. New Delhi.

Reference Books:

1. Engineering Chemistry – B. K. Sharma – Krishna Prakashan – Meerut.

2. Introduction to Nanoscience - S. M. Lindsay - Oxford University Press

3. Engineering Chemistry - B. L. Tembe, Kamaluddin and M. S. Krishnan, (NPTEL).

EE-1203 : ENGLISH

Course Objectives:

- To make students understand the explicit and implicit meanings of a text/topic;

- To give exposure to new words and phrases, and aid to use them in different contexts;
- To apply relevant writing formats to draft essays, letters, emails and presentations; and
- To adapt oneself to a given situation and develop a functional approach to finding solutions: adaptability and problem solving.

Course Outcomes:

- Students will be able to analyse a given text and discover the various aspects related to language and literature;
- Learn the various language structures, parts of speech and figures of speech;
- Develop one's reading and writing abilities for enhanced communication; and
- Learn to apply the topics in real-life situations for creative and critical use.

SYLLABUS

On the conduct of life: William Hazlitt

Life skills: Values and Ethics

If: Rudyard Kipling

The Brook: Alfred Tennyson

Life skills: Self-Improvement

How I Became a Public Speaker: George Bernard Shaw

The Death Trap: Saki

Life skills: Time Management

On saving Time: Seneca

Chindu Yellama

Life skills: Innovation

Muhammad Yunus

Politics and the English Language: George Orwell

Life skills: Motivation

Dancer with a White Parasol: Ranjana Dave

Grammar: Prepositions – Articles – Noun-Pronoun Agreement, Subject-Verb Agreement – Misplaced Modifiers – Clichés, Redundancies.

Vocabulary: Introduction to Word Formation – Root Words from other Languages – Prefixes and Suffixes – Synonyms, Antonyms – Common Abbreviations

Writing: Clauses and Sentences – Punctuation – Principles of Good Writing – Essay Writing – Writing a Summary

Writing: Essay Writing

Life skills: Innovation

Muhammad Yunus

Textbook: Language and Life: A Skills Approach Board of Editors, Orient Blackswan Publishers, India. 2018.

References :

1. *Practical English Usage*, Michael Swan. OUP. 1995.
2. *Remedial English Grammar*, F.T. Wood. Macmillan.2007
3. *On Writing Well*, William Zinsser. Harper Resource Book. 2001
4. *Study Writing*, Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
5. *Communication Skills*, Sanjay Kumar and PushpLata. Oxford University Press. 2011.
6. *Exercises in Spoken English*, Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

EE-1204 : CPNM

Course Objectives:

- The course is designed to provide complete knowledge of C language.
- To provide students with understanding of code organization and functional hierarchical decomposition with using complex data types.
- To provide knowledge to the Students to develop logics which will help them to create programs, applications in C.
- This course aims to identify tasks in which the numerical techniques learned are applicable and apply them to write programs, and hence use computers effectively to solve the task.
- This course provides the fundamental knowledge which is useful in understanding the other programming languages.

Course Outcomes:

- Identify basic elements of C programming structures like data types, expressions, control statements, various simple functions and Apply them in problem solving.
- Apply various operations on derived data types like arrays and strings in problem solving.
- Design and Implement of modular Programming and memory management using Functions, pointers.
- Apply Structure, Unions and File handling techniques to Design and Solve different engineering programs with minimal complexity.
- Apply Numerical methods to Solve the complex Engineering problems.

SYLLABUS

1. Introduction to C: Basic structure of C program, Constants, Variables and data types, Operators and Expressions, Arithmetic Precedence and associativity, Type Conversions. Managing Input and Output Operations Formatted Input, Formatted Output.

2. Decision Making, Branching, Looping, Arrays & Strings: Decision making with if statement, Simple if statement, The if...else statement, Nesting of if...else statement, the else..if ladder, switch statement, the (?:) operator, the GOTO statement., The while statement, the do statement, The for statement, Jumps in Loops ,One, Two-dimensional Arrays, Character Arrays. Declaration and initialization of Strings, reading and writing of strings, String handling functions, Table of strings.

3. Functions: Definition of Functions, Return Values and their Types, Function Calls, Function Declaration, Category of Functions: No Arguments and no Return Values, Arguments but no Return Values, Arguments with Return Values, No Argument but Returns a Value, Functions that Return Multiple Values. Nesting of functions, recursion, passing arrays to functions, passing strings to functions, the scope, visibility and lifetime of variables.

4. Pointers: Accessing the address of a variable, declaring pointer variables, initializing of pointer variables, accessing variables using pointers, chain of pointers, pointer expressions, pointers and arrays, pointers and character strings, array of pointers, pointers as function arguments, functions returning pointers, pointers to functions, pointers to structures-Program Applications

5. Structure and Unions: Defining a structure, declaring structure variables, accessing structure members, structure initialization, copying and comparing structure variables, arrays of structures, arrays within structures, structures within structures, structures and functions and unions, size of structures and bit-fields- Program applications.

6. File handling: Defining and opening a file, closing a file, Input/ Output operations on files, Error handling during I/O operations, random access to files and Command Line Arguments- Program Applications

7. Numerical Methods: Solutions of Algebraic and Transcendental Equations, Bisection Method, Newton Raphson Method. Newton's forward and backward Interpolation, Lagrange's Interpolation in unequal intervals. Numerical Integration: Trapezoidal rule, Simpson's 1/3 rules. Solutions of Ordinary First Order Differential Equations: Euler's Method, Modified Euler's Method and Runge-Kutta Method.

Text Book:

1. Programming in ANSI C, E Balagurusamy, 6th Edition. McGraw Hill Education (India) Private Limited.
2. Introduction to Numerical Methods, SS Sastry, Prentice Hall

Reference Books:

1. Let Us C ,YashwantKanetkar, BPB Publications, 5th Edition.
2. Computer Science, A structured programming approach using C", B.A.Forouzan and R.F.Gilberg, " 3rd Edition, Thomson, 2007.
3. The C –Programming Language' B.W. Kernighan, Dennis M. Ritchie, PHI.
4. Scientific Programming: C-Language, Algorithms and Models in Science, Luciano M. Barone (Author), Enzo Marinari (Author), Giovanni Organtini, World Scientific.

EE-1205 : COMPUTATIONAL METHODS IN ELECTRICAL ENGINEERING

Course objectives:

- To introduce to modern analytical and computational methods in critical problem solving related electrical engineering.
- To identify appropriate algorithms to obtain solutions for mathematical models.
- To introduce to fundamentals of computational techniques for solving engineering problems.
- To provide basic working knowledge of artificial intelligence in solving complex problems.

Course outcomes:

- Identify suitable numerical technique for the solution of a mathematical model.
- Study and analyze the various computational algorithms.
- Develop and Apply algorithms for various numerical analysis methods.
- Obtain the solutions by using various numerical methods.

SYLLABUS

Numerical Integration and Differentiation: Introduction, Trapezoidal Rule, Simpson's Rule, Gaussian Quadrature, Romberg Integration, Numerical Differentiation

Nonlinear Systems of Equations: Bisection Method, Fixed-Point Method, Newton–Raphson Method: Method, Rate of Convergence Analysis, Breakdown Phenomena and algorithm, Least squares approximation, Chaotic Phenomena and a Cryptography Application.

Introduction to Graph Theory: Basic Concepts, Terminology, Directed Graphs, Flow Graphs for Differential Equations, Construction and Analysis of Signal Flow Graphs, Signal-Flow-Graph Reduction and the Solution of Equations, Flow-Graph Algebra, Loop Elimination and Equation Solving by Equation Reduction, Mason's Rule, Application of Mason's Rule to Dynamic Systems.

Introduction to Nano-scale Solution Methods: Special Models for the Nanoscale, Brief Overview of Partial Differential Equations, Applications of Hyperbolic PDEs, The Finite-Difference (FD) Method, The Finite-Difference Time-Domain (FDTD) Method, The Finite Element Method, The Finite Volume method.

Introduction to Computational Intelligence: Artificial intelligence and Computational intelligence, Fundamental elements of soft computing: Logic of fuzzy sets, Computational models of neural nets, Genetic Algorithms. Computational learning theory, Synergism in soft computing: Neuro – Fuzzy, Neuro-GA, Fuzzy-GA synergism, Neuro belief network, GA belief network, Neuro Fuzzy GA belief network synergism.(basic treatment of various concepts only)

Text Books:

1. "An Introduction to Numerical Analysis for Electrical And Computer Engineers" by Christopher J. Zarowski, John Wiley & Sons, Inc. 2004
2. "Graph Theory In Modern Engineering-Computer Aided Design, Control, Optimization, Reliability Analysis" by Ernest J. Henley & R. A. Williams, Academic Press, 1973.

Reference Books:

3. "Computational Methods for Nanoscale Applications - Particles, Plasmons and Waves" by Igor Tsukerman, Springer 2008.
4. "Computational Intelligence- Principles, Techniques and Applications" by Amit Konar, Springer 2005.

EE-1206 : ENGLISH LANGUAGE LAB

Course Objectives:

- To make students recognize the sounds of English through Audio-Visual aids;
- To help students build their confidence and help them to overcome their inhibitions and self- consciousness while speaking in English;
- To familiarize the students with stress and intonation and enable them to speak English effectively; and
- To give learners exposure to and practice in speaking in both formal and informal contexts.

Course Outcomes:

- Students will be sensitized towards recognition of English sound patterns and the fluency in their speech will be enhanced;
- A study of the communicative items in the laboratory will help students become successful in the competitive world;
- Students will be able to participate in group activities like roleplays, group discussions and debates; and

- Students will be able to express themselves fluently and accurately in social as well professional context.

SYLLABUS

Introduction to Phonetics: The Sounds of English (Speech sound – vowels and consonants) - Stress and Intonation - Accent and Rhythm.

Listening Skills: Listening for gist and specific information - listening for Note taking, summarizing and for opinions - Listening to the speeches of eminent personalities.

Speaking Skills: Self-introduction - Conversation Skills (Introducing and taking leave) - Giving and asking for information - Role Play - Just A Minute (JAM) session - Telephone etiquette.

Reading and Writing skills: Reading Comprehension – Précis Writing - E-Mail writing - Punctuation.

Presentation skills: Verbal and non-verbal communication - Body Language - Making a Presentation.

Reference Books:

1. Ashraf Rizvi. *Effective Technical Communication*. Tata McGraw Hill Education Private Limited, New Delhi.
2. *Speak Well*. Orient Blackswan Publishers, Hyderabad.
3. Allan Pease. *Body Language*. Manjul Publishing House, New Delhi.

EE-1207 : CHEMISTRY LAB

Course Objectives:

- To develop the fine skills of quantitative determination of various chemical components through titrimetric analysis
- To prepare and use ionexchange/ zeolite columns for the removal of hardness of water
- To develop the skill of organic synthesis through the preparation of a polymer/ drug

Course Outcomes:

- The course provides quantitative determine the amount of various chemical species in solutions by titrations and conduct the quantitative determinations with accuracy
- The course provides to develop novel materials to be used as zeolite and prepare columns for removal of hardness of water
- The course provides to synthesise a polymer or a drug

SYLLABUS

1. Determination of Sodium Hydroxide with HCl (Na_2CO_3 Primary Standard)

2. Determination of Alkalinity (Carbonate and Hydroxide) of water sample
3. Determination of Fe(II)/Mohr's Salt by Permanganometry
4. Determination of Oxalic Acid by Permanganometry
5. Determination of Chromium (VI) by Mohr's Salt Solution
6. Determination of Zinc by EDTA method
7. Determination of Hardness of Water sample by EDTA method
8. Determination of Chlorine in water by Iodometric Titration
9. Ionexchange/ Zeolite column for removal of hardness of water
10. Synthesis of Polymer/ drug

Reference Books:

1. Vogel's Quantitative Chemical Analysis – V – Edition – Longman.
2. Experiments in Applied Chemistry (For Engineering Students) – Sinita Rattan – S. K. Kataria & Sons, New Delhi

EE-1208 : CPNM LAB

Course Objectives:

- To impart writing skill of C programming to the students and solving problems.
- To write and execute programs in C to solve problems such as Modularize the problems into small modules and then convert them into programs.,
- To write and execute programs in C to solve problems such as arrays, files, strings, structures and different numerical methods.
- This reference has been prepared for the beginners to help them understand the basic to advanced concepts related to Objective-C Programming languages.

Course Outcomes:

- Understand various computer components, Installation of software. C programming development environment, compiling, debugging, and linking and executing a program using the development environment.
- Analyzing the complexity of problems, Modularize the problems into small modules and then convert them into programs.
- Construct programs that demonstrate effective use of C features including arrays, strings, structures, pointers and files.
- Apply and practice logical ability to solve the real world problems.
- Apply Numerical methods to Solve the complex Engineering problems.

SYLLABUS

1. Write a program to read x, y coordinates of 3 points and then calculate the area of a triangle formed by them and print the coordinates of the three points and the area of the triangle. What will be the output from your program if the three given points are in a straight line?
2. Write a program, which generates 100 random integers in the range of 1 to 100. Store them in an array and then print the arrays. Write 3 versions of the program using different loop constructs. (e.g. for, while, and do while).
3. Write a set of string manipulation functions e.g. for getting a sub-string from a given position, Copying one string to another, Reversing a string, adding one string to another.
4. Write a program which determines the largest and the smallest number that can be stored in different data types like short, int, long, float, and double. What happens when you add 1 to the largest possible integer number that can be stored?
5. Write a program, which generates 100 random real numbers in the range of 10.0 to 20.0, and sort them in descending order.
6. Write a function for transposing a square matrix in place (in place means that you are not allowed to have full temporary matrix).
7. First use an editor to create a file with some integer numbers. Now write a program, which reads these numbers and determines their mean and standard deviation.
8. Given two points on the surface of the sphere, write a program to determine the smallest arc length between them.
9. Implement bisection method to find the square root of a given number to a given accuracy.
10. Implement Newton Raphson method to det. a root of polynomial equation.
11. Given table of x and corresponding f(x) values, Write a program which will determine f(x) value at an intermediate x value by using Lagrange's interpolation/
12. Write a function which will invert a matrix.
13. Implement Simpson's rule for numerical integration.
14. Write a program to solve a set of linear algebraic equations.

Instrumentation Technology

Scheme and Syllabus (With effect from 2020-21 admitted batch)

B.Tech I Year - I Semester

Course CreditsC code	Category	Course Title	Hours per week			Internal Marks	External Marks	Total Marks	
			L	T	P				
IN-1101	BS	Maths – I	3	0	0	30	70	100	3
IN -1102	BS	Physics	3	0	0	30	70	100	3
IN -1103	ES	Engineering Graphics	1	0	4	30	70	100	3
IN -1104	ES	Electronic Devices and Circuits	3	0	0	30	70	100	3
IN -1105	ES	Material Science and Engineering	3	0	0	30	70	100	3
IN -1106	ES	Workshop Lab	0	0	3	50	50	100	1.5
IN -1107	BS	Physics Lab	0	0	3	50	50	100	1.5
IN -1108	ES	Electronic devices and circuits Lab	0	0	3	50	50	100	1.5
Total Credits									19.5

B.Tech I Year - II Semester

Course CreditsC code	Category	Course Title	Hours per week			Internal Marks	External Marks	Total Marks	
			L	T	P				
IN -1201	BS	Maths – II	3	0	0	30	70	100	3
IN -1202	BS	Chemistry	3	0	0	30	70	100	3
IN -1203	HSS	English	3	0	0	30	70	100	3
IN -1204	ES	CPNM	3	0	3	30	70	100	3
IN -1205	ES	Analog Electronic Circuits	3	0	0	30	70	100	3
IN - 1206	HSS	English Language Lab	0	0	2	50	50	100	1.5
IN -1207	BS	Chemistry Lab	0	0	3	50	50	100	1.5
IN -1208	ES	CPNM Lab	0	0	3	50	50	100	1.5
Total Credits									19.5

IN-1101 : MATHEMATICS-I**Course Objectives:**

- To transmit the knowledge of Partial differentiation.
- To know of getting maxima and minima of function of two variables and finding errors and approximations.
- To evaluate double and triple integrals, volumes of solids and area of curved surfaces.
- To expand a periodical function as Fourier series and half-range Fourier series.

Course Outcomes:

- Find the partial derivatives of functions of two or more variables.
- Evaluate maxima and minima, errors and approximations.
- Evaluate double and triple integrals, volumes of solids and area of curved surfaces.
- To expand a periodical function as Fourier series and half-range Fourier series.
- Have a fundamental understanding of Fourier series and be able to give Fourier expansions of a given function.

SYLLABUS

(Partial Differentiation) Introduction - Functions of two or more variables - Partial derivatives - Homogeneous functions – Euler's theorem - Total derivative - Change of variables – Jacobins. Mean value Theorems (without proofs)

(Applications of Partial Differentiation) Geometrical interpretation - Tangent plane and Normal to a surface -Taylor's theorem for functions of two variables - Errors and approximations -Total differential. Maxima and Minima of functions of two variables - Lagrange's method of undetermined multipliers - Differentiation under the integral Sign - Leibnitz's rule.

(Multiple Integrals) Introduction - Double Integrals - Change of Order of Integration - Double Integrals in Polar Coordinates - Triple Integrals - Change of Variables.

(Multiple Integrals-Applications) Area enclosed by plane curves - Volumes of solids - Area of a curved surface - Calculation of Mass - Center of gravity - Moment of inertia - product of inertia – principal axes- Beta Function - Gamma Function - Relation between Beta and Gamma Functions. Error Function or Probability Integral.

(Fourier Series) Introduction - Euler's Formulae - Conditions for a Fourier Expansion - Functions having points of discontinuity - Change of Interval - Odd and Even Functions - Expansions of Odd or Even Periodic Functions, Half-Range Series - Parseval's Formula. Practical Harmonic analysis.

TEXT BOOK: Scope and Treatment as in "Higher Engineering Mathematics", by Dr. B.S. Grewal, 43rd Edition, Khanna publishers.

REFERENCE BOOKS:

1. Graduate Engineering Mathematics by V B Kumar Vatti., I.K.International publishing house Pvt. Ltd.
2. Advanced Engineering Mathematics by Erwin Kreyszig.
3. A text book of Engineering Mathematics, by N.P. Bali and Dr. Manish Goyal, Lakshmi Publications.

4. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.

5. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.

6. Higher Engineering Mathematics by Dr. M.K.Venkataraman.

IN-1102 : PHYSICS

Course Objectives:

- To impart knowledge in basic concept of physics of Thermodynamics relevant to engineering applications.
- To grasp the concepts of physics for electromagnetism and its application to engineering. Learn production of Ultrasonics and their applications in engineering.
- To Develop understanding of interference, diffraction and polarization: connect it to a few engineering applications.
- To Learn basics of lasers and optical fibers and their use in some applications.
- To Understand concepts and principles in quantum mechanics and Nanophase Materials. Relate them to some applications.

Course Outcomes:

- Understand the fundamentals of Thermodynamics and Laws of thermodynamics. Understand the working of Carnot cycle and concept of entropy.
- Gain Knowledge on the basic concepts of electric and magnetic fields. Understand the concept of the nature of magnetic materials. Gain knowledge on electromagnetic induction and its applications .
- Understand the Theory of Superposition of waves. Understand the formation of Newton's rings and the working of Michelson's interferometer. Remember the basics of diffraction, Evaluate the path difference. Analysis of Fraunhofer Diffraction due to a single slit
- Understand the interaction of matter with radiation, Characteristics of Lasers, Principle, working schemes of Laser and Principle of Optical Fiber. Realize their role in optical fiber communication.
- Understand the intuitive ideas of the Quantum physics and understand dual nature of matter. Compute Eigen values, Eigen functions, momentum of Atomic and subatomic particles using Time independent one Dimensional Schrodinger's wave equation. Understand the fundamentals and synthesis processes of Nanophase materials.

SYLLABUS

THERMODYNAMICS: Introduction, Heat and Work, First law of thermodynamics and applications, Reversible and Irreversible process,

Carnot cycle and Efficiency, Second law of thermodynamics, Carnot's Theorem, Entropy, Second law in terms of entropy, Entropy and disorder, Third law of thermodynamics (statement only).

ELECTROMAGNETISM Concept of electric flux, Gauss's law - some applications, Magnetic field - Magnetic force on current, torque on current loop, The Biot-Savart's Law, B near a long wire, B for a circular Current loop, Ampere's law, B for a solenoid, Hall effect, Faraday's law of induction, Lenz's law, Induced magnetic fields, Displacement current, Maxwell's equations (no derivation), Magnetic materials: Classification of magnetic materials and properties.

OPTICS

Interference: Principles of superposition – Young's Experiment – Coherence - Interference in thin films (reflected light), Newton's Rings, Michelson Interferometer and its applications.

Diffraction: Introduction, Differences between interference and diffraction, Fresnel and Fraunhofer diffraction, Fraunhofer diffraction at a single slit (Qualitative and quantitative treatment).

Polarisation: Polarisation by reflection, refraction and double refraction in uniaxial crystals, Nicol prism, Quarter and Half wave plate, circular and elliptical polarization.

LASERS and FIBRE OPTICS

Introduction, characteristics of a laser beam, spontaneous and stimulated emission of radiation, population inversion, Ruby laser, He-Ne laser, Semiconductor laser, applications of lasers

Introduction to optical fibers, principle of propagation of light in optical fibers, Acceptance Angle and cone of a fibre, Numerical aperture, Modes of propagations, classification of fibers, Fibre optics in communications, Application of optical fibers.

MODERN PHYSICS

Introduction, De Broglie concept of matter waves, Heisenberg uncertainty principle, Schrodinger time independent wave equation, application to a particle in a box. Free electron theory of metals, Kronig - Penney model (qualitative treatment), Origin of energy band formation in solids, Classification of materials into conductors, semi conductors and insulators.

Nanophase Materials

Introduction, properties, Top-down and bottom up approaches, Synthesis - Ball milling, Chemical vapour deposition method , sol-gel methods, Applications of nano materials.

TEXT BOOKS :

1. Physics by David Halliday and Robert Resnick – Part I and Part II - Wiley.

2. A textbook of Engineering Physics, Dr. M. N. Avadhanulu, Dr. P.G. Kshirsagar - S. Chand

3. Engineering Physics by R.K. Gaur and S.L. Gupta –Dhanpat Rai

Reference Books:

1. Modern Engineering Physics by A.S. Vadudeva

2. University Physics by Young and Freedman

IN-1103 : ENGINEERING GRAPHICS

Course Objectives:

- Understand the basics of Engineering Graphics and BIS conventions.
- Develop the graphical skills for communication of concepts, ideas and design of engineering products through technical drawings
- Demonstrate and practice the various profiles/curves used in engineering practice through standard procedures.
- Demonstrate and practice the orthographic projections of points, lines, planes, solids and section of solids
- Demonstrate and practice the development of surfaces of simple solids
- Familiarize the basic concept of isometric views clearly.

Course Outcomes:

- Develop simple engineering drawings by considering BIS standards.
- Able to draw different engineering curves with standard Procedures
- Comprehend the basics of orthographic projections and deduce orthographic projections of points, lines, planes and solids at different orientations in real life environment.
- Visualize clearly the sections of solids.
- Apply the concepts of development of surfaces while designing/analyzing any product.
- Recognize the significance of isometric drawing to relate 2D environment with 3D environment.

SYLLABUS

Introduction: Lines, Lettering and Dimensioning, Geometrical Constructions, and Scales.

Curves: Conic sections: General construction of ellipse, parabola and hyperbola. Construction of involutes of circle and polygons only. Normal and tangent to curves.

Projections of Points: Principal or Reference Planes, Projections of a point situated in any one of the four quadrants.

Projections of Straight Lines: Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane.

Projections of Straight Line Inclined to Both the Reference Planes: Projections of Planes: Projection of Perpendicular planes: Perpendicular to both reference planes, perpendicular to one reference plane and parallel to other reference plane and perpendicular to one reference plane and inclined to other reference plane. Projection of Oblique planes. Introduction to Auxiliary Planes.

Projections of Solids: Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to other and axes inclined to both the reference planes.

Sections of Solids: Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids (Prism, Pyramid, Cylinder and Cone) in simple position only.

Development of Surfaces: Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.

Isometric Views: Isometric projection, Isometric scale and Isometric view. Isometric view of Prisms, Pyramids, cylinder, cone, and their combinations.

Text Book:

Elementary Engineering Drawing by N.D.Bhatt, Charotar Publishing House.

Reference:

Engineering Graphics by K.L. Narayana and P. Kanniah, Tata McGraw Hill

IN 1104 : ELECTRONIC DEVICES AND CIRCUITS

Course Objectives:

- This course gives an overview of carrier transport phenomena in semiconductors, characteristics and applications of semiconductor devices like P-N junction diode,
- Bipolar Junction transistor (BJT), Field Effect Transistors (FET), Metal oxide Semiconductor Field Effect Transistor (MOSFET) and various special devices.

- Emphasis is placed on analysis, selection and proper biasing of transistors like BJT and FET.

Course Outcomes:

- At the end of the course, the student will be able to Remember the transport phenomena of charge carriers in semiconductors.
- Understand the operation of Diode, BJT and FET.
- Apply different types of filters in AC and DC conversion.
- Analyze the different types of diodes, operation and its characteristics.
- Evaluate the different biasing techniques used in BJT and FET.

SYLLABUS

Semiconductor Physics: Energy band theory of crystals, conductors, insulators, semiconductors, mobility and conductivity, energy distribution of electrons, electrons and holes in a Intrinsic semiconductors, conductivity of semiconductor, carrier concentration in Intrinsic semiconductors, donor and acceptor impurities, mass action law, charge densities in a semiconductor with impurities, Fermi level in semiconductor with impurities, diffusion, carrier life time, continuity equation, hall effect.

Semiconductor Diode Characteristics: Qualitative theory of p-n junction, p-n junction as a diode, band structure of an open circuited p-n junction, current components in a diode, qualitative theory of diode currents, Volt-Ampere characteristics, temperature dependence of a diode characteristics, diode resistance, diode capacitance, transition and diffusion capacitances.

Rectifiers: Half wave rectifier, Full wave rectifier with center tap transformer and Bridge circuit –Derivation of DC, RMS currents and voltages, Ripple factor, Efficiency, Peak inverse voltage, Transformer utilization factor and percentage regulation. Rectifiers using filters: Inductive filter, capacitive filter, L-section filter, Pi filter.

Bipolar Junction Transistor (BJT) : Introduction to three terminal devices, BJT construction, types and different regions of operations, Transistor as an amplifier. Transistor current components-Emitter efficiency, Transport factor, Large Signal current gain, input and output characteristics of transistor in common base, common emitter and common collector configurations, relation between α , β and γ , base width modulation, Ebers-Moll Model.

Field Effect Transistors (FET): Comparison between FET and BJT, Classification of FET, Construction, operation, Drain and Transfer characteristics of JFET and MOSFET.

TEXT BOOKS

1. Jacob Milliman Christos C Halkias, "Electriionic Devices and Circuits," Tata Mcgraw Hill Publishers, New Delhi.

2. Bes Streetman and Sanjay Banerjee," Solid State Electronic Devices," Prentice Hall

IN-1105 : MATERIAL SCIENCE

Course Objectives:

- An introduction to the mechanical properties of metals and physical properties is explained.
- Gives the beginning student an appreciation of recent developments in materials science & engineering within the framework of this class. To review physics and chemistry in the context of materials science & engineering. To describe the different types of bonding in solids.
- The meaning of phases, and the different types of phase transformations. How to interpret a binary phase diagram, especially the compositions and fractions of equilibrium phases according to the lever rule.
- The meaning and use of time-temperature-transformation diagrams. The crystal structures for common metals and semiconductors. To give knowledge about semiconductor physics, charge carriers and energy band diagrams. It discusses working and applications of basic devices, including p-n junctions.
- Magnetic Materials and Dielectric materials, their applications which discusses the principles and concepts behind magnetic materials and dielectric materials. It explains their applications in the fields of physics and engineering.
- The powder metallurgy process provides a host of advantages over competing metalworking technologies.

Course Outcomes:

- An ability to apply knowledge of mathematics, science and engineering, to understand different materials and their properties.
- Given a type of material, be able to qualitatively describe the bonding scheme and its general physical properties, strength as well as possible applications.
- Given a binary phase diagram microstructures obtained by suitable thermal treatments. An ability to identify the phases and their interrelationship in different alloy systems.
- An ability to design a system, component or process to meet desired needs within, realistic constraints such as economic, safety, manufacturability and sustainability etc., while selecting a material to manufacture the designed components.
- Powder metallurgy processes add up to part-to-part uniformity for improved product quality, shape and material flexibility, application versatility, and cost effectiveness, types and manufacturing of composite

materials. An ability to use modern techniques, skills, and engineering tools appropriate to materials research and engineering.

SYLLABUS

MECHANICAL PROPERTIES: Definitions of mechanical properties, Tensile Testing, Impact Testing, Hardness Tests- Brinell, Vickers and Rockwell tests, Plastic deformation.

EQUILIBRIUM DIAGRAMS: Phase rule-binary Alloy systems-Solid Solutions-Eutectic-Peritectic-Meritect-Entectoid systems-The Lever Rule, IRON-CARBON Diagram.

MAGNETIC MATERIALS : Types of magnetic materials, Ferromagnetism and related Phenomena- Domain structure-Hysteresis Loop- Soft and Hard magnetic materials.

DIELECTRIC MATERIALS : Dielectric materials, Polarization, Types of Polarization, Temperature and Frequency effects on polarization, Dielectric loss, Dielectric Breakdown- Ferro Electric materials.

SEMICONDUCTORS: Intrinsic and Extrinsic semiconductors-different types of extrinsic semi conducting ma-Energy band diagrams- Fermi energy level and P-N junction diode, Homojunction and Heterojunction

POWDER METALLURGY: Steps in Powder Metallurgy Processes- Powder production, Compaction, Sintering, & Secondary operations

TEXTBOOKS:

1. Material Science and Engineering by V.Raghavan-prentice Hall of India, New Delhi.
2. Testing of Metallic Materials by A.V.K.SuryaNarayana, Prentice Hall of India.

REFERENCE BOOKS:

1. Introduction to Material science for Engineers by J.F.Shackelford, Macmillan publishing Co., New York
2. Semiconductor and Electronic devices, Adir Bar-Lev, Prentice Hall of India, New Delhi.
3. Practical Experimental Metallurgy by D.Eurof Davies, Elsevier Publishing Co. Ltd. London

IN-1106 : WORKSHOP LAB

Course Objectives:

- Get hands on experience with the working skills in Carpentry trade.
- Know how to work with Sheet Metal tools.
- Get familiar with the working skills of Metal Fitting operations.
- Get hands on experience with house hold electrical wiring.

Course Outcomes:

- Can be able to work with Wood Materials in real time applications.
- Can be able to build various parts with Sheet Metal in day-to-day life.
- Can be able to apply Metal Fitting skills in various applications.
- Can be able to apply this knowledge to basic house electrical wiring and repairs.

SYLLABUS

Carpentry: Any three jobs from – Half lap joint, Mortise and Tenon joint, Half – lap Dovetail joint, Corner Dovetail joint, Central Bridle joint.

Sheet Metal: Any three jobs from – Square tray, Taper tray(sides), Funnel, Elbow pipe joint.

Fitting: Any three jobs from – Square, Hexagon, Rectangular fit, Circular fit and Triangular fit.

House wiring: Any three jobs from – Tube light wiring, Ceiling fan wiring, Stair-case wiring, Corridor wiring.

References:

1. Elements of workshop technology, Vol.1 by S. K. and H. K. Choudary.
2. Work shop Manual / P.Kannaiah/ K.L.Narayana/ SciTech Publishers.
3. Engineering Practices Lab Manual, Jeyapoovan, Saravana Pandian, 4/e Vikas.

IN-1107 : PHYSICS LAB

Course Objectives:

- To enable the students to acquire skill, technique and utilization of the Instruments
- Draw the relevance between the theoretical knowledge and to imply it in a practical manner with respect to analyze various electronic circuits and its components.
- To impart the practical knowledge in basic concepts of Wave optics, Lasers and Fiber optics.
- To familiarize the handling of basic physical apparatus like Vernier callipers, screw gauge, spectrometers, travelling microscope, laser device, optical fibre, etc.

Course Outcomes:

- Ability to design and conduct experiments as well as to analyze and interpret
- Ability to apply experimental skills to determine the physical quantities related to Heat, Electromagnetism and Optics

- The student will learn to draw the relevance between theoretical knowledge and the means to imply it in a practical manner by performing various relative experiments.

SYLLABUS

1. Determination of Radius of Curvature of a given Convex Lens By forming Newton's Rings.
2. Determination of Wavelength of Spectral Lines in the Mercury Spectrum by Normal Incidence method.
3. Study the Intensity Variation of the Magnetic Field along axis of Current Carrying Circular Coil.
4. Determination of Cauchy's Constants of a Given Material of the Prism using Spectrometer.
5. Determination of Refractive Index of Ordinary ray $m_{\text{---}}$ and Extraordinary ray $m_{\text{---}}$.
6. Determination of Thickness Given Paper Strip by Wedge Method.
7. Calibration of Low Range Voltmeter.
8. Calibration of Low Range Ammeter.
9. Determination of Magnetic Moment and Horizontal Component of Earth's Magnetic Field.
10. Lees Method - Coefficient of thermal Conductivity of a Bad Conductor.
11. Carey Foster's Bridge – Verification of laws of Resistance and Determination Of Specific Resistance.
12. Melde's Apparatus – Frequency of electrically maintained Tuning Fork.
13. Photoelectric cell-Characteristics.
14. Planks Constants.
15. Laser- Diffraction.

IN-1108 : Electronic Devices and Circuits Laboratory

Course Objective:

- The course gives an overview of basic lab equipments like CRO, Function generators, calculation of basic semiconductor device parameters from their VI characteristics and application of P-N junction diodes in rectifier circuits.

Course Outcomes:

- At the end of the course, the student will be able to
- Understand the operation of regulated power supplies, Function generators and CRO.

- Analyze the characteristics of different electronic devices such as diodes and transistors.

- Design the rectifier circuits.

Lab Experiments

1. Study of functionality of basic devices and lab equipment.
2. Measurement of signal characteristics using CRO
3. P-N Junction diode Volt- Ampere characteristics
4. Zener diode Volt – Ampere characteristics
5. Half wave rectifier with out filters
6. Half wave rectifier with capacitor and inductor filters
7. Full wave rectifier with out filters
8. Full wave rectifier with capacitor and inductor filters
9. Bridge rectifier with out and with filters.
10. Transistor characteristics under CB configuration
11. Transistor characteristics under CE configuration
12. Transistor characteristics under CC configuration
13. Drain and Transfer characteristics of Field effect Transistor
14. Study of Low pass filter
15. Study of high pass filter

IN-1201 : Mathematics – II

Course Objectives:

- The way of obtaining rank, eigen values and eigen vectors of a matrix.
- To know the importance of Cayley-Hamilton theorem and getting canonical form from a given quadratic form.
- To solve the system of equations by using direct and indirect methods.
- To solve first order and higher order differential equations by various methods.
- To obtain the Laplace transforms and inverse Laplace transforms for a given functions and their applications.

Course Outcomes:

- Find rank, eigen values and eigen vectors of a matrix and understand the importance of Cayley-Hamilton theorem.
- Reduce quadratic form to canonical forms and solving linear systems by direct and indirect methods.
- Demonstrate solutions to first order differential equations by various methods and solve basic applications problems related to electrical circuits, orthogonal trajectories and Newton's law of cooling

- Discriminate among the structure and procedure of solving higher order differential equations with constant and variable coefficients.
- Understand Laplace transforms and its properties and finding the solution of ordinary differential equations.

SYLLABUS

(Linear Algebra) Rank of a matrix- Echelon form, Normal Form - Solution of Linear System of Equations - Consistency of Linear System of Equations - Direct & Indirect Methods: Gauss elimination method, LU Factorization method, Gauss Seidal Method. Complex Matrices: Hermitian, Skew-Hermitian and Unitary Matrices and their Properties.

(Eigen Values and Eigen Vectors) Eigen Values and Eigen Vectors of a Matrix - Cayley-Hamilton theorem - Inverse and Powers of a Matrix using Cayley-Hamilton's theorem and its applications. Diagonalization of a Matrix - Quadratic Forms - Reduction of Quadratic Form to Canonical Form - Nature of a Quadratic Form.

(Ordinary Differential Equations of First Order and its Applications)

Formation of ordinary differential equations (ODEs) - Solution of an ordinary differential equation - Equations of the first order and first degree - Linear differential equation - Bernoulli's equation - Exact differential equations - Equations reducible to exact equations - Orthogonal Trajectories - Simple Electric (LR & CR) Circuits - Newton's Law of Cooling - Law of Natural growth and decay.

(Differential Equations of Higher Order) Solutions of Linear Ordinary Differential Equations with Constant Coefficients - Rules for finding the complimentary function - Rules for finding the particular integral - Method of variation of parameters - Cauchy's linear equation - Legendre's linear equation - Simultaneous linear differential equations.

(Laplace Transforms) Introduction - Existence Conditions - Transforms of Elementary Functions - Properties of Laplace Transforms - Transforms of Derivatives - Transforms of Integrals - Multiplication by t^n - Division by t - Evaluation of integrals by Laplace Transforms - Inverse Laplace Transform - Applications of Laplace Transforms to Ordinary Differential Equations - Simultaneous Linear Differential Equations with Constant Coefficients - Second Shifting Theorem - Laplace Transforms of Unit Step Function, Unit Impulse Function and Laplace Transforms of Periodic Functions.

TEXT BOOK:

Scope and Treatment as in "Higher Engineering Mathematics", by Dr. B.S. Grewal, 43rd edition, Khanna publishers.

REFERENCE BOOKS:

7. Graduate Engineering Mathematics by V B Kumar Vatti., I.K. International publishing house Pvt. Ltd.

1. Advanced Engineering Mathematics by Erwin Kreyszig.
2. A text book of Engineering Mathematics, by N.P. Bali and Dr. Manish Goyal. Lakshmi Publications.
3. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.
4. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.

IN-1202 : Chemistry

Course Objectives:

- To apply the basic knowledge of Chemistry to the Engineering Discipline.
- To develop knowledge about water and its treatment for industrial and potable purposes.
- To develop understanding in the areas of Polymers, Mechanism of Corrosion of Metals and Corrosion Control Methods, Fuels, Lubricants and Nanomaterials for of conducting polymers, bio-degradable polymers and fiber reinforced plastics and apply the knowledge for solving existing challenges faced in various engineering and societal areas.

Course outcome:

- This course applies the basic concepts and principles studied in Chemistry to Engineering.
- It provides an application of chemistry to different branches of engineering
- The students will be able acquire knowledge in the areas of Water Chemistry, Polymers, Corrosion, Fuels and Lubricants and nanomaterials and suggest innovative solutions for existing challenges in these areas.

SYLLABUS

Water Chemistry Sources of Water – Impurities and their influence of living systems – WHO Limits – Hardness and its Determination – Boiler Troubles and their removal – Water Softening Methods – Lime-Soda, Zeolite and Ion Exchange - Municipal Water Treatment-Break Point Chlorination – Desalination of Sea Water – Reverse Osmosis Method, Electro-dialysis.

Polymers and Plastics Polymers: Definition – Types of Polymerization (Addition & Condensation) – Mechanisms of Addition Polymerization – Radical and Ionic – Thermodynamics of Polymerization Process. Plastics: Thermosetting and Thermoplastics – Effect of Polymer Structure on Properties of Cellulose Derivatives – Vinyl Resins – Nylon (6,6), Reinforced Plastics – Conducting Polymers.

Corrosion Corrosion: Origin and Theory – Types of Corrosion: Chemical and Electrochemical; Pitting, Inter granular, Waterline, Stress – Galvanic Series – Factors Effecting Corrosion.

Corrosion Controlling Methods: Protective Coatings: Metallic Coatings, Electroplating and Electroless Plating – Chemical conversion Coatings – Phosphate, Chromate, Anodized, Organic Coatings – Paints and Special Paints.

Fuels and Lubricants Solid Fuels: Wood and Coal, Ranking of Coal – Analysis (Proximate and Ultimate) Coke Manufacture – Otto Hoffmann's Process – Applications; Liquid Fuels: Petroleum Refining – Motor Fuels – Petrol and Diesel Oil – Knocking – Octane number – Cetane Number; Gaseous Fuels: Biogas, LPG and CNG – Characteristics – Applications; Rocket Fuels: Propellants – Classification – Characteristics

Lubricants: Classification – Mechanism – Properties of Lubricating Oils – Selection of Lubricants for Engineering Applications.

Nanomaterials Nanomaterials, Properties and application of fullerenes, fullerols, Carbon nanotubes and nanowires. Synthesis - Top-down and Bottom-up approaches - Nanocomposites - Nanoelectronics- Applications of nanomaterials in catalysis, telecommunication and medicine.

Text Books:

1. Engineering Chemistry – PC Jain and M. Jain – Dhanpath Rai and Sons, New Delhi.
2. A Text book of Engineering Chemistry – S. S. Dara – S. Chand & Co. New Delhi.

Reference Books:

1. Engineering Chemistry – B. K. Sharma – Krishna Prakashan – Meerut.
2. Introduction to Nanoscience - S. M. Lindsay - Oxford University Press
3. Engineering Chemistry - B. L. Tembe, Kamaluddin and M. S. Krishnan, (NPTEL).

IN-1203 : ENGLISH

Course Objectives:

- To make students understand the explicit and implicit meanings of a text/topic;
- To give exposure to new words and phrases, and aid to use them in different contexts;
- To apply relevant writing formats to draft essays, letters, emails and presentations; and
- To adapt oneself to a given situation and develop a functional approach to finding solutions: adaptability and problem solving.

Course Outcomes:

- Students will be able to analyse a given text and discover the various aspects related to language and literature;
- Learn the various language structures, parts of speech and figures of speech;
- Develop one's reading and writing abilities for enhanced communication; and
- Learn to apply the topics in real-life situations for creative and critical use.

SYLLABUS

On the conduct of life: William Hazlitt

Life skills: Values and Ethics

If: Rudyard Kipling

The Brook: Alfred Tennyson

Life skills: Self-Improvement

How I Became a Public Speaker: George Bernard Shaw

The Death Trap: Saki

Life skills: Time Management

On saving Time: Seneca

Chindu Yellama

Life skills: Innovation

Muhammad Yunus

Politics and the English Language: George Orwell

Life skills: Motivation

Dancer with a White Parasol: Ranjana Dave

Grammar: Prepositions – Articles – Noun-Pronoun Agreement, Subject-Verb Agreement – Misplaced Modifiers – Clichés, Redundancies.

Vocabulary: Introduction to Word Formation – Root Words from other Languages – Prefixes and Suffixes – Synonyms, Antonyms – Common Abbreviations

Writing: Clauses and Sentences – Punctuation – Principals of Good Writing – Essay Writing – Writing a Summary

Writing: Essay Writing

Life skills: Innovation

Muhammad Yunus

Textbook: *Language and Life: A Skills Approach* Board of Editors, Orient Blackswan Publishers, India. 2018.

References :

1. *Practical English Usage*, Michael Swan. OUP. 1995.
2. *Remedial English Grammar*, F.T. Wood. Macmillan.2007
3. *On Writing Well*, William Zinsser. Harper Resource Book. 2001
4. *Study Writing*, Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
5. *Communication Skills*, Sanjay Kumar and PushpLata. Oxford University Press. 2011.
6. *Exercises in Spoken English*, Parts. I-III. CIEFL, Hyderabad. Oxford University Press.IN-1204

CPNM :

Course Objectives:

- The course is designed to provide complete knowledge of C language.
- To provide students with understanding of code organization and functional hierarchical decomposition with using complex data types.
- To provide knowledge to the Students to develop logics which will help them to create programs, applications in C.
- This course aims to identify tasks in which the numerical techniques learned are applicable and apply them to write programs, and hence use computers effectively to solve the task.
- This course provides the fundamental knowledge which is useful in understanding the other programming languages.

Course Outcomes:

- Identify basic elements of C programming structures like data types, expressions, control statements, various simple functions and Apply them in problem solving.
- Apply various operations on derived data types like arrays and strings in problem solving.
- Design and Implement of modular Programming and memory management using Functions, pointers.
- Apply Structure, Unions and File handling techniques to Design and Solve different engineering programs with minimal complexity.
- Apply Numerical methods to **Solve** the complex Engineering problems.

SYLLABUS

1. Introduction to C: Basic structure of C program, Constants, Variables and data types, Operators and Expressions, Arithmetic Precedence and

associativity, Type Conversions. Managing Input and Output Operations Formatted Input, Formatted Output.

2. Decision Making, Branching, Looping, Arrays & Strings: Decision making with if statement, Simple if statement, The if...else statement, Nesting of if...else statement, the else..if ladder, switch statement, the (?:) operator, the GOTO statement., The while statement, the do statement, The for statement, Jumps in Loops ,One, Two-dimensional Arrays, Character Arrays. Declaration and initialization of Strings, reading and writing of strings, String handling functions, Table of strings.

3. Functions: Definition of Functions, Return Values and their Types, Function Calls, Function Declaration, Category of Functions: No Arguments and no Return Values, Arguments but no Return Values, Arguments with Return Values, No Argument but Returns a Value, Functions that Return Multiple Values. Nesting of functions, recursion, passing arrays to functions, passing strings to functions, the scope, visibility and lifetime of variables.

4. Pointers: Accessing the address of a variable, declaring pointer variables, initializing of pointer variables, accessing variables using pointers, chain of pointers, pointer expressions, pointers and arrays, pointers and character strings, array of pointers, pointers as function arguments, functions returning pointers, pointers to functions, pointers to structures-Program Applications

5. Structure and Unions: Defining a structure, declaring structure variables, accessing structure members, structure initialization, copying and comparing structure variables, arrays of structures, arrays within structures, structures within structures, structures and functions and unions, size of structures and bit-fields- Program applications.

6. File handling: Defining and opening a file, closing a file, Input/ Output operations on files, Error handling during I/O operations, random access to files and Command Line Arguments- Program Applications

7. Numerical Methods: Solutions of Algebraic and Transcendental Equations, Bisection Method, Newton Raphson Method. Newton's forward and backward Interpolation, Lagrange's Interpolation in unequal intervals. Numerical Integration: Trapezoidal rule, Simpson's 1/3 rules. Solutions of Ordinary First Order Differential Equations: Euler's Method, Modified Euler's Method and Runge-Kutta Method.

Text Book:

1. Programming in ANSI C, E Balagurusamy, 6th Edition. McGraw Hill Education (India) Private Limited.
2. Introduction to Numerical Methods, SS Sastry, Prentice Hall

Reference Books:

1. Let Us C ,YashwantKanetkar, BPB Publications, 5th Edition.
2. Computer Science, A structured programming approach using C", B.A.Forouzan and R.F.Gilberg, " 3rd Edition, Thomson, 2007.
3. The C –Programming Language' B.W. Kernighan, Dennis M. Ritchie, PHI.
4. Scientific Programming: C-Language, Algorithms and Models in Science, Luciano M. Barone (Author), Enzo Marinari (Author), Giovanni Organtini, World Scientific.

IN1205 ANALOG ELECTRONIC CIRCUITS

Course Objectives: In this course student will learn about

- Analysis of single and multi stage amplifiers.
- Frequency response of single and multi stage amplifiers.
- Different power amplifiers.
- Concept of negative feedback in amplifiers.
- Operation, types and stability of oscillators.

Course Outcomes: At the end of the course, student will be able to

- Design different single and multi stage amplifiers.
- Understand the effect of capacitance on frequency response.
- Understand the application of power amplifiers.
- Know the importance of negative feedback in amplifiers.
- Design sinusoidal oscillators for different frequencies.

Small Signal Frequency Transistor Amplifiers: Hybrid parameter model of a Two Port network, h parameter model for transistor in CE, CB and CC configurations. Typical h-parameter values, h parameter conversion from one configuration to another configuration. Analysis of CE, CB and CC Amplifiers using h parameter model. CE Amplifier with emitter resistance.

Multistage Amplifiers: Cascade Amplifier (RC Coupled Amplifier), Cascade Amplifier, Darlington Pair and Analysis.

Transistor at High Frequencies: The hybrid common Emitter Transistor model, Hybrid α conductance in terms of low frequency h parameters- Transconductance, input impedance, Feedback conductance. Base spreading resistance, output conductance and hybrid capacitance. The CE short circuit current gain obtained with the hybrid α model- Bandwidth f_p and parameter f_{β} , current gain with resistive load, Transistor amplifier response with source resistance-Gain Bandwidth product.

Power Amplifiers: Classification of large signal amplifiers, Distortion in Amplifiers- Second harmonic Distortion and higher order harmonic distortion, Class A power amplifiers, Direct coupled and Transformer coupled Class B power amplifiers- push pull and complementary symmetry class AB power amplifiers, Class C power amplifiers, Class D and S power amplifiers.

Feedback Amplifiers: Open loop amplifiers, voltage amplifiers, current amplifier, Transresistance Amplifier and Transconductance Amplifiers, Closed loop amplifiers- Block diagram, concept of negative feedback, concept of positive feedback, characteristics of negative feedback amplifiers, classification of negative feedback amplifiers-Voltage series negative feedback amplifiers, voltage shunt feedback amplifiers, current series feedback amplifiers, current shunt feedback amplifiers and their analysis.

Sinusoidal Oscillators: Barkhausen Criterion, classification of oscillators, Hartly oscillators, Colpitts oscillators, RC phase shift oscillators using BJT and JFET, Wein Bridge oscillators, crystal oscillators, Frequency and amplitude stability of Oscillators.

TEXT BOOKS

Jacob Milliman and Christos C Halkias, " Electronic Devices and Circuits," Tata Mcgrah Hill Publishers, New Delhi, Fourth REprint, 2011.

IN-1206 : ENGLISH LANGUAGE LAB

Course Objectives:

- To make students recognize the sounds of English through Audio-Visual aids;
- To help students build their confidence and help them to overcome their inhibitions and self- consciousness while speaking in English;
- To familiarize the students with stress and intonation and enable them to speak English effectively; and
- To give learners exposure to and practice in speaking in both formal and informal contexts.

Course Outcomes:

- Students will be sensitized towards recognition of English sound patterns and the fluency in their speech will be enhanced;
- A study of the communicative items in the laboratory will help students become successful in the competitive world;
- Students will be able to participate in group activities like roleplays, group discussions and debates; and
- Students will be able to express themselves fluently and accurately in social as well professional context.

SYLLABUS

Introduction to Phonetics: The Sounds of English (Speech sound – vowels and consonants) - Stress and Intonation - Accent and Rhythm.

Listening Skills: Listening for gist and specific information - listening for Note taking, summarizing and for opinions - Listening to the speeches of eminent personalities.

Speaking Skills: Self-introduction - Conversation Skills (Introducing and taking leave) - Giving and asking for information - Role Play - Just A Minute (JAM) session - Telephone etiquette.

Reading and Writing skills: Reading Comprehension – Précis Writing - E-Mail writing - Punctuation.

Presentation skills: Verbal and non-verbal communication - Body Language - Making a Presentation.

Reference Books:

1. Ashraf Rizvi. *Effective Technical Communication*. Tata McGraw Hill Education Private Limited, New Delhi.
2. *Speak Well*. Orient Blackswan Publishers, Hyderabad.
3. Allan Pease. *Body Language*. Manjul Publishing House, New Delhi.

IN-1207 CHEMISTRY LAB

Course Objectives:

- To develop the fine skills of quantitative determination of various chemical components through titrimetric analysis
- To prepare and use ionexchange/ zeolite columns for the removal of hardness of water
- To develop the skill of organic synthesis through the preparation of a polymer/ drug

Course Outcomes:

- The course provides quantitative determine the amount of various chemical species in solutions by titrations and conduct the quantitative determinations with accuracy
- The course provides to develop novel materials to be used as zeolite and prepare columns for removal of hardness of water
- The course provides to synthesise a polymer or a drug

SYLLABUS

1. Determination of Sodium Hydroxide with HCl (Na_2CO_3 Primary Standard)
2. Determination of Alkalinity (Carbonate and Hydroxide) of water sample

3. Determination of Fe(II)/Mohr's Salt by Permanganometry
4. Determination of Oxalic Acid by Permanganometry
5. Determination of Chromium (VI) by Mohr's Salt Solution
6. Determination of Zinc by EDTA method
7. Determination of Hardness of Water sample by EDTA method
8. Determination of Chlorine in water by Iodometric Titration
9. Ionexchange/ Zeolite column for removal of hardness of water
10. Synthesis of Polymer/ drug

Reference Books:

1. Vogel's Quantitative Chemical Analysis – V – Edition – Longman.
2. Experiments in Applied Chemistry (For Engineering Students) – Sinita Rattan – S. K. Kataria & Sons, New Delhi

IN-1208 : CPNM LAB

Course Objectives:

- To impart writing skill of C programming to the students and solving problems.
- To write and execute programs in C to solve problems such as Modularize the problems into small modules and then convert them into programs.,
- To write and execute programs in C to solve problems such as arrays, files, strings, structures and different numerical methods.
- This reference has been prepared for the beginners to help them understand the basic to advanced concepts related to Objective-C Programming languages.

Course Outcomes:

- Understand various computer components, Installation of software. C programming development environment, compiling, debugging, and linking and executing a program using the development environment.
- Analyzing the complexity of problems, Modularize the problems into small modules and then convert them into programs.
- Construct programs that demonstrate effective use of C features including arrays, strings, structures, pointers and files.
- Apply and practice logical ability to solve the real world problems.
- Apply Numerical methods to Solve the complex Engineering problems.

SYLLABUS

1. Write a program to read x, y coordinates of 3 points and then calculate the area of a triangle formed by them and print the coordinates of

the three points and the area of the triangle. What will be the output from your program if the three given points are in a straight line?

2. Write a program, which generates 100 random integers in the range of 1 to 100. Store them in an array and then print the arrays. Write 3 versions of the program using different loop constructs. (e.g. for, while, and do while).

3. Write a set of string manipulation functions e.g. for getting a substring from a given position, Copying one string to another, Reversing a string, adding one string to another.

4. Write a program which determines the largest and the smallest number that can be stored in different data types like short, int, long, float, and double. What happens when you add 1 to the largest possible integer number that can be stored?

5. Write a program, which generates 100 random real numbers in the range of 10.0 to 20.0, and sort them in descending order.

6. Write a function for transposing a square matrix in place (in place means that you are not allowed to have full temporary matrix).

7. First use an editor to create a file with some integer numbers. Now write a program, which reads these numbers and determines their mean and standard deviation.

8. Given two points on the surface of the sphere, write a program to determine the smallest arc length between them.

9. Implement bisection method to find the square root of a given number to a given accuracy.

10. Implement Newton Raphson method to det. a root of polynomial equation.

11. Given table of x and corresponding f(x) values, Write a program which will determine f(x) value at an intermediate x value by using Lagrange's interpolation/

12. Write a function which will invert a matrix.

13. Implement Simpson's rule for numerical integration.

14. Write a program to solve a set of linear algebraic equations.

INFORMATION TECHNOLOGY

Scheme and Syllabus (With effect from 2020-21 admitted batch)

B.Tech I Year - I Semester

Course CreditsC code	Category	Course Title	Hours per week			Internal	External	Total
			L	T	P	Marks	Marks	Marks
IT-1101	BS	Mathematics – I	3	0	0	30	70	100
IT-1102	BS	Chemistry	3	0	0	30	70	100

IT-1103	HSS	English	3	0	0	30	70	100	3
IT-1104	ES	CPNM	3	0	3	30	70	100	3
IT-1105	ES	Discrete Mathematical Structures	3	0	0	30	70	100	3
IT-1106	HSS	English Language Lab	0	0	2	50	50	100	1.5
IT-1107	BS	Chemistry Lab	0	0	3	50	50	100	1.5
IT-1108	ES	CPNM Lab	0	0	3	50	50	100	1.5
Total Credits									19.5

B.Tech I Year - II Semester

Course CreditsC code	Category	Course Title	Hours per week			Internal	External	Total	
			L	T	P	Marks	Marks	Marks	
IT-1201	BS	Mathematics – II	3	0	0	30	70	100	3
IT-1202	BS	Physics	3	0	0	30	70	100	3
IT-1203	ES	Engineering Graphics	1	0	4	30	70	100	3
IT-1204	ES	Data Structures	3	0	0	30	70	100	3
IT-1205	ES	Digital Logic Design	3	0	0	30	70	100	3
IT-1206	ES	Workshop Lab	0	0	3	50	50	100	1.5
IT-1207	BS	Physics Lab	0	0	3	50	50	100	1.5
IT-1208	ES	Data Structures Lab	0	0	3	50	50	100	1.5
		Total Credits							19.5

IT-1101 : MATHEMATICS-I

CourseObjectives:

- To transmit the knowledge of Partial differentiation.
- To know of getting maxima and minima of function of two variables and finding errors and approximations.
- To evaluate double and triple integrals, volumes of solids and area of curved surfaces.
- To expand a periodical function as Fourier series and half-range Fourier series.

CourseOutcomes:

- Find the partial derivatives of functions of two or more variables.
- Evaluate maxima and minima, errors and approximations.
- Evaluate double and triple integrals, volumes of solids and area of curved surfaces.
- To expand a periodical function as Fourier series and half-range Fourier series.

- Have a fundamental understanding of Fourier series and be able to give Fourier expansions of a given function.

SYLLABUS

(Partial Differentiation) Introduction - Functions of two or more variables - Partial derivatives - Homogeneous functions – Euler's theorem - Total derivative - Change of variables – Jacobins. Mean value Theorems (without proofs)

(Applications of Partial Differentiation) Geometrical interpretation - Tangent plane and Normal to a surface -Taylor's theorem for functions of two variables - Errors and approximations -Total differential. Maxima and Minima of functions of two variables - Lagrange's method of undetermined multipliers - Differentiation under the integral Sign - Leibnitz's rule.

(Multiple Integrals) Introduction - Double Integrals - Change of Order of Integration - Double Integrals in Polar Coordinates - Triple Integrals - Change of Variables.

(Multiple Integrals-Applications) Area enclosed by plane curves - Volumes of solids - Area of a curved surface - Calculation of Mass - Center of gravity - Moment of inertia - product of inertia – principal axes- Beta Function - Gamma Function - Relation between Beta and Gamma Functions. Error Function or Probability Integral.

(Fourier Series) Introduction - Euler's Formulae - Conditions for a Fourier Expansion - Functions having points of discontinuity - Change of Interval - Odd and Even Functions - Expansions of Odd or Even Periodic Functions, Half-Range Series - Parseval's Formula. Practical Harmonic analysis.

TEXT BOOK:

Scope and Treatment as in "Higher Engineering Mathematics", by Dr. B.S. Grewal, 43rd Edition, Khanna publishers.

REFERENCE BOOKS:

1. Graduate Engineering Mathematics by V B Kumar Vatti., I.K.International publishing house Pvt. Ltd.
2. Advanced Engineering Mathematics by Erwin Kreyszig.
3. A text book of Engineering Mathematics, by N.P. Bali and Dr. Manish Goyal, Lakshmi Publications.
4. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.
5. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.
6. Higher Engineering Mathematics by Dr. M.K.Venkataraman.

IT-1102 : Chemistry

Course Objectives:

- To apply the basic knowledge of Chemistry to the Engineering Discipline.
- To develop knowledge about water and its treatment for industrial and potable purposes.
- To develop understanding in the areas of Polymers, Mechanism of Corrosion of Metals and Corrosion Control Methods, Fuels, Lubricants and Nanomaterials for of conducting polymers, bio-degradable polymers and fiber reinforced plastics and apply the knowledge for solving existing challenges faced in various engineering and societal areas.

Course outcome:

- This course applies the basic concepts and principles studied in Chemistry to Engineering.
- It provides an application of chemistry to different branches of engineering
- The students will be able acquire knowledge in the areas of Water Chemistry, Polymers, Corrosion, Fuels and Lubricants and nanomaterials and suggest innovative solutions for existing challenges in these areas.

SYLLABUS

Water Chemistry : Sources of Water – Impurities and their influence of living systems – WHO Limits – Hardness and its Determination – Boiler Troubles and their removal – Water Softening Methods – Lime-Soda, Zeolite and Ion Exchange - Municipal Water Treatment-Break Point Chlorination – Desalination of Sea Water – Reverse Osmosis Method, Electro-dialysis.

Polymers and Plastics **Polymers:** Definition – Types of Polymerization (Addition & Condensation) – Mechanisms of Addition Polymerization – Radical and Ionic – Thermodynamics of Polymerization Process. Plastics: Thermosetting and Thermoplastics – Effect of Polymer Structure on Properties of Cellulose Derivatives – Vinyl Resins – Nylon (6,6), Reinforced Plastics – Conducting Polymers.

Corrosion Corrosion: Origin and Theory – Types of Corrosion: Chemical and Electrochemical; Pitting, Inter granular, Waterline, Stress – Galvanic Series – Factors Effecting Corrosion.

Corrosion Controlling Methods: Protective Coatings: Metallic Coatings, Electroplating and Electroless Plating – Chemical conversion Coatings – Phosphate, Chromate, Anodized, Organic Coatings – Paints and Special Paints.

Fuels and Lubricants Solid Fuels: Wood and Coal, Ranking of Coal – Analysis (Proximate and Ultimate) Coke Manufacture – Otto Hoffmann's Process – Applications; Liquid Fuels: Petroleum Refining – Motor Fuels –

Petrol and Diesel Oil – Knocking – Octane number – Cetane Number;
Gaseous Fuels: Biogas, LPG and CNG – Characteristics – Applications;
Rocket Fuels: Propellants – Classification – Characteristics

Lubricants: Classification – Mechanism – Properties of Lubricating Oils
– Selection of Lubricants for Engineering Applications.

Nanomaterials Nanomaterials, Properties and application of fullerenes,
fullerols, Carbon nanotubes and nanowires. Synthesis - Top-down and
Bottom-up approaches - Nanocomposites - Nanoelectronics- Applications of
nanomaterials in catalysis, telecommunication and medicine.

Text Books:

1. Engineering Chemistry – PC Jain and M. Jain – Dhanpath Rai and Sons, New Delhi.
2. A Text book of Engineering Chemistry – S. S. Dara – S. Chand & Co. New Delhi.

Reference Books:

1. Engineering Chemistry – B. K. Sharma – Krishna Prakashan – Meerut.
2. Introduction to Nanoscience - S. M. Lindsay - Oxford University Press
3. Engineering Chemistry - B. L. Tembe, Kamaluddin and M. S. Krishnan, (NPTEL).

IT-1103 : ENGLISH

Course Objectives:

- To make students understand the explicit and implicit meanings of a text/topic;
- To give exposure to new words and phrases, and aid to use them in different contexts;
- To apply relevant writing formats to draft essays, letters, emails and presentations; and
- To adapt oneself to a given situation and develop a functional approach to finding solutions: adaptability and problem solving.

Course Outcomes:

- Students will be able to analyse a given text and discover the various aspects related to language and literature;
- Learn the various language structures, parts of speech and figures of speech;
- Develop one's reading and writing abilities for enhanced communication; and

- Learn to apply the topics in real-life situations for creative and critical use.

SYLLABUS

On the conduct of life: William Hazlitt

Life skills: Values and Ethics

If: Rudyard Kipling

The Brook: Alfred Tennyson

Life skills: Self-Improvement

How I Became a Public Speaker: George Bernard Shaw

The Death Trap: Saki

Life skills: Time Management

On saving Time: Seneca

Chindu Yellama

Life skills: Innovation

Muhammad Yunus

Politics and the English Language: George Orwell

Life skills: Motivation

Dancer with a White Parasol: Ranjana Dave

Grammar: Prepositions – Articles – Noun-Pronoun Agreement, Subject-Verb Agreement – Misplaced Modifiers – Clichés, Redundancies.

Vocabulary: Introduction to Word Formation – Root Words from other Languages – Prefixes and Suffixes – Synonyms, Antonyms – Common Abbreviations

Writing: Clauses and Sentences – Punctuation – Principles of Good Writing – Essay Writing – Writing a Summary

Writing: Essay Writing

Life skills: Innovation

Muhammad Yunus

Textbook: Language and Life: A Skills Approach Board of Editors, Orient Blackswan Publishers, India. 2018.

References :

1. Practical English Usage, Michael Swan. OUP. 1995.
2. Remedial English Grammar, F.T. Wood. Macmillan. 2007
3. On Writing Well, William Zinsser. Harper Resource Book. 2001
4. Study Writing, Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.

5. Communication Skills, Sanjay Kumar and PushpLata. Oxford University Press. 2011.

6. Exercises in Spoken English, Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

IT-1104 : CPNM

Course Objectives:

- The course is designed to provide complete knowledge of C language.
- To provide students with understanding of code organization and functional hierarchical decomposition with using complex data types.
- To provide knowledge to the Students to develop logics which will help them to create programs, applications in C.
- This course aims to identify tasks in which the numerical techniques learned are applicable and apply them to write programs, and hence use computers effectively to solve the task.
- This course provides the fundamental knowledge which is useful in understanding the other programming languages.

Course Outcomes:

- Identify basic elements of C programming structures like data types, expressions, control statements, various simple functions and Apply them in problem solving.
- Apply various operations on derived data types like arrays and strings in problem solving.
- Design and Implement of modular Programming and memory management using Functions, pointers.
- Apply Structure, Unions and File handling techniques to Design and Solve different engineering programs with minimal complexity.
- Apply Numerical methods to Solve the complex Engineering problems.

SYLLABUS

1. Introduction to C: Basic structure of C program, Constants, Variables and data types, Operators and Expressions, Arithmetic Precedence and associativity, Type Conversions. Managing Input and Output Operations Formatted Input, Formatted Output.

2. Decision Making, Branching, Looping, Arrays & Strings: Decision making with if statement, Simple if statement, The if...else statement, Nesting of if...else statement, the else..if ladder, switch statement, the (?:) operator, the GOTO statement., The while statement, the do statement, The for statement, Jumps in Loops ,One, Two-dimensional Arrays, Character Arrays. Declaration and initialization of Strings, reading and writing of strings, String handling functions, Table of strings.

3. Functions: Definition of Functions, Return Values and their Types, Function Calls, Function Declaration, Category of Functions: No Arguments and no Return Values, Arguments but no Return Values, Arguments with Return Values, No Argument but Returns a Value, Functions that Return Multiple Values. Nesting of functions, recursion, passing arrays to functions, passing strings to functions, the scope, visibility and lifetime of variables.

4. Pointers: Accessing the address of a variable, declaring pointer variables, initializing of pointer variables, accessing variables using pointers, chain of pointers, pointer expressions, pointers and arrays, pointers and character strings, array of pointers, pointers as function arguments, functions returning pointers, pointers to functions, pointers to structures-Program Applications

5. Structure and Unions: Defining a structure, declaring structure variables, accessing structure members, structure initialization, copying and comparing structure variables, arrays of structures, arrays within structures, structures within structures, structures and functions and unions, size of structures and bit-fields- Program applications.

6. File handling: Defining and opening a file, closing a file, Input/ Output operations on files, Error handling during I/O operations, random access to files and Command Line Arguments- Program Applications

7. Numerical Methods: Solutions of Algebraic and Transcendental Equations, Bisection Method, Newton Raphson Method. Newton's forward and backward Interpolation, Lagrange's Interpolation in unequal intervals. Numerical Integration: Trapezoidal rule, Simpson's 1/3 rules. Solutions of Ordinary First Order Differential Equations: Euler's Method, Modified Euler's Method and Runge-Kutta Method.

Text Book:

1. Programming in ANSI C, E Balagurusamy, 6th Edition. McGraw Hill Education (India) Private Limited.
2. Introduction to Numerical Methods, SS Sastry, Prentice Hall

Reference Books:

1. Let Us C ,YashwantKanetkar, BPB Publications, 5th Edition.
2. Computer Science, A structured programming approach using C", B.A.Forouzan and R.F.Gilberg, " 3rd Edition, Thomson, 2007.
3. The C –Programming Language' B.W. Kernighan, Dennis M. Ritchie, PHI.
4. Scientific Programming: C-Language, Algorithms and Models in Science, Luciano M. Barone (Author), EnzoMarinari (Author), Giovanni Organtini, World Scientific.

IT1105 : DISCRETE MATHEMATICAL STRUCTURES

Course Objectives:

- To understand mathematical arguments using logical connectives and quantifiers and verify the validity of logical flow of arguments using propositional, predicate logic and truth tables.
- To understand about permutations and combinations.
- To understand various types of relations and discuss various properties of the relations.
- To study the graphs, graph isomorphism and spanning trees.
- To study about Boolean algebra and Finite State Machines.

Course Outcomes:

At the end of the course student will be able to

- Rewrite mathematical arguments using logical connectives and quantifiers and verify the validity of logical flow of arguments using propositional, predicate logic.
- Identify and give examples of various types of relations and describe various properties of the relations.
- Ability to solve problems using permutations and combinations.
- Determine isomorphism of graphs and spanning tree of a given graph using BFS/DFS algorithms. Also determine minimal spanning tree of a given graph.

SYLLABUS

1. The Foundations-Logic and Proofs: Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers Rules of Inference, Introduction to Proofs, Proof Methods and Strategy, Basic Structures-Sets, Functions, Sequences and Sums: Sets, Set Operations, Functions, Sequences and Summations.
2. The Fundamentals-Algorithms, the Integers and Matrices: Algorithms, The Growth of Functions, Complexity of Algorithms, The Integers and Division, Primes and Greatest Common Divisors, Integers and Algorithms, Applications of Number Theory, Matrices.
3. Induction and Recursion: Mathematical Induction, Strong Induction and Well-Ordering, Recursive Definitions and Structural Induction, Recursive Algorithms, Program Correctness. Counting: The Basics of Counting, The Pigeonhole Principle, Permutations and Combinations, Binomial Coefficients, Generalized Permutations and Combinations, Generating Permutations and Combinations.
4. Advanced Counting Techniques: Recurrence Relations, Solving Linear Recurrence Relations, Divide-and-Conquer Algorithms and Recursion Relations, Generating Functions, Inclusion-Exclusion, and Applications of Inclusion-Exclusion.

5. Relations: Relations and their properties, n-ary relations, applications, Representation, closure, equivalence relations, Partial orderings.

Graphs: Graphs and Graph Models, Graph Terminology and Special Types of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest-Path Problems, Planar Graphs, Graph Coloring

6. Trees: Introduction to Trees, Applications of Trees, Tree Traversal, Spanning Trees, Minimum Spanning Trees,

7. Boolean Algebra: Boolean Functions, Representing Boolean Functions, Logic Gates, Minimization of Circuits

Modeling Computation: Languages and Grammars, Finite-State Machines with Output, Finite-State Machines with No Output, Language Recognition, Turing Machines

Text Book:

1. Discrete Mathematics & Its Applications with Combinatorics and Graph Theory by Kenneth H Rosen, Tata McGraw-Hill Publishing Company Ltd., New Delhi.

Reference Books:

1. Discrete Mathematics for Computer Scientists & Mathematicians by Joe L. Mott, Abraham Kandel, Theodore P. Baker, Prentice-Hall, India.

2. Discrete Mathematics by Richard Johnson Baug, Pearson Education, New Delhi.

3. Discrete and Combinatorial Mathematics by Ralph. G. Grimaldi, Pearson Education, New Delhi.

IT-1106 : ENGLISH LANGUAGE LAB

Course Objectives:

- To make students recognize the sounds of English through Audio-Visual aids;
- To help students build their confidence and help them to overcome their inhibitions and self-consciousness while speaking in English;
- To familiarize the students with stress and intonation and enable them to speak English effectively; and
- To give learners exposure to and practice in speaking in both formal and informal contexts.

Course Outcomes:

- Students will be sensitized towards recognition of English sound patterns and the fluency in their speech will be enhanced;
- A study of the communicative items in the laboratory will help students become successful in the competitive world;

- Students will be able to participate in group activities like roleplays, group discussions and debates; and
- Students will be able to express themselves fluently and accurately in social as well professional context.

SYLLABUS

Introduction to Phonetics: The Sounds of English (Speech sound – vowels and consonants) - Stress and Intonation - Accent and Rhythm.

Listening Skills: Listening for gist and specific information - listening for Note taking, summarizing and for opinions - Listening to the speeches of eminent personalities.

Speaking Skills: Self-introduction - Conversation Skills (Introducing and taking leave) - Giving and asking for information - Role Play - Just A Minute (JAM) session - Telephone etiquette.

Reading and Writing skills: Reading Comprehension – Précis Writing - E-Mail writing - Punctuation.

Presentation skills: Verbal and non-verbal communication - Body Language - Making a Presentation.

Reference Books:

1. Ashraf Rizvi. *Effective Technical Communication*. Tata McGraw Hill Education Private Limited, New Delhi.
2. *Speak Well*. Orient Blackswan Publishers, Hyderabad.
3. Allan Pease. *Body Language*. Manjul Publishing House, New Delhi.

IT-1107 : CHEMISTRY LAB

Course Objectives:

- To develop the fine skills of quantitative determination of various chemical components through titrimetric analysis
- To prepare and use ionexchange/ zeolite columns for the removal of hardness of water
- To develop the skill of organic synthesis through the preparation of a polymer/ drug

Course Outcomes:

- The course provides quantitative determine the amount of various chemical species in solutions by titrations and conduct the quantitative determinations with accuracy
- The course provides to develop novel materials to be used as zeolite and prepare columns for removal of hardness of water
- The course provides to synthesise a polymer or a drug

SYLLABUS

1. Determination of Sodium Hydroxide with HCl (Na_2CO_3 Primary Standard)
2. Determination of Alkalinity (Carbonate and Hydroxide) of water sample
3. Determination of Fe(II)/Mohr's Salt by Permanganometry
4. Determination of Oxalic Acid by Permanganometry
5. Determination of Chromium (VI) by Mohr's Salt Solution
6. Determination of Zinc by EDTA method
7. Determination of Hardness of Water sample by EDTA method
8. Determination of Chlorine in water by Iodometric Titration
9. Ionexchange/ Zeolite column for removal of hardness of water
10. Synthesis of Polymer/ drug

Reference Books:

1. Vogel's Quantitative Chemical Analysis – V – Edition – Longman.
2. Experiments in Applied Chemistry (For Engineering Students) – Sinita Rattan – S. K. Kataria & Sons, New Delhi IT-1108

CPNM LAB:

Course Objectives:

- To impart writing skill of C programming to the students and solving problems.
- To write and execute programs in C to solve problems such as Modularize the problems into small modules and then convert them into programs.,
- To write and execute programs in C to solve problems such as arrays, files, strings, structures and different numerical methods.
- This reference has been prepared for the beginners to help them understand the basic to advanced concepts related to Objective-C Programming languages.

Course Outcomes:

- Understand various computer components, Installation of software. C programming development environment, compiling, debugging, and linking and executing a program using the development environment.
- Analyzing the complexity of problems, Modularize the problems into small modules and then convert them into programs.
- Construct programs that demonstrate effective use of C features including arrays, strings, structures, pointers and files.
- Apply and practice logical ability to solve the real world problems.

- Apply Numerical methods to Solve the complex Engineering problems.

SYLLABUS

1. Write a program to read x, y coordinates of 3 points and then calculate the area of a triangle formed by them and print the coordinates of the three points and the area of the triangle. What will be the output from your program if the three given points are in a straight line?
2. Write a program, which generates 100 random integers in the range of 1 to 100. Store them in an array and then print the arrays. Write 3 versions of the program using different loop constructs. (e.g. for, while, and do while).
3. Write a set of string manipulation functions e.g. for getting a sub-string from a given position, Copying one string to another, Reversing a string, adding one string to another.
4. Write a program which determines the largest and the smallest number that can be stored in different data types like short, int, long, float, and double. What happens when you add 1 to the largest possible integer number that can be stored?
5. Write a program, which generates 100 random real numbers in the range of 10.0 to 20.0, and sort them in descending order.
6. Write a function for transposing a square matrix in place (in place means that you are not allowed to have full temporary matrix).
7. First use an editor to create a file with some integer numbers. Now write a program, which reads these numbers and determines their mean and standard deviation.
8. Given two points on the surface of the sphere, write a program to determine the smallest arc length between them.
9. Implement bisection method to find the square root of a given number to a given accuracy.
10. Implement Newton Raphson method to det. a root of polynomial equation.
11. Given table of x and corresponding f(x) values, Write a program which will determine f(x) value at an intermediate x value by using Lagrange's interpolation/
12. Write a function which will invert a matrix.
13. Implement Simpson's rule for numerical integration.
14. Write a program to solve a set of linear algebraic equations.

IT-1201 : Mathematics – II

Course Objectives:

- The way of obtaining rank, eigen values and eigen vectors of a matrix.
- To know the importance of Cayley-Hamilton theorem and getting canonical form from a given quadratic form.
- To solve the system of equations by using direct and indirect methods.
- To solve first order and higher order differential equations by various methods.
- To obtain the Laplace transforms and inverse Laplace transforms for a given functions and their applications.

Course Outcomes:

- Find rank, eigen values and eigen vectors of a matrix and understand the importance of Cayley-Hamilton theorem.
- Reduce quadratic form to canonical forms and solving linear systems by direct and indirect methods.
- Demonstrate solutions to first order differential equations by various methods and solve basic applications problems related to electrical circuits, orthogonal trajectories and Newton's law of cooling
- Discriminate among the structure and procedure of solving higher order differential equations with constant and variable coefficients.
- Understand Laplace transforms and its properties and finding the solution of ordinary differential equations.

SYLLABUS

(Linear Algebra) Rank of a matrix- Echelon form, Normal Form - Solution of Linear System of Equations - Consistency of Linear System of Equations - Direct & Indirect Methods: Gauss elimination method, LU Factorization method, Gauss Seidal Method. Complex Matrices: Hermitian, Skew-Hermitian and Unitary Matrices and their Properties.

(Eigen Values and Eigen Vectors) Eigen Values and Eigen Vectors of a Matrix - Cayley-Hamilton theorem - Inverse and Powers of a Matrix using Cayley-Hamilton's theorem and its applications. Diagonalization of a Matrix - Quadratic Forms - Reduction of Quadratic Form to Canonical Form - Nature of a Quadratic Form.

(Ordinary Differential Equations of First Order and its Applications) Formation of ordinary differential equations (ODEs) - Solution of an ordinary differential equation - Equations of the first order and first degree - Linear differential equation - Bernoulli's equation - Exact differential equations - Equations reducible to exact equations - Orthogonal Trajectories - Simple Electric (LR & CR) Circuits - Newton's Law of Cooling - Law of Natural growth and decay.

(Differential Equations of Higher Order) Solutions of Linear Ordinary Differential Equations with Constant Coefficients - Rules for finding the

complimentary function - Rules for finding the particular integral - Method of variation of parameters - Cauchy's linear equation - Legendre's linear equation - Simultaneous linear differential equations.

(Laplace Transforms) Introduction - Existence Conditions - Transforms of Elementary Functions - Properties of Laplace Transforms - Transforms of Derivatives - Transforms of Integrals - Multiplication by t^n - Division by t - Evaluation of integrals by Laplace Transforms - Inverse Laplace Transform - Applications of Laplace Transforms to Ordinary Differential Equations - Simultaneous Linear Differential Equations with Constant Coefficients - Second Shifting Theorem - Laplace Transforms of Unit Step Function, Unit Impulse Function and Laplace Transforms of Periodic Functions.

TEXT BOOK:

Scope and Treatment as in "Higher Engineering Mathematics", by Dr. B.S. Grewal, 43rd edition, Khanna publishers.

REFERENCE BOOKS:

7. Graduate Engineering Mathematics by V B Kumar Vatti., I.K. International publishing house Pvt. Ltd.

1. Advanced Engineering Mathematics by Erwin Kreyszig.

2. A text book of Engineering Mathematics, by N.P. Bali and Dr. Manish Goyal. Lakshmi Publications.

3. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.

4. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.

IT-1202 : PHYSICS

Course Objectives:

- To impart knowledge in basic concept of physics of Thermodynamics relevant to engineering applications.
- To grasp the concepts of physics for electromagnetism and its application to engineering. Learn production of Ultrasonics and their applications in engineering.
- To Develop understanding of interference, diffraction and polarization: connect it to a few engineering applications.
- To Learn basics of lasers and optical fibers and their use in some applications.
- To Understand concepts and principles in quantum mechanics and Nanopahse Materials. Relate them to some applications.

Course Outcomes:

- Understand the fundamentals of Thermodynamics and Laws of thermodynamics. Understand the working of Carnot cycle and concept of entropy.

- Gain Knowledge on the basic concepts of electric and magnetic fields. Understand the concept of the nature of magnetic materials. Gain knowledge on electromagnetic induction and its applications .

- Understand the Theory of Superposition of waves. Understand the formation of Newton's rings and the working of Michelson's interferometer. Remember the basics of diffraction, Evaluate the path difference. Analysis of Fraunhofer Diffraction due to a single slit

- Understand the interaction of matter with radiation, Characteristics of Lasers, Principle, working schemes of Laser and Principle of Optical Fiber. Realize their role in optical fiber communication.

- Understand the intuitive ideas of the Quantum physics and understand dual nature of matter. Compute Eigen values, Eigen functions, momentum of Atomic and subatomic particles using Time independent one Dimensional Schrodinger's wave equation. Understand the fundamentals and synthesis processes of Nanophase materials.

SYLLABUS

THERMODYNAMICS Introduction, Heat and Work, First law of thermodynamics and applications, Reversible and Irreversible process, Carnot cycle and Efficiency, Second law of thermodynamics, Carnot's Theorem, Entropy, Second law in terms of entropy, Entropy and disorder, Third law of thermodynamics (statement only).

ELECTROMAGNETISM Concept of electric flux, Gauss's law - some applications, Magnetic field - Magnetic force on current, torque on current loop, The Biot-Savart's Law, B near a long wire, B for a circular Current loop, Ampere's law, B for a solenoid, Hall effect, Faraday's law of induction, Lenz's law, Induced magnetic fields, Displacement current, Maxwell's equations (no derivation), Magnetic materials: Classification of magnetic materials and properties.

Ultrasonics : Introduction, Production of Ultrasonics – Piezoelectric and Magnetostriction methods, acoustic grating, applications of ultrasonics.

OPTICS

Interference: Principles of superposition – Young's Experiment – Coherence - Interference in thin films (reflected light), Newton's Rings, Michelson Interferometer and its applications.

Diffraction: Introduction, Differences between interference and diffraction, Fresnel and Fraunhofer diffraction, Fraunhofer diffraction at a single slit (Qualitative and quantitative treatment).

Polarisation: Polarisation by reflection, refraction and double refraction in uniaxial crystals, Nicol prism, Quarter and Half wave plate, circular and elliptical polarization.

LASERS and FIBRE OPTICS : Introduction, characteristics of a laser beam, spontaneous and stimulated emission of radiation, population inversion, Ruby laser, He-Ne laser, Semiconductor laser, applications of lasers

Introduction to optical fibers, principle of propagation of light in optical fibers, Acceptance Angle and cone of a fibre, Numerical aperture, Modes of propagations, classification of fibers, Fibre optics in communications, Application of optical fibers.

MODERN PHYSICS : Introduction, De Broglie concept of matter waves, Heisenberg uncertainty principle, Schrodinger time independent wave equation, application to a particle in a box. Free electron theory of metals, Kronig - Penney model (qualitative treatment), Origin of energy band formation in solids, Classification of materials into conductors, semi conductors and insulators.

Nanophase Materials : Introduction, properties, Top-down and bottom up approaches, Synthesis - Ball milling, Chemical vapour deposition method, sol-gel methods, Applications of nano materials.

TEXT BOOKS :

1. Physics by David Halliday and Robert Resnick – Part I and Part II - Wiley.
2. A textbook of Engineering Physics, Dr. M. N. Avadhanulu, Dr. P.G. Kshirsagar - S. Chand
3. Engineering Physics by R.K. Gaur and S.L. Gupta –Dhanpat Rai

Reference Books:

1. Modern Engineering Physics by A.S. Vadudeva
2. University Physics by Young and Freedman

IT-1203 : ENGINEERING GRAPHICS

Course Objectives:

- Understand the basics of Engineering Graphics and BIS conventions.
- Develop the graphical skills for communication of concepts, ideas and design of engineering products through technical drawings
- Demonstrate and practice the various profiles/curves used in engineering practice through standard procedures.
- Demonstrate and practice the orthographic projections of points, lines, planes, solids and section of solids
- Demonstrate and practice the development of surfaces of simple solids
- Familiarize the basic concept of isometric views clearly.

Course Outcomes:

- Develop simple engineering drawings by considering BIS standards.
- Able to draw different engineering curves with standard Procedures
- Comprehend the basics of orthographic projections and deduce orthographic projections of points, lines, planes and solids at different orientations in real life environment.
- Visualize clearly the sections of solids.
- Apply the concepts of development of surfaces while designing/analyzing any product.
- Recognize the significance of isometric drawing to relate 2D environment with 3D environment.

SYLLABUS

Introduction: Lines, Lettering and Dimensioning, Geometrical Constructions, and Scales.

Curves: Conic sections: General construction of ellipse, parabola and hyperbola. Construction of involutes of circle and polygons only. Normal and tangent to curves.

Projections of Points: Principal or Reference Planes, Projections of a point situated in any one of the four quadrants.

Projections of Straight Lines: Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane.

Projections of Straight Line Inclined to Both the Reference Planes: Projections of Planes: Projection of Perpendicular planes: Perpendicular to both reference planes, perpendicular to one reference plane and parallel to other reference plane and perpendicular to one reference plane and inclined to other reference plane. Projection of Oblique planes. Introduction to Auxiliary Planes.

Projections of Solids: Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to other and axes inclined to both the reference planes.

Sections of Solids: Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids (Prism, Pyramid, Cylinder and Cone) in simple position only.

Development of Surfaces: Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.

Isometric Views: Isometric projection, Isometric scale and Isometric view. Isometric view of Prisms, Pyramids, cylinder, cone, and their combinations.

Text Book:

Elementary Engineering Drawing by N.D.Bhatt, Charotar Publishing House.

Reference:

Engineering Graphics by K.L. Narayana and P. Kanniah, Tata McGraw Hill

IT-1204 : DATA STRUCTURES

Course Objectives:

- Assess how the choice of data structures and algorithm design methods impacts the performance of programs.
- Choose the appropriate data structure and algorithm design method for a specified application.
- Solve problems using data structures such as linear lists, stacks, queues, binary trees, heaps binary search trees, and graphs and writing programs for these solutions.

Course Outcomes:

- Describe how arrays, records, linked structures, stacks, queues, trees, and graphs are represented in memory and used by algorithm.
- Demonstrate different methods for traversing trees.
- Compare alternative implementations of data structures with respect to performance.
- Discuss the computational efficiency of the principal algorithms for sorting and searching

SYLLABUS

1. Introduction to Data Structures: Review of C Programming, Recursive Definition and Processes, Recursion in C, Simulation of Recursion, Efficiency of Recursion, Abstract Data Types, Meaning and Definition of Data Structures, Arrays

2. Stacks: Stack as an Abstract Data Type, Primitive Operations, Implementing Stack Operations using Arrays, Infix, Postfix and Prefix: Definitions, Evaluation and Conversions. Queues: Queue as an Abstract Data Type, Sequential Representation, Types of Queues, Operations, Implementation using Arrays.

3. Linked List: Operations, Implementation of Stacks, Queues and priority Queues using Linked Lists+, Circular Lists: Insertion, Deletion and Concatenation Operations, Stacks and Queues as Circular Lists, Doubly Linked Lists.

4. Trees: Binary Trees - Definitions and Operations, Binary Tree Representation: Node Representation, Implicit array Representation, Binary Tree Traversal, Threaded Binary Trees and their Traversal, Trees and their Applications; Tree Searching: Insertion and Deletion of a node from a Binary Search Tree, Efficiency of Binary Search Tree operations.

5. Searching: Basic Searching Techniques: Dictionary as an Abstract Data Type, Algorithmic Notation, Sequential Searching and its Efficiency, Binary Search, Interpolation Search.

6. Sorting: General Background: Efficiency, Asymptotic Notations, Efficiency of Sorting, Bubble Sort and Quick Sort and their Efficiency, Selection Sorting, Binary Tree Sort, Heap Sort, Insertion Sorts, Shell Sort, Address calculation Sort, Merge and Radix Sorts.

7. Graphs and Their Application: Definition of Graphs, Representation of Graphs, Transitive closure, Linked Representation of Graphs, Topological Ordering of nodes, Graph Traversal and Spanning Forests, Undirected Graphs and their Traversals, Applications of Graphs, Minimal Spanning Trees.

Textbooks:

1. Data Structures Using C and C++ Yddish Langsam, Moshe J. Augenstein and Aaron M.Tanenbaum, Prentice Hall Of India (2nd Edition)

2. Data Structures, Algorithms and Applications with C++, Sahani McGraw Hill.

IT-1205 : DIGITAL LOGIC DESIGN

Course Objectives:

- To introduce the basic principles for design of combinational circuit and sequential circuits.
- To learn simple digital circuits in preparation for computer engineering.

Course Outcomes:

A student who successfully fulfills the course requirements will have demonstrated:

- An ability to define different number systems, binary addition and subtraction, 2's complement representation and operations with this representation.
- An ability to understand the different Boolean algebra theorems and apply them for logic functions.
- An ability to define the Karnaugh map for a few variables and perform an algorithmic reduction of logic functions.
- An ability to define the following combinational circuits: multiplexer, de-multiplexers encoders/decoders, comparators, arithmetic-logic units; and to be able to build simple circuits.

- An ability to understand asynchronous and synchronous sequential circuits, like counters and shift registers.
- An ability to understand memories like RAM and ROM, Programmable Logic Array and Programmable Array Logic.

SYLLABUS

1. Binary Systems: Digital Systems. Binary Numbers. Number Base Conversions. Octal and Hexadecimal Numbers. Complements. Signed Binary Numbers. Binary Codes. Binary Storage and Registers. Binary Logic
2. Boolean Algebra and Logic Gates: Basic Definitions. Axiomatic Definition of Boolean Algebra. Basic Theorems and Properties of Boolean Algebra. Boolean Functions. Canonical and Standard Forms. Other Logic Operations. Digital Logic Gates. Integrated Circuits.
3. Combinational Logic Design, Gate-Level Minimization: The Map Method. Four- Variable Map. Five-Variable Map. Product of Sums Simplification. Don't-Care Conditions. NAND and NOR Implementation. Other Two- Level Implementations Exclusive-OR Function. Hardware Description Language (HDL).
4. Combinational Logic: Combinational Circuits. Analysis Procedure. Design Procedure. Binary Adder Subtractor. Decimal Adder. Binary Multiplier. Magnitude Comparator. Decoders. Encoders. Multiplexers. HDL For Combinational Circuits.
5. Sequential Logic Design, Synchronous Sequential Logic: Sequential Circuits. Latches
Flip Flops. Analysis of Clocked Sequential Circuits. HDL For Sequential Circuits. State Reduction and Assignment. Design Procedure.
6. Registers and Counters: Registers. Shift Registers. Ripple Counters. Synchronous Counters. Other Counters. HDL for Registers and Counters.
7. Memory and Programmable Logic: Introduction. Random-Access Memory. Memory Decoding, Error Detection and Correction. Read-Only Memory. Programmable Logic Array. Programmable Array Logic. Sequential Programmable Devices.

TEXTBOOK:

1. Digital Design, 3rd Edition, M. Morris Mano, Pearson Education.

REFERENCE BOOKS:

1. Digital Logic Design Principles, Norman Balabanian & Bradley Carlson, John Wiley & Sons (Asia) Pvt. Ltd., 2002
2. Fundamentals of Digital Logic with VHDL Design, Stephen Brown and Zvonko Vranesic, Tata McGraw-Hill Edition, 2002

IT-1206 : WORKSHOP LAB

Course Objectives:

- Get hands on experience with the working skills in Carpentry trade.
- Know how to work with Sheet Metal tools.
- Get familiar with the working skills of Metal Fitting operations.
- Get hands on experience with house hold electrical wiring.

Course Outcomes:

- Can be able to work with Wood Materials in real time applications.
- Can be able to build various parts with Sheet Metal in day-to-day life.
- Can be able to apply Metal Fitting skills in various applications.
- Can be able to apply this knowledge to basic house electrical wiring and repairs.

SYLLABUS

Carpentry: Any three jobs from – Half lap joint, Mortise and Tenon joint, Half – lap Dovetail joint, Corner Dovetail joint, Central Bridle joint.

Sheet Metal: Any three jobs from – Square tray, Taper tray (sides), Funnel, Elbow pipe joint.

Fitting: Any three jobs from – Square, Hexagon, Rectangular fit, Circular fit and Triangular fit.

House wiring: Any three jobs from – Tube light wiring, Ceiling fan wiring, Stair-case wiring, Corridor wiring.

References:

1. Elements of workshop technology, Vol.1 by S. K. and H. K. Choudary.
2. Workshop Manual / P. Kannaiah/ K.L. Narayana/ SciTech Publishers.
3. Engineering Practices Lab Manual, Jeyapoovan, Saravana Pandian, 4/e Vikas.

IT-1207 : PHYSICS LAB

Course Objectives:

- To enable the students to acquire skill, technique and utilization of the Instruments
- Draw the relevance between the theoretical knowledge and to imply it in a practical manner with respect to analyze various electronic circuits and its components.
- To impart the practical knowledge in basic concepts of Wave optics, Lasers and Fiber optics.
- To familiarize the handling of basic physical apparatus like Vernier callipers, screw gauge, spectrometers, travelling microscope, laser device, optical fibre, etc.

Course Outcomes:

- Ability to design and conduct experiments as well as to analyze and interpret
- Ability to apply experimental skills to determine the physical quantities related to Heat, Electromagnetism and Optics
- The student will learn to draw the relevance between theoretical knowledge and the means to imply it in a practical manner by performing various relative experiments.

SYLLABUS

1. Determination of Radius of Curvature of a given Convex Lens By forming Newton's Rings.
2. Determination of Wavelength of Spectral Lines in the Mercury Spectrum by Normal Incidence method.
3. Study the Intensity Variation of the Magnetic Field along axis of Current Carrying Circular Coil.
4. Determination of Cauchy's Constants of a Given Material of the Prism using Spectrometer.
5. Determination of Refractive Index of Ordinary ray $m_{\text{---}}_o$ and Extraordinary $m_{\text{---}}_e$ ray.
6. Determination of Thickness Given Paper Strip by Wedge Method.
7. Calibration of Low Range Voltmeter.
8. Calibration of Low Range Ammeter.
9. Determination of Magnetic Moment and Horizontal Component of Earth's Magnetic Field.
10. Lees Method - Coefficient of thermal Conductivity of a Bad Conductor.
11. Carey Foster's Bridge – Verification of laws of Resistance and Determination Of Specific Resistance.
12. Melde's Apparatus – Frequency of electrically maintained Tuning Fork.
13. Photoelectric cell-Characteristics.
14. Planks Constants.
15. Laser- Diffraction.

IT-1208 : DATA STRUCTURES LAB

Course Objectives:

- To implement stacks and queues using arrays and linked lists.
- To develop programs for searching and sorting algorithms.

- To write programs using concepts of various trees.
- To implement programs using graphs.

Course Outcomes:

- Student will be able to write programs to implement stacks and queues.
- Ability to implement various searching and sorting techniques.
- Ability to implement programs using trees and graphs.

SYLLABUS

List of Programs:

1. Write a C program for sorting a list using Bubble sort and then apply binary search.
2. Write a C program to implement the operations on stacks.
3. Write a C program to implement the operations on circular queues.
4. Write a C program for evaluating a given postfix expression using stack.
5. Write a C program for converting a given infix expression to postfix form using stack.
6. Write a C program for implementing the operations of a dequeue
7. Write a C program for the representation of polynomials using circular linked list and for the addition of two such polynomials
8. Write a C program for quick sort
9. Write a C program for Merge sort.
10. Write a C program for Heap sort
11. Write a C program to create a binary search tree and for implementing the in order, preorder, post order traversal using recursion
12. a)Write a C program for finding the transitive closure of a digraph
b)Write a C program for finding the shortest path from a given source to any vertex in a digraph using Dijkstra's algorithm
13. a)Write a C program for finding the Depth First Search of a graph.
b)Write a C program for finding the Breadth First Search of a graph.

Mechanical Engineering

Scheme and Syllabus (With effect from 2020-21 admitted batch)

B.Tech / Year - I Semester

Course Credits	Category	Course Title	Hours per week			Internal Marks	External Marks	Total Marks	
code			L	T	P				
MC1101	BS	Maths – I	3	0	0	30	70	100	3

MC1102	BS	Physics	3	0	0	30	70	100	3
MC1103	ES	Engg. Graphics	1	0	4	30	70	100	3
MC1104	ES	Engg. Mechanics	3	0	0	30	70	100	3
MC1105	ES	Elec. Technology	3	0	0	30	70	100	3
MC1106	ES	Workshop	0	0	3	50	50	100	1.5
MC1107	BS	Physics Lab	0	0	3	50	50	100	1.5
MC1108	ES	Elec. Tech.Lab	0	0	3	50	50	100	1.5
Total Credits									19.5

B.Tech I Year - II Semester

Course Credits code	Category	Course Title	Hours per week			Internal Marks	External Marks	Total Marks	
			L	T	P				
BT-1101	BS	Mathematics – I	3	0	0	30	70	100	3
MC1201	BS	Maths – II	3	0	0	30	70	100	3
MC1202	BS	Chemistry	3	0	0	30	70	100	3
MC1203	HSS	English	3	0	0	30	70	100	3
MC1204	ES	CPNM	3	0	3	30	70	100	3
MC1205	ES	Strength of Materials - I	3	0	0	30	70	100	3
MC1206	HSS	English Language Lab	0	0	2	50	50	100	1.5
MC1207	BS	Chemistry Lab	0	0	3	50	50	100	1.5
MC1208	ES	CPNM Lab	0	0	3	50	50	100	1.5
Total Credits									19.5

MC 1101 - MATHEMATICS-I

Course Objectives: The contents of this course fulfill the fundamental requirements of knowledge of Mathematics for learning Engineering subjects. The main objectives of student learning are:

1. To transmit the knowledge of Partial differentiation.
2. To know of getting maxima and minima of function of two variables and finding errors and approximations.
3. To evaluate double and triple integrals, volumes of solids and area of curved surfaces.
4. To expand a periodical function as Fourier series and half-range Fourier series.

Course Outcomes: At the end of this course, the student will understand and be able to apply the basic principles of differential and integral calculus to various engineering problems. Particularly, the student will be able to

1. Find the partial derivatives of functions of two or more variables.

2. Evaluate maxima and minima, errors and approximations.
3. Evaluate double and triple integrals, volumes of solids and area of curved surfaces.
4. To expand a periodical function as Fourier series and half-range Fourier series.
5. Have a fundamental understanding of Fourier series and be able to give Fourier expansions of a given function.

Partial Differentiation, Multiple Integrals, Fourier Series and Their Applications

(Partial Differentiation) : Introduction - Functions of two or more variables - Partial derivatives - Homogeneous functions – Euler's theorem - Total derivative - Change of variables – Jacobins. Mean value Theorems (without proofs)

(Applications of Partial Differentiation) Geometrical interpretation - Tangent plane and Normal to a surface -Taylor's theorem for functions of two variables - Errors and approximations -Total differential. Maxima and Minima of functions of two variables - Lagrange's method of undetermined multipliers - Differentiation under the integral Sign - Leibnitz's rule.

(Multiple Integrals) Introduction - Double Integrals - Change of Order of Integration - Double Integrals in Polar Coordinates - Triple Integrals - Change of Variables.

(Multiple Integrals-Applications) Area enclosed by plane curves - Volumes of solids - Area of a curved surface - Calculation of Mass - Center of gravity - Moment of inertia - product of inertia – principal axes- Beta Function - Gamma Function - Relation between Beta and Gamma Functions. Error Function or Probability Integral.

(Fourier Series) Introduction - Euler's Formulae - Conditions for a Fourier Expansion - Functions having points of discontinuity - Change of Interval - Odd and Even Functions - Expansions of Odd or Even Periodic Functions, Half-Range Series - Parseval's Formula. Practical Harmonic analysis.

TEXT BOOK:

Scope and Treatment as in "Higher Engineering Mathematics", by Dr. B.S. Grewal, 43rd Edition, Khanna publishers.

REFERENCE BOOKS:

1. Graduate Engineering Mathematics by V B Kumar Vatti., I.K.International publishing house Pvt. Ltd.
2. Advanced Engineering Mathematics by Erwin Kreyszig.
3. A text book of Engineering Mathematics, by N.P. Bali and Dr. Manish Goyal, Lakshmi Publications.

4. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.

5. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.

6. Higher Engineering Mathematics by Dr. M.K.Venkataraman.

MC1102- PHYSICS

Course Objectives:

- To impart knowledge in basic concept of physics of Thermodynamics relevant to engineering applications.
- To grasp the concepts of physics for electromagnetism and its application to engineering. Learn production of Ultrasonics and their applications in engineering.
- To Develop understanding of interference, diffraction and polarization: connect it to a few engineering applications.
- To Learn basics of lasers and optical fibers and their use in some applications.
- To Understand concepts and principles in quantum mechanics and Nanophase Materials. Relate them to some applications.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

- Understand the fundamentals of Thermodynamics and Laws of thermodynamics. Understand the working of Carnot cycle and concept of entropy.
- Gain Knowledge on the basic concepts of electric and magnetic fields. Understand the concept of the nature of magnetic materials. Gain knowledge on electromagnetic induction and its applications .
- Understand the Theory of Superposition of waves. Understand the formation of Newton's rings and the working of Michelson's interferometer. Remember the basics of diffraction, Evaluate the path difference. Analysis of Fraunhofer Diffraction due to a single slit
- Understand the interaction of matter with radiation, Characteristics of Lasers, Principle, working schemes of Laser and Principle of Optical Fiber. Realize their role in optical fiber communication.
- Understand the intuitive ideas of the Quantum physics and understand dual nature of matter. Compute Eigen values, Eigen functions, momentum of Atomic and subatomic particles using Time independent one Dimensional Schrodinger's wave equation. Understand the fundamentals and synthesis processes of Nanophase materials.

THERMODYNAMICS

Introduction, Heat and Work, First law of thermodynamics and applications, Reversible and Irreversible process, Carnot cycle and Efficiency, Second law of thermodynamics, Carnot's Theorem, Entropy, Second law in terms of entropy, Entropy and disorder, Third law of thermodynamics (statement only).

ELECTROMAGNETISM

Concept of electric flux, Gauss's law - some applications, Magnetic field - Magnetic force on current, torque on current loop, The Biot-Savart's Law, B near a long wire, B for a circular Current loop, Ampere's law, B for a solenoid, Hall effect, Faraday's law of induction, Lenz's law, Induced magnetic fields, Displacement current, Maxwell's equations (no derivation), Magnetic materials: Classification of magnetic materials and properties.

Ultrasonics : Introduction, Production of Ultrasonics – Piezoelectric and Magnetostriction methods, acoustic grating, applications of ultrasonics.

OPTICS

Interference: Principles of superposition – Young's Experiment – Coherence - Interference in thin films (reflected light), Newton's Rings, Michelson Interferometer and its applications.

Diffraction: Introduction, Differences between interference and diffraction, Fresnel and Fraunhofer diffraction, Fraunhofer diffraction at a single slit (Qualitative and quantitative treatment).

Polarisation: Polarisation by reflection, refraction and double refraction in uniaxial crystals, Nicol prism, Quarter and Half wave plate, circular and elliptical polarization.

LASERS and FIBRE OPTICS

Introduction, characteristics of a laser beam, spontaneous and stimulated emission of radiation, population inversion, Ruby laser, He-Ne laser, Semiconductor laser, applications of lasers

Introduction to optical fibers, principle of propagation of light in optical fibers, Acceptance Angle and cone of a fibre, Numerical aperture, Modes of propagations, classification of fibers, Fibre optics in communications, Application of optical fibers.

MODERN PHYSICS

Introduction, De Broglie concept of matter waves, Heisenberg uncertainty principle, Schrodinger time independent wave equation, application to a particle in a box. Free electron theory of metals, Kronig - Penney model (qualitative treatment), Origin of energy band formation in solids, Classification of materials into conductors, semi conductors and insulators.

Nanophase Materials

Introduction, properties, Top-down and bottom up approaches, Synthesis - Ball milling, Chemical vapour deposition method, sol-gel methods, Applications of nano materials.

TEXT BOOKS :

1. Physics by David Halliday and Robert Resnick – Part I and Part II - Wiley.
2. A textbook of Engineering Physics, Dr. M. N. Avadhanulu, Dr. P.G. Kshirsagar - S. Chand
3. Engineering Physics by R.K. Gaur and S.L. Gupta –Dhanpat Rai

Reference Books:

1. Modern Engineering Physics by A.S. Vadudeva
2. University Physics by Young and Freedman

MC1103- ENGINEERING GRAPHICS

Course Objectives:

The main objectives of the course are to

- Understand the basics of Engineering Graphics and BIS conventions.
- Develop the graphical skills for communication of concepts, ideas and design of engineering products through technical drawings
- Demonstrate and practice the various profiles/curves used in engineering practice through standard procedures.
- Demonstrate and practice the orthographic projections of points, lines, planes, solids and section of solids
- Demonstrate and practice the development of surfaces of simple solids
- Familiarize the basic concept of isometric views clearly.

Course Outcomes:

After completion of the course, the student will be able to

- Develop simple engineering drawings by considering BIS standards.
- Able to draw different engineering curves with standard Procedures
- Comprehend the basics of orthographic projections and deduce orthographic projections of points, lines, planes and solids at different orientations in real life environment.
- Visualize clearly the sections of solids.
- Apply the concepts of development of surfaces while designing/analyzing any product.
- Recognize the significance of isometric drawing to relate 2D environment with 3D environment.

SYLLABUS

Introduction: Lines, Lettering and Dimensioning, Geometrical Constructions, and Scales.

Curves: Conic sections: General construction of ellipse, parabola and hyperbola. Construction of involutes of circle and polygons only. Normal and tangent to curves.

Projections of Points: Principal or Reference Planes, Projections of a point situated in any one of the four quadrants.

Projections of Straight Lines: Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane.

Projections of Straight Line Inclined to Both the Reference Planes: Projections of Planes: Projection of Perpendicular planes: Perpendicular to both reference planes, perpendicular to one reference plane and parallel to other reference plane and perpendicular to one reference plane and inclined to other reference plane. Projection of Oblique planes. Introduction to Auxiliary Planes.

Projections of Solids: Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to other and axes inclined to both the reference planes.

Sections of Solids: Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids (Prism, Pyramid, Cylinder and Cone) in simple position only.

Development of Surfaces: Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.

Isometric Views: Isometric projection, Isometric scale and Isometric view. Isometric view of Prisms, Pyramids, cylinder, cone, and their combinations.

Text Book:

Elementary Engineering Drawing by N.D.Bhatt, Charotar Publishing House.

Reference:

Engineering Graphics by K.L. Narayana and P. Kanniah, Tata McGraw Hill

MC1104- ENGINEERING MECHANICS

COURSE OBJECTIVES:

- To make the students to know the importance of this subject in the field of engineering particularly related to Mechanical Engineering.
- To make them learn the fundamentals of Mechanics, equation of static equilibrium & Dynamic equilibrium of particles and rigid bodies.
- To learn the effect of friction on equilibrium.
- To learn kinematics, kinetics of particle and rigid body, related principles.
- To implement the above concepts to solve practical engineering problems.

COURSE OUTCOME:

- At the end of this course, student must be in a position to analysis and solve the practical problems of statics and dynamics.
- Enables the students better understand the subjects like Theory of Machines, Strength of Materials, Design of machine elements etc.

Forces in a plane: Concepts, concurrent forces, static equilibrium equations, concept of friction, parallel forces, concept of distributed forces, couples in a plane, distributed forces, centroids.

Analysis of trusses and Frames: Method of joints and method of sections only, frames

Forces in space: Concurrent and parallel forces in a plane, couples in space, principle of virtual work.

Rectilinear Motion: Kinematics of rectilinear translation, Differential equation of rectilinear translation, force proportional to displacement, free vibrations, D'Alembert's principle, momentum, impulse, work and energy,

Curvilinear translation: Kinematics of curvilinear motion, differential equations of curvilinear motion, projectiles, D'Alembert's principle, Work and energy in curvilinear motion.

Rotation of rigid body about a fixed axis: Kinematics of rotation, equation of motion for a rigid body, rotation under the action of a constant moment, torsional vibrations, compound pendulum, general case of moment proportional to angle of rotation, D'Alembert's principle of rotation.

Plane motion of rigid body: Kinematics of plane motion, instantaneous centre, equations of plane motion, D'Alembert's principle in plane motion, the principle of angular momentum in plane motion, energy equation for plane motion.

Text book:

1.Engineering Mechanics by Timoshenko and Young

References:

1. Engineering mechanics – Statics & Dynamics by James L. meriam, L.G. Kraige
2. Engineering Mechanics Statics and dynamics, by Tayal, A.K
3. Engineering Mechanics by SS Bhavikkati
4. A textbook of Engineering Mechanics by RS Khurmi

MC1105- ELECTRICAL TECHNOLOGY

Course Objectives:

- Impart a basic knowledge of electrical quantities such as current, voltage, power, energy and frequency to understand the impact of technology in a global and societal context.
- Provide working knowledge for the analysis of basic DC and AC circuits used in electrical and electronic devices.
- To explain the working principle, construction, applications of DC machines, AC machines & measuring instruments.
- Highlight the importance of transformers in transmission and distribution of electric power.

Course Outcomes:

On completion of the course students will be able to

- Predict the behavior of any electrical and magnetic circuits.
- Formulate and solve complex AC, Dc circuits.
- Identify the type of electrical machine used for that particular application.
- Realize the requirement of transformers in transmission and distribution of electric power and other applications.
- Function on multi-disciplinary teams.

SYLLABUS:

Magnetic Circuits: Definitions of magnetic circuit, Reluctance, Magnetomotive force (m.m.f), Magnetic flux, Simple problems on magnetic circuits, Hysteresis loss.

Electromagnetic Induction: Faraday's laws of Electromagnetic induction, Induced E.M.F., Dynamically induced E.M.F., Statically induced E.M.F., Self inductance, Mutual inductance.

D.C. Generators: D.C. generator principle, Construction of D.C. generator, E.M.F. equation of D.C. generator, Types of D.C. generators, Armature reaction, Losses in D.C. generator, Efficiency, Characteristics of D.C. generators, Applications of D.C. generator.

D.C. Motors: D.C. motor principle, Working of D.C. motors, Significance of back E.M.F., Torque equation of D.C. motors, Types of D.C. motors,

Characteristics of D.C. motors, Speed control methods of D.C. motors, Applications of D.C. motor. Testing of D.C. machines: Losses and efficiency, Direct load test and Swinburne's test.

A.C. Circuits: Introduction of steady state analysis of A.C. circuits, Single and balanced 3-phase circuits.

Transformers: Transformer principle, E.M.F. equation of transformer, Transformer on load, Equivalent circuit of transformer, Voltage regulation of transformer, Losses in a transformer, Calculation of efficiency and regulation by open circuit and short circuit tests.

Three Phase Induction Motor: Induction motor working principle, Construction of 3-phase induction motor, Principle of operation, Types of 3-phase induction motor, Torque equation of induction motor, Slip-torque characteristics, Starting torque, Torque under running condition, Maximum torque equation, Power stages of induction motor, Efficiency calculation of induction motor by direct loading.

Alternator: Alternator working principle, E.M.F. equation of alternator, Voltage regulation by sync, impedance method.

Synchronous Motor: Synchronous motor principle of operation, Construction. Methods of starting of synchronous motor.

Electrical Measurements: Principles of measurement of current, voltage, power and energy. Types of Ammeters, Voltmeters, Watt-meters, Energy meters, Electrical conductivity meter. Potentiometer, Megger.

Text Book:

1. Elements of Electrical Engineering and Electronics by V.K. Mehta, S. Chand & Co.

Reference:

A First Course in Electrical Engineering by Kothari.

MC1106- WORKSHOP

Course Objectives: The engineering work shop practice is included to introduce some common shop practices and on hands on experience to appreciate the use of skill, tools, equipment and general practices to all the engineering students. This laboratory course is aimed to provide the practical exposure to the students in the fields of Carpentry, Fitting, Sheet Metal and house electrical wiring works to

1. Get hands on experience with the working skills in Carpentry trade.
2. Know how to work with Sheet Metal tools.
3. Get familiar with the working skills of Metal Fitting operations.
4. Get hands on experience with house hold electrical wiring.

Course Outcomes: By the end of this laboratory, the student

1. Can be able to work with Wood Materials in real time applications.

2. Can be able to build various parts with Sheet Metal in day-to-day life.

3. Can be able to apply Metal Fitting skills in various applications.

4. Can be able to apply this knowledge to basic house electrical wiring and repairs.

Carpentry: Any three jobs from – Half lap joint, Mortise and Tenon joint, Half – lap Dovetail joint, Corner Dovetail joint, Central Bridle joint.

Sheet Metal: Any three jobs from – Square tray, Taper tray(sides), Funnel, Elbow pipe joint.

Fitting: Any three jobs from – Square, Hexagon, Rectangular fit, Circular fit and Triangular fit.

House wiring: Any three jobs from – Tube light wiring, Ceiling fan wiring, Stair-case wiring, Corridor wiring.

References:

1. Elements of workshop technology, Vol.1 by S. K. and H. K. Choudary.

2. Work shop Manual / P.Kannaiah/ K.L.Narayana/ SciTech Publishers.

3. Engineering Practices Lab Manual, Jeyapoovan, Saravana Pandian, 4/e Vikas.

MC1107-PHYSICS LAB

Course Objectives:

This subject is common to all first year branches of UG engineering. At the end of the course the student is expected to

- To enable the students to acquire skill, technique and utilization of the Instruments
- Draw the relevance between the theoretical knowledge and to imply it in a practical manner with respect to analyze various electronic circuits and its components.
- To impart the practical knowledge in basic concepts of Wave optics, Lasers and Fiber optics.
- To familiarize the handling of basic physical apparatus like Vernier callipers, screw gauge, spectrometers, travelling microscope, laser device, optical fibre, etc.

Course Outcomes:

- Ability to design and conduct experiments as well as to analyze and interpret
- Ability to apply experimental skills to determine the physical quantities related to Heat, Electromagnetism and Optics

- The student will learn to draw the relevance between theoretical knowledge and the means to imply it in a practical manner by performing various relative experiments.

List of Experiments:

1. Determination of Radius of Curvature of a given Convex Lens By forming Newton's Rings.
2. Determination of Wavelength of Spectral Lines in the Mercury Spectrum by Normal Incidence method.
3. Study the Intensity Variation of the Magnetic Field along axis of Current Carrying Circular Coil.
4. Determination of Cauchy's Constants of a Given Material of the Prism using Spectrometer.
5. Determination of Refractive Index of Ordinary ray m_o and Extraordinary ray m_e .
6. Determination of Thickness Given Paper Strip by Wedge Method.
7. Calibration of Low Range Voltmeter.
8. Calibration of Low Range Ammeter.
9. Determination of Magnetic Moment and Horizontal Component of Earth's Magnetic Field.
10. Lees Method - Coefficient of thermal Conductivity of a Bad Conductor.
11. Carey Foster's Bridge – Verification of laws of Resistance and Determination Of Specific Resistance.
12. Melde's Apparatus – Frequency of electrically maintained Tuning Fork.
13. Photoelectric cell-Characteristics.
14. Planks Constants.
15. Laser- Diffraction.

MC1108 ELECTRICAL TECHNOLOGY LAB

Course objective:

- To make students learn to calibrate wattmeter and energy meter and conduct a practical analysis of linear circuits by using mesh and nodal analysis.
- To make the student to learn and predict the characteristics of DC & AC machines and rectifiers.
- To make the students to study different meters and instruments for measurement of electrical quantities.

- To make the students to understand 3 phase balanced and unbalanced star and delta connected supply and load and to measure power in 3 phase circuits.

Course Outcomes:

- Analyze linear circuits by using network theorem.
- Predict the performance characteristics of DC machines and induction motor
- Predict the regulation of single phase transformer & alternator
- Observe the performance of rectifiers.

LIST OF EXPERIMENTS:

1. Study and Calibration of wattmeter and energy meter.
2. Measurement of armature resistance, field resistance and filament resistance.
3. Verification of KCL and KVL.
4. Superposition theorem.
5. Parameters of a choke coil.
6. O.C. and S.C. tests on transformer.
7. Load test on D.C. shunt machine.
8. O.C. test on D.C. separately excited machine.
9. Swinburnes test.
10. 3 phase induction motor (No load and rotor block tests) load tests.
11. Alternator regulation by Syn. Impedance method

MC1201- MATHEMATICS-II

Course Objectives: The contents of this course fulfill the fundamental requirements of knowledge of Mathematics for learning Engineering subjects. The main objectives of student learning are :

1. The way of obtaining rank, eigen values and eigen vectors of a matrix.
2. To know the importance of Cayley-Hamilton theorem and getting canonical form from a given quadratic form.
3. To solve the system of equations by using direct and indirect methods.
4. To solve first order and higher order differential equations by various methods.
5. To obtain the Laplace transforms and inverse Laplace transforms for a given functions and their applications.

Course Outcomes: At the end of this course, the student will understand and be able to apply the basic principles of Linear

Algebra, ODEs and Laplace Transforms to various engineering problems. Particularly, the student will be able to

1. Find rank, eigen values and eigen vectors of a matrix and understand the importance of Cayley-Hamilton theorem.
2. Reduce quadratic form to canonical forms and solving linear systems by direct and indirect methods.
3. Demonstrate solutions to first order differential equations by various methods and solve basic applications problems related to electrical circuits, orthogonal trajectories and Newton's law of cooling
4. Discriminate among the structure and procedure of solving higher order differential equations with constant and variable coefficients.
5. Understand Laplace transforms and its properties and finding the solution of ordinary differential equations.

Matrix Algebra, Ordinary Differential Equations and Laplace Transforms

(Linear Algebra) Rank of a matrix- Echelon form, Normal Form - Solution of Linear System of Equations - Consistency of Linear System of Equations - Direct & Indirect Methods: Gauss elimination method, LU Factorization method, Gauss Seidal Method. Complex Matrices: Hermitian, Skew-Hermitian and Unitary Matrices and their Properties.

(Eigen Values and Eigen Vectors) Eigen Values and Eigen Vectors of a Matrix - Cayley-Hamilton theorem - Inverse and Powers of a Matrix using Cayley-Hamilton's theorem and its applications. Diagonalization of a Matrix - Quadratic Forms - Reduction of Quadratic Form to Canonical Form - Nature of a Quadratic Form.

(Ordinary Differential Equations of First Order and its Applications)

Formation of ordinary differential equations (ODEs) - Solution of an ordinary differential equation - Equations of the first order and first degree - Linear differential equation - Bernoulli's equation - Exact differential equations - Equations reducible to exact equations - Orthogonal Trajectories - Simple Electric (LR & CR) Circuits - Newton's Law of Cooling - Law of Natural growth and decay.

(Differential Equations of Higher Order)

Solutions of Linear Ordinary Differential Equations with Constant Coefficients - Rules for finding the complimentary function - Rules for finding the particular integral - Method of variation of parameters - Cauchy's linear equation - Legendre's linear equation - Simultaneous linear differential equations.

(Laplace Transforms)

Introduction - Existence Conditions - Transforms of Elementary Functions - Properties of Laplace Transforms - Transforms of Derivatives - Transforms of Integrals - Multiplication by t^n - Division by t - Evaluation of

integrals by Laplace Transforms - Inverse Laplace Transform - Applications of Laplace Transforms to Ordinary Differential Equations - Simultaneous Linear Differential Equations with Constant Coefficients - Second Shifting Theorem - Laplace Transforms of Unit Step Function, Unit Impulse Function and Laplace Transforms of Periodic Functions.

TEXT BOOK:

Scope and Treatment as in "Higher Engineering Mathematics", by Dr. B.S. Grewal, 43rd edition, Khanna publishers.

REFERENCE BOOKS:

1. Graduate Engineering Mathematics by V B Kumar Vatti., I.K. International publishing house Pvt. Ltd.
1. Advanced Engineering Mathematics by Erwin Kreyszig.
2. A text book of Engineering Mathematics, by N.P. Bali and Dr. Manish Goyal. Lakshmi Publications.
3. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.
4. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.

MC1202 – Chemistry

Course Objectives:

- To apply the basic knowledge of Chemistry to the Engineering Discipline.
- To develop knowledge about water and its treatment for industrial and potable purposes.
- To develop understanding in the areas of Polymers, Mechanism of Corrosion of Metals and Corrosion Control Methods, Fuels, Lubricants and Nanomaterials for of conducting polymers, bio-degradable polymers and fiber reinforced plastics and apply the knowledge for solving existing challenges faced in various engineering and societal areas.

Course outcome:

- This course applies the basic concepts and principles studied in Chemistry to Engineering.
- It provides an application of chemistry to different branches of engineering
- The students will be able acquire knowledge in the areas of Water Chemistry, Polymers, Corrosion, Fuels and Lubricants and nanomaterials and suggest innovative solutions for existing challenges in these areas.

Water Chemistry

(8 Hrs)

Sources of Water – Impurities and their influence of living systems – WHO Limits – Hardness and its Determination – Boiler Troubles and their

removal – Water Softening Methods – Lime-Soda, Zeolite and Ion Exchange
- Municipal Water Treatment-Break Point Chlorination – Desalination of Sea Water – Reverse Osmosis Method, Electro-dialysis.

Polymers and Plastics (8 Hrs)

Polymers: Definition – Types of Polymerization (Addition & Condensation) – Mechanisms of Addition Polymerization – Radical and Ionic – Thermodynamics of Polymerization Process. Plastics: Thermosetting and Thermoplastics – Effect of Polymer Structure on Properties of Cellulose Derivatives – Vinyl Resins – Nylon (6,6), Reinforced Plastics – Conducting Polymers.

Corrosion (8 Hrs)

Corrosion: Origin and Theory – Types of Corrosion: Chemical and Electrochemical; Pitting, Inter granular, Waterline, Stress – Galvanic Series – Factors Effecting Corrosion.

Corrosion Controlling Methods: Protective Coatings: Metallic Coatings, Electroplating and Electroless Plating – Chemical conversion Coatings – Phosphate, Chromate, Anodized, Organic Coatings – Paints and Special Paints.

Fuels and Lubricants (8 Hrs)

Solid Fuels: Wood and Coal, Ranking of Coal – Analysis (Proximate and Ultimate) Coke Manufacture – Otto Hoffmann's Process – Applications; Liquid Fuels: Petroleum Refining – Motor Fuels – Petrol and Diesel Oil – Knocking – Octane number – Cetane Number; Gaseous Fuels: Biogas, LPG and CNG – Characteristics – Applications; Rocket Fuels: Propellants – Classification – Characteristics Lubricants: Classification – Mechanism – Properties of Lubricating Oils – Selection of Lubricants for Engineering Applications.

Nanomaterials (8 Hrs)

Nanomaterials, Properties and application of fullerenes, fullerols, Carbon nanotubes and nanowires. Synthesis - Top-down and Bottom-up approaches - Nanocomposites - Nanoelectronics- Applications of nanomaterials in catalysis, telecommunication and medicine.

Text Books:

1. Engineering Chemistry – PC Jain and M. Jain – Dhanpath Rai and Sons, New Delhi.

2. A Text book of Engineering Chemistry – S. S. Dara – S. Chand & Co. New Delhi.

Reference Books:

1. Engineering Chemistry – B. K. Sharma – Krishna Prakashan – Meerut.

2. Introduction to Nanoscience - S. M. Lindsay - Oxford University Press

3. Engineering Chemistry - B. L. Tembe, Kamaluddin and M. S. Krishnan, (NPTEL).

MC1203 – ENGLISH

Course Objectives:

- To make students understand the explicit and implicit meanings of a text/topic;
- To give exposure to new words and phrases, and aid to use them in different contexts;
- To apply relevant writing formats to draft essays, letters, emails and presentations; and
- To adapt oneself to a given situation and develop a functional approach to finding solutions: adaptability and problem solving.

Course Outcomes:

- Students will be able to analyse a given text and discover the various aspects related to language and literature;
- Learn the various language structures, parts of speech and figures of speech;
- Develop one's reading and writing abilities for enhanced communication; and
- Learn to apply the topics in real-life situations for creative and critical use.

UNIT-1

Reading: On the conduct of life: William Hazlitt

Grammar: Prepositions

Vocabulary: Word Formation I: Introduction to Word Formation

Writing: Clauses and Sentences

Life skills: Values and Ethics

If: Rudyard Kipling

UNIT-2

Reading: The Brook: Alfred Tennyson

Grammar: Articles

Vocabulary: Word Formation II: Root Words from other Languages

Writing: Punctuation

Life skills: Self-Improvement

How I Became a Public Speaker: George Bernard Shaw

UNIT-3

Reading: The Death Trap: Saki

Grammar: Noun-Pronoun Agreement, Subject- Verb Agreement

Vocabulary: Word Formation III: Prefixes and Suffixes

Writing: Principals of Good Writing

Life skills: Time Management

On saving Time: Seneca

UNIT-4

Reading: ChinduYellama

Grammar: Misplaced Modifiers

Vocabulary: Synonyms, Antonyms

Writing: Essay Writing

Life skills: Innovation

Muhammad Yunus

UNIT-5

Reading: Politics and the English Language: George Orwell

Grammar: Clichés, Redundancies

Vocabulary: Common Abbreviations

Writing: Writing a Summary

Life skills: Motivation

The Dancer with a White Parasol: Ranjana Dave

Prescribed Textbook: Language and Life: A Skills Approach Board of Editors, Orient Blackswan Publishers, India. 2018.

Suggested Readings

1. *Practical English Usage*, Michael Swan. OUP. 1995.
2. *Remedial English Grammar*, F.T. Wood. Macmillan.2007
3. *On Writing Well*, William Zinsser. Harper Resource Book. 2001
4. *Study Writing*, Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
5. *Communication Skills*, Sanjay Kumar and PushpLata. Oxford University Press. 2011.
6. *Exercises in Spoken English*, Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

MC1204-CPNM

Course Objectives:

- The course is designed to provide complete knowledge of C language.

- To provide students with understanding of code organization and functional hierarchical decomposition with using complex data types.

- To provide knowledge to the Students to develop logics which will help them to create programs, applications in C.

- This course aims to identify tasks in which the numerical techniques learned are applicable and apply them to write programs, and hence use computers effectively to solve the task.

- This course provides the fundamental knowledge which is useful in understanding the other programming languages.

Course Outcomes:

- Identify basic elements of C programming structures like data types, expressions, control statements, various simple functions and Apply them in problem solving.

- Apply various operations on derived data types like arrays and strings in problem solving.

- Design and Implement of modular Programming and memory management using Functions, pointers.

- Apply Structure, Unions and File handling techniques to Design and Solve different engineering programs with minimal complexity.

- Apply Numerical methods to Solve the complex Engineering problems.

SYLLABUS

1. Introduction to C: Basic structure of C program, Constants, Variables and data types, Operators and Expressions, Arithmetic Precedence and associativity, Type Conversions. Managing Input and Output Operations Formatted Input, Formatted Output.

2. Decision Making, Branching, Looping, Arrays & Strings: Decision making with if statement, Simple if statement, The if...else statement, Nesting of if...else statement, the else..if ladder, switch statement, the (?:) operator, the GOTO statement., The while statement, the do statement, The for statement, Jumps in Loops ,One, Two-dimensional Arrays, Character Arrays. Declaration and initialization of Strings, reading and writing of strings, String handling functions, Table of strings.

3. Functions: Definition of Functions, Return Values and their Types, Function Calls, Function Declaration, Category of Functions: No Arguments and no Return Values, Arguments but no Return Values, Arguments with Return Values, No Argument but Returns a Value, Functions that Return Multiple Values. Nesting of functions, recursion, passing arrays to functions, passing strings to functions, the scope, visibility and lifetime of variables.

4. Pointers: Accessing the address of a variable, declaring pointer variables, initializing of pointer variables, accessing variables using pointers, chain of pointers, pointer expressions, pointers and arrays, pointers and character strings, array of pointers, pointers as function arguments, functions returning pointers, pointers to functions, pointers to structures-Program Applications

5. Structure and Unions: Defining a structure, declaring structure variables, accessing structure members, structure initialization, copying and comparing structure variables, arrays of structures, arrays within structures, structures within structures, structures and functions and unions, size of structures and bit-fields- Program applications.

6. File handling: Defining and opening a file, closing a file, Input/ Output operations on files, Error handling during I/O operations, random access to files and Command Line Arguments- Program Applications

7. Numerical Methods: Solutions of Algebraic and Transcendental Equations, Bisection Method, Newton Raphson Method. Newton's forward and backward Interpolation, Lagrange's Interpolation in unequal intervals. Numerical Integration: Trapezoidal rule, Simpson's 1/3 rules. Solutions of Ordinary First Order Differential Equations: Euler's Method, Modified Euler's Method and Runge-Kutta Method.

Text Book:

1. Programming in ANSI C, E Balagurusamy, 6th Edition. McGraw Hill Education (India) Private Limited.

2. Introduction to Numerical Methods, SS Sastry, Prentice Hall

Reference Books:

1. Let Us C, Yashwant Kanetkar, BPB Publications, 5th Edition.

2. Computer Science, A structured programming approach using C", B.A.Forouzan and R.F.Gilberg, " 3rd Edition, Thomson, 2007.

3. The C –Programming Language' B.W. Kernighan, Dennis M. Ritchie, PHI.

4. Scientific Programming: C-Language, Algorithms and Models in Science, Luciano M. Barone (Author), Enzo Marinari (Author), Giovanni Organtini, World Scientific.

MC1205-Department

STRENGTH OF MATERIALS-1

Course objective:

- To make students to understand the concept of stress and strain and enable them to calculate different types of stresses and strains under simple and complex loading.

- To make students to calculate shearing force and bending moments of different types of beams.

- To apply the knowledge of determining moment of inertias of different cross sections and identify the stresses and deflections induced in beams

- To enable the students to understand stresses induced in the transmission shafts and helical coil springs against different types of loading conditions.

- To develop knowledge in calculation of stresses and identifying the type of failure in cylinders and spherical shells.

Course outcomes:

The student will be able to

- Determine stresses and strains induced in a mechanical component for various types of loads. Further, the student can also determine principal stresses and strains.

- Calculate shear force and bending moments induced in beams for different types of loading conditions

- Calculate moment of inertias of different cross sections and analyze the beams for determination of stresses and deflections using double integration, Macaulay's and moment area method.

- Identify the mode of failure in transmission shafts and determine stresses induced in shaft and springs subjected to complex loading conditions

- Apply the principles of stresses and strains in thin cylinders and shells and evaluate longitudinal and circumferential stresses.

SYLLABUS:

Simple Stresses: Stress, Strain, Stress- Strain curve, Lateral strain, Relationship between elastic constants, Bars of varying cross-section, Compound bars, Temperature stresses in bars. **Complex Stresses:** Stresses on an inclined plane under different uniaxial and biaxial stress conditions, Principal planes and principal stresses, Mohr's circle, Relation between elastic constants, Strain energy, Impact loading.

Bending Moments and Shear Forces: Beam - Types of loads, Types of supports, S.F. and B.M. diagrams for Cantilever, Simply supported and Over hanging beams.

Moment of Inertia: Concept of Moment of Inertia, Parallel axis theorem and Perpendicular axis theorem, Moment of Inertia and Mass Moment of Inertia of simple and composite sections.

Stresses in Beams: Theory of bending, Flexural formula, Determination bending stresses – section modulus of rectangular and circular sections

(Solid and Hollow), I,T, Angle and Channel sections – Design of simple beam sections, Shear stresses in beams, Shear stress distribution across various beams sections like rectangular, circular, triangular, I, T, angle sections.

Deflections of Beams: Relation between curvature, slope and deflection, double integration method, Macaulay's method, Moment area method -application to simple cases including Cantilever, Simply supported and Over hanging beams.

Torsional Stresses in Shafts and Springs: Analysis of torsional stresses, Power transmitted, Combined bending and torsion, Closed and open coiled helical springs, Theories of Failure: Application design of shafts

Cylinders and Spherical Shells: Stresses and strains in thin cylinders, Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and Volumetric strains – changes in dia, and volume of thin cylinders and Thin spherical shell.

Text Books:

1. Analysis of Structures, by Vazirani and Ratwani, Vol. 1, 1993 edition.
2. Mechanics of Materials by James M. Gere , Stephen P. Timoshenko , CBS Publishers
3. Solid Mechanics, by Popov

Reference:

1. Strength of Materials, by Timoshenko
2. Strength of Materials -By Jindal, Umesh Publications.
3. Analysis of structures by Vazirani and Ratwani.
4. Mechanics of Structures Vol-III, by S.B.Junnarkar.
5. Strength of Materials by Andrew Pytel and Ferdinond L. Singer Longman

MC1206- ENGLISH LANGUAGE LAB

Course Objectives:

- To make students recognize the sounds of English through Audio-Visual aids;
- To help students build their confidence and help them to overcome their inhibitions and self- consciousness while speaking in English;
- To familiarize the students with stress and intonation and enable them to speak English effectively; and
- To give learners exposure to and practice in speaking in both formal and informal contexts.

Course Outcomes:

- Students will be sensitized towards recognition of English sound patterns and the fluency in their speech will be enhanced;
- A study of the communicative items in the laboratory will help students become successful in the competitive world;
- Students will be able to participate in group activities like roleplays, group discussions and debates; and
- Students will be able to express themselves fluently and accurately in social as well professional context.

UNIT-I Introduction to Phonetics: The Sounds of English (Speech sound – vowels and consonants) - Stress and Intonation - Accent and Rhythm.

UNIT-II Listening Skills: Listening for gist and specific information - listening for Note taking, summarizing and for opinions - Listening to the speeches of eminent personalities.

UNIT-III Speaking Skills: Self-introduction - Conversation Skills (Introducing and taking leave) - Giving and asking for information - Role Play - Just A Minute (JAM) session - Telephone etiquette.

UNIT-IV Reading and Writing skills: Reading Comprehension – Précis Writing - E-Mail writing - Punctuation.

UNIT-V Presentation skills: Verbal and non-verbal communication - Body Language - Making a Presentation.

Reference Books:

1. Ashraf Rizvi. Effective Technical Communication. Tata McGraw Hill Education Private Limited, New Delhi.
2. Speak Well. Orient Blackswan Publishers, Hyderabad.
3. Allan Pease. *Body Language*. Manjul Publishing House, New Delhi.

MC1207- CHEMISTRY LAB

Course Objectives:

- To develop the fine skills of quantitative determination of various chemical components through titrimetric analysis
- To prepare and use ionexchange/ zeolite columns for the removal of hardness of water
- To develop the skill of organic synthesis through the preparation of a polymer/ drug

Course Outcomes:

- The course provides quantitative determine the amount of various chemical species in solutions by titrations and conduct the quantitative determinations with accuracy

- The course provides to develop novel materials to be used as zeolite and prepare columns for removal of hardness of water

- The course provides to synthesise a polymer or a drug

List of Experiments

1. Determination of Sodium Hydroxide with HCl (Na_2CO_3 Primary Standard)
2. Determination of Alkalinity (Carbonate and Hydroxide) of water sample
3. Determination of Fe(II)/Mohr's Salt by Permanganometry
4. Determination of Oxalic Acid by Permanganometry
5. Determination of Chromium (VI) by Mohr's Salt Solution
6. Determination of Zinc by EDTA method
7. Determination of Hardness of Water sample by EDTA method
8. Determination of Chlorine in water by Iodometric Titration
9. Ionexchange/ Zeolite column for removal of hardness of water
10. Synthesis of Polymer/ drug

Reference Books:

1. Vogel's Quantitative Chemical Analysis – V – Edition – Longman.
2. Experiments in Applied Chemistry (For Engineering Students) – Sinita Rattan – S. K. Kataria & Sons, New Delhi

CC1208- CPNM LAB

Course Objectives:

- To impart writing skill of C programming to the students and solving problems.
- To write and execute programs in C to solve problems such as Modularize the problems into small modules and then convert them into programs.,
- To write and execute programs in C to solve problems such as arrays, files, strings, structures and different numerical methods.
- This reference has been prepared for the beginners to help them understand the basic to advanced concepts related to Objective-C Programming languages.

Course Outcomes:

- Understand various computer components, Installation of software. C programming development environment, compiling, debugging, and linking and executing a program using the development environment.
- Analyzing the complexity of problems, Modularize the problems into small modules and then convert them into programs.

- Construct programs that demonstrate effective use of C features including arrays, strings, structures, pointers and files.

- Apply and practice logical ability to solve the real world problems.

- Apply Numerical methods to Solve the complex Engineering problems.

SYLLABUS

1. Write a program to read x, y coordinates of 3 points and then calculate the area of a triangle formed by them and print the coordinates of the three points and the area of the triangle. What will be the output from your program if the three given points are in a straight line?

2. Write a program, which generates 100 random integers in the range of 1 to 100. Store them in an array and then print the arrays. Write 3 versions of the program using different loop constructs. (e.g. for, while, and do while).

3. Write a set of string manipulation functions e.g. for getting a sub-string from a given position, Copying one string to another, Reversing a string, adding one string to another.

4. Write a program which determines the largest and the smallest number that can be stored in different data types like short, int, long, float, and double. What happens when you add 1 to the largest possible integer number that can be stored?

5. Write a program, which generates 100 random real numbers in the range of 10.0 to 20.0, and sort them in descending order.

6. Write a function for transposing a square matrix in place (in place means that you are not allowed to have full temporary matrix).

7. First use an editor to create a file with some integer numbers. Now write a program, which reads these numbers and determines their mean and standard deviation.

8. Given two points on the surface of the sphere, write a program to determine the smallest arc length between them.

9. Implement bisection method to find the square root of a given number to a given accuracy.

10. Implement Newton Raphson method to det. a root of polynomial equation.

11. Given table of x and corresponding f(x) values, Write a program which will determine f(x) value at an intermediate x value by using Lagrange's interpolation/

12. Write a function which will invert a matrix.

13. Implement Simpson's rule for numerical integration.

14. Write a program to solve a set of linear algebraic equations.

Metallurgical Engineering

Scheme and Syllabus (With effect from 2020-21 admitted batch)

B.Tech I Year - I Semester

Course CreditsC code	Category	Course Title	Hours per week			Internal Marks	External Marks	Total Marks	
			L	T	P				
MT-1101 BS	Maths – I		3	0	0	30	70	100	3
MT-1102 BS	Physics		3	0	0	30	70	100	3
MT-1103 ES	Engg .Graphics		1	0	4	30	70	100	3
MT-1104 ES	Principles of Extractive Metallurgy		3	0	0	30	70	100	3
MT-1105 ES	Fuels, Refractories & Furnaces		3	0	0	30	70	100	3
MT-1106 ES	Workshop		0	0	3	50	50	100	1.5
MT-1107 BS	Physics Lab		0	0	3	50	50	100	1.5
MT-1108 ES	Fuels Lab		0	0	3	50	50	100	1.5
Total Credits									19.5

B.Tech I Year - II Semester

Course CreditsC code	Category	Course Title	Hours per week			Internal Marks	External Marks	Total Marks	
			L	T	P				
MT-1201 BS	Maths – II		3	0	0	30	70	100	3
MT-1202 BS	Chemistry		3	0	0	30	70	100	3
MT-1203 HSS	English		3	0	0	30	70	100	3
MT-1204 ES	CPNM		3	0	3	30	70	100	3
MT-1205 ES	Elements of Materials Science		3	0	0	30	70	100	3
MT-1206 HSS	English Language Lab		0	0	2	50	50	100	1.5
MT-1207 BS	Chemistry Lab		0	0	3	50	50	100	1.5
MT-1208 ES	CPNM Lab		0	0	3	50	50	100	1.5
Total Credits									19.5

MT - 1101 - MATHEMATICS-I

Course Objectives: The contents of this course fulfill the fundamental requirements of knowledge of Mathematics for learning Engineering subjects. The main objectives of student learning are:

- To transmit the knowledge of Partial differentiation.
- To know of getting maxima and minima of function of two variables and finding errors and approximations.

- To evaluate double and triple integrals, volumes of solids and area of curved surfaces.

- To expand a periodical function as Fourier series and half-range Fourier series.

Course Outcomes: At the end of this course, the student will understand and be able to apply the basic principles of differential and integral calculus to various engineering problems. Particularly, the student will be able to

- Find the partial derivatives of functions of two or more variables.
- Evaluate maxima and minima, errors and approximations.
- Evaluate double and triple integrals, volumes of solids and area of curved surfaces.

- To expand a periodical function as Fourier series and half-range Fourier series.

- Have a fundamental understanding of Fourier series and be able to give Fourier expansions of a given function. Partial Differentiation, Multiple Integrals, Fourier Series and Their Applications

(Partial Differentiation)

Introduction - Functions of two or more variables - Partial derivatives - Homogeneous functions – Euler's theorem - Total derivative - Change of variables – Jacobins. Mean value Theorems (without proofs)

(Applications of Partial Differentiation)

Geometrical interpretation -Tangent plane and Normal to a surface - Taylor's theorem for functions of two variables - Errors and approximations - Total differential. Maxima and Minima of functions of two variables - Lagrange's method of undetermined multipliers - Differentiation under the integral Sign - Leibnitz's rule.

(Multiple Integrals)

Introduction - Double Integrals - Change of Order of Integration - Double Integrals in Polar Coordinates - Triple Integrals - Change of Variables.

(Multiple Integrals-Applications)

Area enclosed by plane curves - Volumes of solids - Area of a curved surface - Calculation of Mass - Center of gravity - Moment of inertia - product of inertia – principal axes- Beta Function - Gamma Function - Relation between Beta and Gamma Functions. Error Function or Probability Integral.

(Fourier Series)

Introduction - Euler's Formulae - Conditions for a Fourier Expansion - Functions having points of discontinuity - Change of Interval - Odd and Even

Functions - Expansions of Odd or Even Periodic Functions, Half-Range Series - Parseval's Formula. Practical Harmonic analysis.

TEXT BOOK:

Scope and Treatment as in "Higher Engineering Mathematics", by Dr. B.S. Grewal, 43rd Edition, Khanna publishers.

REFERENCE BOOKS:

1. Graduate Engineering Mathematics by V B Kumar Vatti, I.K. International publishing house Pvt. Ltd.
2. Advanced Engineering Mathematics by Erwin Kreyszig.
3. A text book of Engineering Mathematics, by N.P. Bali and Dr. Manish Goyal, Lakshmi Publications.
4. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.
5. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.
6. Higher Engineering Mathematics by Dr. M.K. Venkataraman

MT-1102- PHYSICS

Course Objectives:

- To impart knowledge in basic concept of physics of Thermodynamics relevant to engineering applications.
- To grasp the concepts of physics for electromagnetism and its application to engineering. Learn production of Ultrasonics and their applications in engineering.
- To Develop understanding of interference, diffraction and polarization: connect it to a few engineering applications.
- To Learn basics of lasers and optical fibers and their use in some applications.
- To Understand concepts and principles in quantum mechanics and Nanophase Materials. Relate them to some applications.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

- Understand the fundamentals of Thermodynamics and Laws of thermodynamics. Understand the working of Carnot cycle and concept of entropy.
- Gain Knowledge on the basic concepts of electric and magnetic fields. Understand the concept of the nature of magnetic materials. Gain knowledge on electromagnetic induction and its applications .

- Understand the Theory of Superposition of waves. Understand the formation of Newton's rings and the working of Michelson's interferometer. Remember the basics of diffraction, Evaluate the path difference. Analysis of Fraunhofer Diffraction due to a single slit

- Understand the interaction of matter with radiation, Characteristics of Lasers, Principle, working schemes of Laser and Principle of Optical Fiber. Realize their role in optical fiber communication.

- Understand the intuitive ideas of the Quantum physics and understand dual nature of matter. Compute Eigen values, Eigen functions, momentum of Atomic and subatomic particles using Time independent one Dimensional Schrodinger's wave equation. Understand the fundamentals and synthesis processes of Nanophase materials.

THERMODYNAMICS

Introduction, Heat and Work, First law of thermodynamics and applications, Reversible and Irreversible process, Carnot cycle and Efficiency, Second law of thermodynamics, Carnot's Theorem, Entropy, Second law in terms of entropy, Entropy and disorder, Third law of thermodynamics (statement only).

ELECTROMAGNETISM

Concept of electric flux, Gauss's law - some applications, Magnetic field - Magnetic force on current, torque on current loop, The Biot-Savart's Law, B near a long wire, B for a circular Current loop, Ampere's law, B for a solenoid, Hall effect, Faraday's law of induction, Lenz's law, Induced magnetic fields, Displacement current, Maxwell's equations (no derivation), Magnetic materials: Classification of magnetic materials and properties.

Ultrasonics : Introduction, Production of Ultrasonics – Piezoelectric and Magnetostriction methods, acoustic grating, applications of ultrasonics.

OPTICS

Interference: Principles of superposition – Young's Experiment – Coherence - Interference in thin films (reflected light), Newton's Rings, Michelson Interferometer and its applications.

Diffraction: Introduction, Differences between interference and diffraction, Fresnel and Fraunhofer diffraction, Fraunhofer diffraction at a single slit (Qualitative and quantitative treatment).

Polarisation: Polarisation by reflection, refraction and double refraction in uniaxial crystals, Nicol prism, Quarter and Half wave plate, circular and elliptical polarization.

LASERS and FIBRE OPTICS

Introduction, characteristics of a laser beam, spontaneous and stimulated emission of radiation, population inversion, Ruby laser, He-Ne laser, Semiconductor laser, applications of lasers

Introduction to optical fibers, principle of propagation of light in optical fibers, Acceptance Angle and cone of a fibre, Numerical aperture, Modes of propagations, classification of fibers, Fibre optics in communications, Application of optical fibers.

MODERN PHYSICS

Introduction, De Broglie concept of matter waves, Heisenberg uncertainty principle, Schrodinger time independent wave equation, application to a particle in a box. Free electron theory of metals, Kronig - Penney model (qualitative treatment), Origin of energy band formation in solids, Classification of materials into conductors, semi conductors and insulators.

Nanophase Materials

Introduction, properties, Top-down and bottom up approaches, Synthesis - Ball milling, Chemical vapour deposition method , sol-gel methods, Applications of nano materials.

TEXT BOOKS :

1. Physics by David Halliday and Robert Resnick – Part I and Part II - Wiley.
2. A textbook of Engineering Physics, Dr. M. N. Avadhanulu, Dr. P.G. Kshirsagar - S. Chand
3. Engineering Physics by R.K. Gaur and S.L. Gupta –Dhanpat Rai

Reference Books:

1. Modern Engineering Physics by A.S. Vadudeva
2. University Physics by Young and Freedman

MT-1103- ENGINEERING GRAPHICS

Course Objectives:

The main objectives of the course are to

- Understand the basics of Engineering Graphics and BIS conventions.
- Develop the graphical skills for communication of concepts, ideas and design of engineering products through technical drawings
- Demonstrate and practice the various profiles/curves used in engineering practice through standard procedures.
- Demonstrate and practice the orthographic projections of points, lines, planes, solids and section of solids
- Demonstrate and practice the development of surfaces of simple solids
- Familiarize the basic concept of isometric views clearly.

Course Outcomes:

After completion of the course, the student will be able to

- Develop simple engineering drawings by considering BIS standards.
- Able to draw different engineering curves with standard Procedures
- Comprehend the basics of orthographic projections and deduce orthographic projections of points, lines, planes and solids at different orientations in real life environment.
- Visualize clearly the sections of solids.
- Apply the concepts of development of surfaces while designing/analyzing any product.
- Recognize the significance of isometric drawing to relate 2D environment with 3D environment.

SYLLABUS

Introduction: Lines, Lettering and Dimensioning, Geometrical Constructions, and Scales.

Curves: Conic sections: General construction of ellipse, parabola and hyperbola. Construction of involutes of circle and polygons only. Normal and tangent to curves.

Projections of Points: Principal or Reference Planes, Projections of a point situated in any one of the four quadrants.

Projections of Straight Lines: Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane.

Projections of Straight Line Inclined to Both the Reference Planes: Projections of Planes: Projection of Perpendicular planes: Perpendicular to both reference planes, perpendicular to one reference plane and parallel to other reference plane and perpendicular to one reference plane and inclined to other reference plane. Projection of Oblique planes. Introduction to Auxiliary Planes.

Projections of Solids: Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to other and axes inclined to both the reference planes.

Sections of Solids: Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids (Prism, Pyramid, Cylinder and Cone) in simple position only.

Development of Surfaces: Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.

Isometric Views: Isometric projection, Isometric scale and Isometric view. Isometric view of Prisms, Pyramids, cylinder, cone, and their combinations.

Text Book:

Elementary Engineering Drawing by N.D.Bhatt, Charotar Publishing House.

Reference:

Engineering Graphics by K.L. Narayana and P. Kannaiah, Tata McGraw Hill

MT-1104- PRINCIPLES OF EXTRACTIVE METALLURGY

Course Objectives:

- To learn and emphasize the Principles of Pyrometallurgy, hydrometallurgy and electrometallurgy.
- To learn scientific concepts of extraction and refining
- Obtain knowledge of equipment used in Pyrometallurgy, hydrometallurgy and electrometallurgy

Course Outcomes:

At the end of the course the student will be able to:

- Classify and describe the extraction routes of pyro metallurgy, hydrometallurgy and electrometallurgy.
- To Illustrate with the help of flow sheet of process taking place in pyro metallurgy, hydrometallurgy and electrometallurgical extractions of metal/matte.
- Choose the type of refining process according to purity required.
- Understand the impact of extractive process on health environment society and will be able to suggest suitable techniques to recycle the by products or to decrease energy consumptions.
- Design the suitable process for extractions.

General Methods of Extraction. Pyro-metallurgy:

Roasting, Types of roasting, Roasting equipment and methods, Predominance area diagrams, Smelting, Smelting furnaces.

Hydro Metallurgy: Advantages and disadvantages, Principles of leaching, Leaching kinetics and factors affecting.

Electro Metallurgy- classification. Principles of refining. Use of vacuum, Zone refining, Vacuum arc re-melting, Electron beam melting, Electro slag refining. Cementation. Electro refining, Electro deposition.

Raw materials: Occurrence and distribution of iron ores in India. Evaluation of iron ore, coke and limestone. Preparation of iron ores: Methods of Beneficiation, Agglomeration of Iron ores.

Sintering: Raw materials, Mechanism of sintering, Sintering machine and its efficiency. Types of sinter. Recent trends in sintering practice. Pelletizing: Raw materials, Theory of Bonding, Bonding mechanism. Disc and Drum pelletiser, Firing units. Indian sintering and pelletisation plants.

Text books

1. Introduction to modern iron making, R.H. Tupkary
2. Introduction to modern iron making, A.K. Biswas
3. Physical Chemistry of Iron & Steel Making, C.Bodsworth
4. Extraction of Non-Ferrous Metals, H.S.Ray, R.Sridhar and K.P.Abraham

References

1. MSTs-United Steel Corporation, Pittsburgh
2. Blast furnace theory & practice- Vol.I & II ,Julius JH.Strysbegen
3. Metallurgy of Non-Ferrous Metals, Dennis, W.H.
4. Non-Ferrous Metallurgy, Sebyukov, N.Min, Pub. Moscow

MT-1105- FUELS, REFRACTORIES AND FURNACES

Course Objectives:

- This course is mainly intended to demonstrate the significance and characterization of conventional fuels that are employed in metallurgical processes.
- Gain an understanding of manufacture, testing, and applications of refractories.
- To gain knowledge related to working principles of furnaces used in metallurgical industries.
- To explain construction, salient features and heat transfer aspects of various furnaces.

Course Outcomes:

At the end of the course the student would be able to:

- Know about a fuel, classify them and compare different types of fuels and describe their testing methods. Explain the coke making process, list out the properties and its by - products recovery
- Apply principles of heat and mass transfer to basic engineering systems and understand the basic concepts and laws of the three modes of heat transfer and apply analytical techniques to the solution of conduction heat-transfer problems
- Classify and explain construction and working of different furnaces. Analyze causes of Heat losses in furnaces and suggest methods of minimization it and Waste heat recovery.

· Explain various manufacturing and testing processes of refractories. Link inherent properties of the refractory mineral and how it affects the production technology and the application

Solid fuels: Classification. Proximate analysis & ultimate analysis of coal. Carbonization of coal. Coke making and by products recovery. Testing and properties of coke.

Liquid fuels: Classification. Petroleum refining. Distillation.

Gaseous fuels: Classification. Production of PG, WG, CWG, LD gas, Coke oven gas and BF gas.

Refractories: Properties, classification and general description. Manufacture, properties and applications of Alumino-silicate, Silica, Dolomite, Magnesite, Chromite and Carbon refractories. Importance and study of SiC, ZrO₂ and cermets. Testing of refractories.

Elements of heat transmission. Steady state conduction, convection and radiation. Furnaces. Classification of furnaces and their use in metallurgical industries. Heat sources, Heat utilization in furnaces, Heat losses in furnaces and furnace efficiency. Heat balance and Sankey diagrams. Principles of waste heat recovery. Recuperators and regenerators. Protective atmospheres.

Text books:

1. Fuels, furnaces and refractories by O.P.Gupta
2. Experimental methods for Engineers, J.P.Holman, McGraw Hill Publication.

Reference:

1. Fuels, Technology by Hinues
2. Fuels by Gilchrist
3. Refractories by Chesty

MT-1106- WORKSHOP

Course Objectives: The engineering work shop practice is included to introduce some common shop practices and on hands on experience to appreciate the use of skill, tools, equipment and general practices to all the engineering students. This laboratory course is aimed to provide the practical exposure to the students in the fields of Carpentry, Fitting, Sheet Metal and house electrical wiring

- Get hands on experience with house hold electrical wiring.

Course Outcomes: By the end of this laboratory, the student

- Can be able to work with Wood Materials in real time applications.
- Can be able to build various parts with Sheet Metal in day-to-day life.
- Can be able to apply Metal Fitting skills in various applications.

- Can be able to apply this knowledge to basic house electrical wiring and repairs.

Carpentry: Any three jobs from – Half lap joint, Mortise and Tenon joint, Half – lap Dovetail joint, Corner Dovetail joint, Central Bridle joint.

Sheet Metal: Any three jobs from – Square tray, Taper tray(sides), Funnel, Elbow pipe joint. Fitting: Any three jobs from – Square, Hexagon, Rectangular fit, Circular fit and Triangular fit.

House wiring: Any three jobs from – Tube light wiring, Ceiling fan wiring, Stair-case wiring, Corridor wiring.

References:

1. Elements of workshop technology, Vol.1 by S. K. and H. K. Choudary.
2. Work shop Manual / P.Kannaiah/ K.L.Narayana/ SciTech Publishers.
3. Engineering Practices Lab Manual, Jeyapoovan, Saravana Pandian, 4/e Vikas.

MT-1107-PHYSICS LAB

Course Objectives: At the end of the course the student is expected to

To enable the students to acquire skill, technique and utilization of the Instruments

- Draw the relevance between the theoretical knowledge and to imply it in a practical manner with respect to analyze various electronic circuits and its components.
- To impart the practical knowledge in basic concepts of Wave optics, Lasers and Fiber optics.
- To familiarize the handling of basic physical apparatus like Vernier callipers, screw gauge, spectrometers, travelling microscope, laser device, optical fibre, etc.

Course Outcomes:

- Ability to design and conduct experiments as well as to analyze and interpret
- Ability to apply experimental skills to determine the physical quantities related to Heat, Electromagnetism and Optics
- The student will learn to draw the relevance between theoretical knowledge and the means to imply it in a practical manner by performing various relative experiments.

List of Experiments:

1. Determination of Radius of Curvature of a given Convex Lens By forming Newton's Rings.
2. Determination of Wavelength of Spectral Lines in the Mercury Spectrum by Normal Incidence method.

3. Study the Intensity Variation of the Magnetic Field along axis of Current Carrying Circular Coil.

4. Determination of Cauchy's Constants of a Given Material of the Prism using Spectrometer.

5. Determination of Refractive Index of Ordinary ray m_o and Extraordinary m_e ray.

6. Determination of Thickness Given Paper Strip by Wedge Method.

7. Calibration of Low Range Voltmeter.

8. Calibration of Low Range Ammeter.

9. Determination of Magnetic Moment and Horizontal Component of Earth's Magnetic Field.

10. Lees Method - Coefficient of thermal Conductivity of a Bad Conductor.

11. Carey Foster's Bridge – Verification of laws of Resistance and Determination Of Specific Resistance.

12. Melde's Apparatus – Frequency of electrically maintained Tuning Fork.

13. Photoelectric cell-Characteristics.

14. Planks Constants.

15. Laser- Diffraction.

MT-1108- FUELS LAB

List of experiments:

1. Determination of Flash and fire points of oils. (Open cup)

2. Determination of Flash and fire points of oils (Closed cup)

3. Determination of Calorific value of fuels (solids, liquids) by Bomb calorimeter

4. Determination of Calorific value of fuels (gaseous) by gas calorimeter.

5. To determine the kinematic and absolute viscosity of the given sample oil using Redwood Viscometer I.

6. To determine the kinematic and absolute viscosity of the given sample oil using Redwood Viscometer II.

7. Determination of carbon residue.

Course Objectives: At the end of the course the student is expected to

- To know the procedures of determining various properties of fuels
- To get familiarized with the handling of equipment calorie meters and viscometers

Course Outcomes:

- Ability to conduct experiments related to fuel properties

- Ability to gain experimental skills to determine the calorific value and viscosity of given fuel sample

MT-1201- MATHEMATICS-II

Course Objectives: The contents of this course fulfill the fundamental requirements of knowledge of Mathematics for learning Engineering subjects. The main objectives of student learning are :

- The way of obtaining rank, eigen values and eigen vectors of a matrix.
- To know the importance of Cayley-Hamilton theorem and getting canonical form from a given quadratic form.
- To solve the system of equations by using direct and indirect methods.
- To solve first order and higher order differential equations by various methods.
- To obtain the Laplace transforms and inverse Laplace transforms for a given functions and their applications.

Course Outcomes: At the end of this course, the student will understand and be able to apply the basic principles of Linear Algebra, ODEs and Laplace Transforms to various engineering problems. Particularly, the student will be able to

- Find rank, eigen values and eigen vectors of a matrix and understand the importance of Cayley-Hamilton theorem.
- Reduce quadratic form to canonical forms and solving linear systems by direct and indirect methods.
- Demonstrate solutions to first order differential equations by various methods and solve basic applications problems related to electrical circuits, orthogonal trajectories and Newton's law of cooling
- Discriminate among the structure and procedure of solving higher order differential equations with constant and variable coefficients.
- Understand Laplace transforms and its properties and finding the solution of ordinary differential equations. Matrix Algebra, Ordinary Differential Equations and Laplace Transforms

(Linear Algebra)

Rank of a matrix- Echelon form, Normal Form - Solution of Linear System of Equations - Consistency of Linear System of Equations - Direct & Indirect Methods: Gauss elimination method, LU Factorization method, Gauss Seidal Method. Complex Matrices: Hermitian, Skew-Hermitian and Unitary Matrices and their Properties.

(Eigen Values and Eigen Vectors)

Eigen Values and Eigen Vectors of a Matrix - Cayley-Hamilton theorem - Inverse and Powers of a Matrix using Cayley-Hamilton's theorem and its

applications. Diagonalization of a Matrix - Quadratic Forms - Reduction of Quadratic Form to Canonical Form - Nature of a Quadratic Form.

(Ordinary Differential Equations of First Order and its Applications)

Formation of ordinary differential equations (ODEs) - Solution of an ordinary differential equation - Equations of the first order and first degree - Linear differential equation - Bernoulli's equation - Exact differential equations - Equations reducible to exact equations - Orthogonal Trajectories - Simple Electric (LR & CR) Circuits - Newton's Law of Cooling - Law of Natural growth and decay.

(Differential Equations of Higher Order)

Solutions of Linear Ordinary Differential Equations with Constant Coefficients - Rules for finding the complimentary function - Rules for finding the particular integral - Method of variation of parameters - Cauchy's linear equation - Legendre's linear equation - Simultaneous linear differential equations.

(Laplace Transforms)

Introduction - Existence Conditions - Transforms of Elementary Functions - Properties of Laplace Transforms - Transforms of Derivatives - Transforms of Integrals - Multiplication by t^n - Division by t - Evaluation of integrals by Laplace Transforms - Inverse Laplace Transform - Applications of Laplace Transforms to Ordinary Differential Equations - Simultaneous Linear Differential Equations with Constant Coefficients - Second Shifting Theorem - Laplace Transforms of Unit Step Function, Unit Impulse Function and Laplace Transforms of Periodic Functions.

TEXT BOOK:

Scope and Treatment as in "Higher Engineering Mathematics", by Dr. B.S. Grewal, 43rd edition, Khanna publishers.

REFERENCE BOOKS:

7. Graduate Engineering Mathematics by V B Kumar Vatti., I.K. International publishing house Pvt. Ltd.

1. Advanced Engineering Mathematics by Erwin Kreyszig.

2. A text book of Engineering Mathematics, by N.P. Bali and Dr. Manish Goyal. Lakshmi Publications.

3. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.

4. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.

MT-1202 – Chemistry

Course Objectives:

· To apply the basic knowledge of Chemistry to the Engineering Discipline.

· To develop knowledge about water and its treatment for industrial and potable purposes.

· To develop understanding in the areas of Polymers, Mechanism of Corrosion of Metals and Corrosion Control Methods, Fuels, Lubricants and Nanomaterials for of conducting polymers, bio-degradable polymers and fiber reinforced plastics and apply the knowledge for solving existing challenges faced in various engineering and societal areas.

Course outcome:

· This course applies the basic concepts and principles studied in Chemistry to Engineering.

· It provides an application of chemistry to different branches of engineering

· The students will be able acquire knowledge in the areas of Water Chemistry, Polymers, Corrosion, Fuels and Lubricants and nanomaterials and suggest innovative solutions for existing challenges in these areas.

Water Chemistry : Sources of Water – Impurities and their influence of living systems – WHO Limits – Hardness and its Determination – Boiler Troubles and their removal – Water Softening Methods – Lime-Soda, Zeolite and Ion Exchange - Municipal Water Treatment-Break Point Chlorination – Desalination of Sea Water – Reverse Osmosis Method, Electro-dialysis.

Polymers and Plastics : Polymers: Definition – Types of Polymerization (Addition & Condensation) – Mechanisms of Addition Polymerization – Radical and Ionic – Thermodynamics of Polymerization Process. **Plastics:** Thermosetting and Thermoplastics – Effect of Polymer Structure on Properties of Cellulose Derivatives – Vinyl Resins – Nylon (6,6), Reinforced Plastics – Conducting Polymers.

Corrosion : Corrosion: Origin and Theory – Types of Corrosion: Chemical and Electrochemical; Pitting, Inter granular, Waterline, Stress – Galvanic Series – Factors Effecting Corrosion.

Corrosion Controlling Methods: Protective Coatings: Metallic Coatings, Electroplating and Electroless Plating – Chemical conversion Coatings – Phosphate, Chromate, Anodized, Organic Coatings – Paints and Special Paints.

Fuels and Lubricants : Solid Fuels: Wood and Coal, Ranking of Coal – Analysis (Proximate and Ultimate) Coke Manufacture – Otto Hoffmann's Process – Applications; Liquid Fuels: Petroleum Refining – Motor Fuels – Petrol and Diesel Oil – Knocking – Octane number – Cetane Number; Gaseous Fuels: Biogas, LPG and CNG – Characteristics – Applications; Rocket Fuels: Propellants – Classification – Characteristics

Lubricants: Classification – Mechanism – Properties of Lubricating Oils – Selection of Lubricants for Engineering Applications.

Nanomaterials : Nanomaterials, Properties and application of fullerenes, fullerols, Carbon nanotubes and nanowires. Synthesis - Top-down and Bottom-up approaches - Nanocomposites - Nanoelectronics- Applications of nanomaterials in catalysis, telecommunication and medicine.

Text Books:

1. Engineering Chemistry – PC Jain and M. Jain – Dhanpath Rai and Sons, New Delhi.

2. A Text book of Engineering Chemistry – S. S. Dara – S. Chand & Co. New Delhi.

Reference Books:

1. Engineering Chemistry – B. K. Sharma – Krishna Prakashan – Meerut.

2. Introduction to Nanoscience - S. M. Lindsay - Oxford University Press

3. Engineering Chemistry - B. L. Tembe, Kamaluddin and M. S. Krishnan, (NPTEL).

MT-1203 – ENGLISH

Course Objectives:

- To make students understand the explicit and implicit meanings of a text/topic;
- To give exposure to new words and phrases, and aid to use them in different contexts;
- To apply relevant writing formats to draft essays, letters, emails and presentations; and
- To adapt oneself to a given situation and develop a functional approach to finding solutions: adaptability and problem solving.

Course Outcomes:

- Students will be able to analyse a given text and discover the various aspects related to language and literature;
- Learn the various language structures, parts of speech and figures of speech;
- Develop one's reading and writing abilities for enhanced communication; and
- Learn to apply the topics in real-life situations for creative and critical use.

SYLLABUS

Reading: On the conduct of life: William Hazlitt

Grammar: Prepositions

Vocabulary: Word Formation I: Introduction to Word Formation

Writing: Clauses and Sentences

Life skills: Values and Ethics

If: Rudyard Kipling

Reading: The Brook: Alfred Tennyson

Grammar: Articles

Vocabulary: Word Formation II: Root Words from other Languages

Writing: Punctuation

Life skills: Self-Improvement

How I Became a Public Speaker: George Bernard Shaw

Reading: The Death Trap: Saki

Grammar: Noun-Pronoun Agreement, Subject- Verb Agreement

Vocabulary: Word Formation III: Prefixes and Suffixes

Writing: Principles of Good Writing

Life skills: Time Management

On saving Time: Seneca

Reading: ChinduYellama

Grammar: Misplaced Modifiers

Vocabulary: Synonyms, Antonyms

Writing: Essay Writing

Life skills: Innovation

Muhammad Yunus

Reading: Politics and the English Language: George Orwell

Grammar: Clichés, Redundancies

Vocabulary: Common Abbreviations

Writing: Writing a Summary

Life skills: Motivation

The Dancer with a White Parasol: Ranjana Dave

Prescribed Textbook: Language and Life: A Skills Approach Board of Editors, Orient Blackswan Publishers, India. 2018.

Suggested Readings

1. *Practical English Usage*, Michael Swan. OUP. 1995.

2. *Remedial English Grammar*, F.T. Wood. Macmillan.2007

3. *On Writing Well*, William Zinsser. Harper Resource Book. 2001

4. *Study Writing*, Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.

5. *Communication Skills*, Sanjay Kumar and PushpLata. Oxford University Press. 2011.

6. *Exercises in Spoken English*, Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

MT-1204 : CPNM

Course Objectives:

- The course is designed to provide complete knowledge of C language.
- To provide students with understanding of code organization and functional hierarchical decomposition with using complex data types.
- To provide knowledge to the Students to develop logics which will help them to create programs, applications in C.
- This course aims to identify tasks in which the numerical techniques learned are applicable and apply them to write programs, and hence use computers effectively to solve the task.
- This course provides the fundamental knowledge which is useful in understanding the other programming languages.

Course Outcomes:

- Identify basic elements of C programming structures like data types, expressions, control statements, various simple functions and Apply them in problem solving.
- Apply various operations on derived data types like arrays and strings in problem solving.
- Design and Implement of modular Programming and memory management using Functions, pointers.
- Apply Structure, Unions and File handling techniques to Design and Solve different engineering programs with minimal complexity.
- Apply Numerical methods to **Solve** the complex Engineering problems.

SYLLABUS

1. Introduction to C: Basic structure of C program, Constants, Variables and data types, Operators and Expressions, Arithmetic Precedence and associativity, Type Conversions. Managing Input and Output Operations Formatted Input, Formatted Output.

2. Decision Making, Branching, Looping, Arrays & Strings: Decision making with if statement, Simple if statement, The if...else statement, Nesting of if...else statement, the else..if ladder, switch statement, the (?:) operator, the GOTO statement., The while statement, the do statement, The for statement, Jumps in Loops ,One, Two-dimensional Arrays, Character

Arrays. Declaration and initialization of Strings, reading and writing of strings, String handling functions, Table of strings.

3. Functions: Definition of Functions, Return Values and their Types, Function Calls, Function Declaration, Category of Functions: No Arguments and no Return Values, Arguments but no Return Values, Arguments with Return Values, No Argument but Returns a Value, Functions that Return Multiple Values. Nesting of functions, recursion, passing arrays to functions, passing strings to functions, the scope, visibility and lifetime of variables.

4. Pointers: Accessing the address of a variable, declaring pointer variables, initializing of pointer variables, accessing variables using pointers, chain of pointers, pointer expressions, pointers and arrays, pointers and character strings, array of pointers, pointers as function arguments, functions returning pointers, pointers to functions, pointers to structures-Program Applications

5. Structure and Unions: Defining a structure, declaring structure variables, accessing structure members, structure initialization, copying and comparing structure variables, arrays of structures, arrays within structures, structures within structures, structures and functions and unions, size of structures and bit-fields- Program applications.

6. File handling: Defining and opening a file, closing a file, Input/ Output operations on files, Error handling during I/O operations, random access to files and Command Line Arguments- Program Applications

7. Numerical Methods: Solutions of Algebraic and Transcendental Equations, Bisection Method, Newton Raphson Method. Newton's forward and backward Interpolation, Lagrange's Interpolation in unequal intervals. Numerical Integration: Trapezoidal rule, Simpson's 1/3 rules. Solutions of Ordinary First Order Differential Equations: Euler's Method, Modified Euler's Method and Runge-Kutta Method.

Text Book:

1. Programming in ANSI C, E Balagurusamy, 6th Edition. McGraw Hill Education (India) Private Limited.
2. Introduction to Numerical Methods, SS Sastry, Prentice Hall

Reference Books:

1. Let Us C ,YashwantKanetkar, BPB Publications, 5th Edition.
2. Computer Science, A structured programming approach using C", B.A.Forouzan and R.F.Gilberg, " 3rd Edition, Thomson, 2007.
3. The C –Programming Language' B.W. Kernighan, Dennis M. Ritchie, PHI.
4. Scientific Programming: C-Language, Algorithms and Models in Science, Luciano M. Barone (Author), Enzo Marinari (Author), Giovanni Organtini, World Scientific.

MT-1205- ELEMENTS OF MATERIALS SCIENCE

Course Objectives:

- To describe the basics of crystal structure and its types
- To gain a thorough knowledge about crystal defects
- To gain a knowledge about electrical and electronic properties of materials
- To gain knowledge of magnetic and optical properties of materials

Course Outcomes:

At the end of the course Student would be able

- To use and apply basics of material science in his own branch of engineering.
- The student will be able to justify the materials behaviour and their properties
- To get basic foundation for learning material technology
- Understand the advances in the materials development .

Introduction classification of materials, Space lattice and unit cells,

Crystal systems Indices for planes and directions. Structures of common metallic materials.

Crystal defects: Point, Line and surface defects. Dislocations, types, Burgers' Vector. Dislocation movement by slip, climb and cross slip. Dislocation sources. Slip systems for BCC, FCC and HCP metals, Critical resolved shear stress (CRSS) for slip, Twinning, Stacking faults, Jogs, Kinks.

Electrical and Electronic properties of materials, Electronic conductivity, free electron theory and band theory of solids. Intrinsic semi-conductors. Super conductivity.

Magnetic properties, Dia, para, ferro, ferri magnetism. Soft and hard magnetic materials and applications.

Optical properties of materials. Refractive index, absorption emission of light, optical fibers. Opto-electronic materials.

Text books:

1. Material Science and Engineering by V.Raghavan
2. Physical Metallurgy by S. H. Avner.

Reference books:

1. Material Science and Engineering by L.H.Van Vleck, 5th edition, Addison Wealey(1985)
2. Structure and properties of Materials by R.M.Rose, L.A.Shepard and J.Wulff, Vol.1,4 John Willey (1966) .
3. Essentials of Material Science by A.G.Guy, McGraw Hill(1976).

4. The Science and Engineering Materials by D.R.Askeland. 2nd Edition, Chapman and Hall (1990).

5. Physical Metallurgy, Vijendra Singh

MT-1206- ENGLISH LANGUAGE LAB

Course Objectives:

- To make students recognize the sounds of English through Audio-Visual aids;
- To help students build their confidence and help them to overcome their inhibitions and self- consciousness while speaking in English;
- To familiarize the students with stress and intonation and enable them to speak English effectively; and
- To give learners exposure to and practice in speaking in both formal and informal contexts.

Course Outcomes:

- Students will be sensitized towards recognition of English sound patterns and the fluency in their speech will be enhanced;
- A study of the communicative items in the laboratory will help students become successful in the competitive world;
- Students will be able to participate in group activities like roleplays, group discussions and debates; and
- Students will be able to express themselves fluently and accurately in social as well professional context.

UNIT-I Introduction to Phonetics: The Sounds of English (Speech sound – vowels and consonants) - Stress and Intonation - Accent and Rhythm.

UNIT-II Listening Skills: Listening for gist and specific information - listening for Note taking, summarizing and for opinions - Listening to the speeches of eminent personalities.

UNIT-III Speaking Skills: Self-introduction - Conversation Skills (Introducing and taking leave) - Giving and asking for information - Role Play - Just A Minute (JAM) session - Telephone etiquette.

UNIT-IV Reading and Writing skills: Reading Comprehension – Précis Writing - E-Mail writing - Punctuation.

UNIT-V **Presentation skills:** Verbal and non-verbal communication - Body Language - Making a Presentation.

Reference Books:

1. Ashraf Rizvi. *Effective Technical Communication*. Tata McGraw Hill Education Private Limited, New Delhi.
2. *Speak Well*. Orient Blackswan Publishers, Hyderabad.
3. Allan Pease. *Body Language*. Manjul Publishing House, New Delhi.

MT-1207- CHEMISTRY LAB

Course Objectives:

- To develop the fine skills of quantitative determination of various chemical components through titrimetric analysis
- To prepare and use ionexchange/ zeolite columns for the removal of hardness of water
- To develop the skill of organic synthesis through the preparation of a polymer/ drug

Course Outcomes:

- The course provides quantitative determine the amount of various chemical species in solutions by titrations and conduct the quantitative determinations with accuracy
- The course provides to develop novel materials to be used as zeolite and prepare columns for removal of hardness of water
- The course provides to synthesise a polymer or a drug

List of Experiments

1. Determination of Sodium Hydroxide with HCl (Na_2CO_3 Primary Standard)
2. Determination of Alkalinity (Carbonate and Hydroxide) of water sample
3. Determination of Fe(II)/Mohr's Salt by Permanganometry
4. Determination of Oxalic Acid by Permanganometry
5. Determination of Chromium (VI) by Mohr's Salt Solution
6. Determination of Zinc by EDTA method
7. Determination of Hardness of Water sample by EDTA method
8. Determination of Chlorine in water by Iodometric Titration
9. Ionexchange/ Zeolite column for removal of hardness of water
10. Synthesis of Polymer/ drug

Reference Books:

1. Vogel's Quantitative Chemical Analysis – V – Edition – Longman.
2. Experiments in Applied Chemistry (For Engineering Students) – Sinita Rattan – S. K. Kataria & Sons, New Delhi

MT-1208 : CPNM LAB

Course Objectives:

- To impart writing skill of C programming to the students and solving problems.
- To write and execute programs in C to solve problems such as Modularize the problems into small modules and then convert them into programs.,
- To write and execute programs in C to solve problems such as arrays, files, strings, structures and different numerical methods.
- This reference has been prepared for the beginners to help them understand the basic to advanced concepts related to Objective-C Programming languages.

Course Outcomes:

- Understand various computer components, Installation of software. C programming development environment, compiling, debugging, and linking and executing a program using the development environment.
- Analyzing the complexity of problems, Modularize the problems into small modules and then convert them into programs.
- Construct programs that demonstrate effective use of C features including arrays, strings, structures, pointers and files.
- Apply and practice logical ability to solve the real world problems.
- Apply Numerical methods to Solve the complex Engineering problems.

SYLLABUS

1. Write a program to read x, y coordinates of 3 points and then calculate the area of a triangle formed by them and print the coordinates of the three points and the area of the triangle. What will be the output from your program if the three given points are in a straight line?
2. Write a program, which generates 100 random integers in the range of 1 to 100. Store them in an array and then print the arrays. Write 3 versions of the program using different loop constructs. (e.g. for, while, and do while).
3. Write a set of string manipulation functions e.g. for getting a sub-string from a given position, Copying one string to another, Reversing a string, adding one string to another.
4. Write a program which determines the largest and the smallest number that can be stored in different data types like short, int, long, float, and double. What happens when you add 1 to the largest possible integer number that can be stored?
5. Write a program, which generates 100 random real numbers in the range of 10.0 to 20.0, and sort them in descending order.

6. Write a function for transposing a square matrix in place (in place means that you are not allowed to have full temporary matrix).

7. First use an editor to create a file with some integer numbers. Now write a program, which reads these numbers and determines their mean and standard deviation.

8. Given two points on the surface of the sphere, write a program to determine the smallest arc length between them.

9. Implement bisection method to find the square root of a given number to a given accuracy.

10. Implement Newton Raphson method to det. a root of polynomial equation.

11. Given table of x and corresponding f(x) values, Write a program which will determine f(x) value at an intermediate x value by using Lagrange's interpolation/

12. Write a function which will invert a matrix.

13. Implement Simpson's rule for numerical integration.

14. Write a program to solve a set of linear algebraic equations.

Naval Architecture & Marine Engineering

Scheme and Syllabus (With effect from 2020-21 admitted batch)

B.Tech I Year - I Semester

Course CreditsC code	Category	Course Title	Hours per week			Internal Marks	External Marks	Total Marks	
			L	T	P				
NM1101 BS	Maths – I		3	0	0	30	70	100	3
NM1102 BS	Physics		3	0	0	30	70	100	3
NM1103 ES	Engg .Graphics		1	0	4	30	70	100	3
NM1104 ES	Introduction to Physical Oceanography		3	0	0	30	70	100	3
NM1105 ES	Introduction to Naval Architecture		3	0	0	30	70	100	3
NM1106 ES	Workshop		0	0	3	50	50	100	1.5
NM1107 BS	Physics Lab		0	0	3	50	50	100	1.5
NM1108 ES	Ship Welding Lab		0	0	3	50	50	100	1.5
Total Credits									19.5

B.Tech I Year - II Semester

Course CreditsC code	Category	Course Title	Hours per week			Internal Marks	External Marks	Total Marks	
			L	T	P				
NM1201 BS	Maths – II		3	0	0	30	70	100	3

NM1202 BS	Chemistry	3	0	0	30	70	100	3
NM1203 HSS	English	3	0	0	30	70	100	3
NM1204 ES	CPNM	3	0	3	30	70	100	3
NM1205 ES	Basic Ship Theory	3	0	0	30	70	100	3
NM1206 HSS	English Language Lab	0	0	2	50	50	100	1.5
NM1207 BS	Chemistry Lab	0	0	3	50	50	100	1.5
NM1208 ES	CPNM Lab	0	0	3	50	50	100	1.5
Total Credits								19.5

NM 1101 - MATHEMATICS-I

Course Objectives: The contents of this course fulfill the fundamental requirements of knowledge of Mathematics for learning Engineering subjects. The main objectives of student learning are:

1. To transmit the knowledge of Partial differentiation.
2. To know of getting maxima and minima of function of two variables and finding errors and approximations.
3. To evaluate double and triple integrals, volumes of solids and area of curved surfaces.
4. To expand a periodical function as Fourier series and half-range Fourier series.

Course Outcomes: At the end of this course, the student will understand and be able to apply the basic principles of differential and integral calculus to various engineering problems. Particularly, the student will be able to

1. Find the partial derivatives of functions of two or more variables.
2. Evaluate maxima and minima, errors and approximations.
3. Evaluate double and triple integrals, volumes of solids and area of curved surfaces.
4. To expand a periodical function as Fourier series and half-range Fourier series.
5. Have a fundamental understanding of Fourier series and be able to give Fourier expansions of a given function.

Partial Differentiation, Multiple Integrals, Fourier Series and Their Applications

(Partial Differentiation)

Introduction - Functions of two or more variables - Partial derivatives - Homogeneous functions – Euler's theorem - Total derivative - Change of variables – Jacobins. Mean value Theorems (without proofs)

(Applications of Partial Differentiation)

Geometrical interpretation -Tangent plane and Normal to a surface - Taylor's theorem for functions of two variables - Errors and approximations - Total differential. Maxima and Minima of functions of two variables - Lagrange's method of undetermined multipliers - Differentiation under the integral Sign - Leibnitz's rule.

(Multiple Integrals)

Introduction - Double Integrals - Change of Order of Integration - Double Integrals in Polar Coordinates - Triple Integrals - Change of Variables.

(Multiple Integrals-Applications)

Area enclosed by plane curves - Volumes of solids - Area of a curved surface - Calculation of Mass - Center of gravity - Moment of inertia - product of inertia – principal axes- Beta Function - Gamma Function - Relation between Beta and Gamma Functions. Error Function or Probability Integral.

(Fourier Series)

Introduction - Euler's Formulae - Conditions for a Fourier Expansion - Functions having points of discontinuity - Change of Interval - Odd and Even Functions - Expansions of Odd or Even Periodic Functions, Half-Range Series - Parseval's Formula. Practical Harmonic analysis.

TEXT BOOK:

Scope and Treatment as in "Higher Engineering Mathematics", by Dr. B.S. Grewal, 43rd Edition, Khanna publishers.

REFERENCE BOOKS:

1. Graduate Engineering Mathematics by V B Kumar Vatti., I.K.International publishing house Pvt. Ltd.
2. Advanced Engineering Mathematics by Erwin Kreyszig.
3. A text book of Engineering Mathematics, by N.P. Bali and Dr. Manish Goyal, Lakshmi Publications.
4. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.
5. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.
6. Higher Engineering Mathematics by Dr. M.K.Venkataraman.

NM 1102- PHYSICS

Course Objectives:

- To impart knowledge in basic concept of physics of Thermodynamics relevant to engineering applications.
- To grasp the concepts of physics for electromagnetism and its application to engineering. Learn production of Ultrasonics and their applications in engineering.

- To Develop understanding of interference, diffraction and polarization: connect it to a few engineering applications.

- To Learn basics of lasers and optical fibers and their use in some applications.

- To Understand concepts and principles in quantum mechanics and Nanophase Materials. Relate them to some applications.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

- Understand the fundamentals of Thermodynamics and Laws of thermodynamics. Understand the working of Carnot cycle and concept of entropy.

- Gain Knowledge on the basic concepts of electric and magnetic fields. Understand the concept of the nature of magnetic materials. Gain knowledge on electromagnetic induction and its applications .

- Understand the Theory of Superposition of waves. Understand the formation of Newton's rings and the working of Michelson's interferometer. Remember the basics of diffraction, Evaluate the path difference. Analysis of Fraunhofer Diffraction due to a single slit

- Understand the interaction of matter with radiation, Characteristics of Lasers, Principle, working schemes of Laser and Principle of Optical Fiber. Realize their role in optical fiber communication.

- Understand the intuitive ideas of the Quantum physics and understand dual nature of matter. Compute Eigen values, Eigen functions, momentum of Atomic and subatomic particles using Time independent one Dimensional Schrodinger's wave equation. Understand the fundamentals and synthesis processes of Nanophase materials.

THERMODYNAMICS

Introduction, Heat and Work, First law of thermodynamics and applications, Reversible and Irreversible process, Carnot cycle and Efficiency, Second law of thermodynamics, Carnot's Theorem, Entropy, Second law in terms of entropy, Entropy and disorder, Third law of thermodynamics (statement only).

ELECTROMAGNETISM

Concept of electric flux, Gauss's law - some applications, Magnetic field - Magnetic force on current, torque on current loop, The Biot-Savart's Law, B near a long wire, B for a circular Current loop, Ampere's law, B for a solenoid, Hall effect, Faraday's law of induction, Lenz's law, Induced magnetic fields, Displacement current, Maxwell's equations (no derivation), Magnetic materials: Classification of magnetic materials and properties.

Ultrasonics : Introduction, Production of Ultrasonics – Piezoelectric and Magnetostriction methods, acoustic grating, applications of ultrasonics.

OPTICS

Interference: Principles of superposition – Young's Experiment – Coherence - Interference in thin films (reflected light), Newton's Rings, Michelson Interferometer and its applications.

Diffraction: Introduction, Differences between interference and diffraction, Fresnel and Fraunhofer diffraction, Fraunhofer diffraction at a single slit (Qualitative and quantitative treatment).

Polarisation: Polarisation by reflection, refraction and double refraction in uniaxial crystals, Nicol prism, Quarter and Half wave plate, circular and elliptical polarization.

LASERS and FIBRE OPTICS

Introduction, characteristics of a laser beam, spontaneous and stimulated emission of radiation, population inversion, Ruby laser, He-Ne laser, Semiconductor laser, applications of lasers

Introduction to optical fibers, principle of propagation of light in optical fibers, Acceptance Angle and cone of a fibre, Numerical aperture, Modes of propagations, classification of fibers, Fibre optics in communications, Application of optical fibers.

MODERN PHYSICS

Introduction, De Broglie concept of matter waves, Heisenberg uncertainty principle, Schrodinger time independent wave equation, application to a particle in a box. Free electron theory of metals, Kronig - Penney model (qualitative treatment), Origin of energy band formation in solids, Classification of materials into conductors, semi conductors and insulators.

Nanophase Materials

Introduction, properties, Top-down and bottom up approaches, Synthesis - Ball milling, Chemical vapour deposition method, sol-gel methods, Applications of nano materials.

TEXT BOOKS :

1. Physics by David Halliday and Robert Resnick – Part I and Part II - Wiley.
2. A textbook of Engineering Physics, Dr. M. N. Avadhanulu, Dr. P.G. Kshirsagar - S. Chand
3. Engineering Physics by R.K. Gaur and S.L. Gupta –Dhanpat Rai

Reference Books:

1. Modern Engineering Physics by A.S. Vadudeva
2. University Physics by Young and Freedman

NM 1103- ENGINEERING GRAPHICS

Course Objectives:

The main objectives of the course are to

CEO1. Understand the basics of Engineering Graphics and BIS conventions.

CEO2. Develop the graphical skills for communication of concepts, ideas and design of engineering products through technical drawings

CEO3. Demonstrate and practice the various profiles/curves used in engineering practice through standard procedures.

CEO4. Demonstrate and practice the orthographic projections of points, lines, planes, solids and section of solids

CEO5. Demonstrate and practice the development of surfaces of simple solids

CEO6. Familiarize the basic concept of isometric views clearly.

Course Outcomes:

After completion of the course, the student will be able to

CO1. Develop simple engineering drawings by considering BIS standards.

CO2. Able to draw different engineering curves with standard Procedures

CO3. Comprehend the basics of orthographic projections and deduce orthographic projections of points, lines, planes and solids at different orientations in real life environment.

CO4. Visualize clearly the sections of solids.

CO5. Apply the concepts of development of surfaces while designing/analyzing any product.

CO6. Recognize the significance of isometric drawing to relate 2D environment with 3D environment.

SYLLABUS

Introduction: Lines, Lettering and Dimensioning, Geometrical Constructions, and Scales.

Curves: Conic sections: General construction of ellipse, parabola and hyperbola. Construction of involutes of circle and polygons only. Normal and tangent to curves.

Projections of Points: Principal or Reference Planes, Projections of a point situated in any one of the four quadrants.

Projections of Straight Lines: Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane.

Projections of Straight Line Inclined to Both the Reference Planes: Projections of Planes: Projection of Perpendicular planes: Perpendicular to both reference planes, perpendicular to one reference plane and parallel to other reference plane and perpendicular to one reference plane and inclined to other reference plane. Projection of Oblique planes. Introduction to Auxiliary Planes.

Projections of Solids: Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to other and axes inclined to both the reference planes.

Sections of Solids: Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids (Prism, Pyramid, cylinder and Cone) in simple position only.

Development of Surfaces: Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.

Isometric Views: Isometric projection, Isometric scale and Isometric view. Isometric view of Prisms, Pyramids, cylinder, cone, and their combinations.

Text Book:

Elementary Engineering Drawing by N.D.Bhatt, Charotar Publishing House.

Reference:

Engineering Graphics by K.L. Narayana and P. Kannaiah, Tata McGraw Hill

NM1104 Introduction to Physical Oceanography

Periods/week : 4 Sessional. : 30 Exam: 70 Credits: 3

Unit I: Physical properties of seawater: Temperature, Salinity and Density distributions. Transparency of seawater, Sound in the sea, Light in the sea, Colour of seawater, Sea Ice. Measurement of Temperature and salinity With Depth.

Unit II: Waves: wave parameters, deep water waves, shallow water waves, transformation of waves in shallow water, wave generation and dissipation.

Tides: Tide producing forces, Types of tides, tidal theories. major tidal constituents-prediction of tides

Water masses: T-S diagram, Characteristics of water masses, Deep circulation water masses, Major water masses of the world oceans.

Unit III: Ocean circulation: Wind induced currents, Upwelling, sinking; equatorial current system, warm and cold currents of major world ocean, seasonal currents in North Indian Ocean, west ward intensification of currents.

Coastal processes: Transformation of waves– refraction, construction of refraction diagram, diffraction, reflection. Coastal and near shore circulation-long shore currents, rip currents and tidal currents.

Unit IV: Beach features: Beach cycles, beach profiles-erosion and accretion, Sediment transport rate – onshore and offshore transport – coastal features – LEO observation

Beach stability – artificial nourishment – coastal defence structures – planning and design of coastal structures – tidal inlets and Lakes, deltas.

Estuaries: Classification, tides in estuaries, estuarine circulation and mixing, Hydrology and hydrograph, sedimentation in estuaries

Unit V: Marine geology: Continental shelf, Slope, Shelf sediments, submarine topography, mid oceanic ridge system, gas hydrates, manganese nodules.

Marine biology: Classification of marine environment, Biogeochemical cycles. Influence of Physical parameters (Temperature, salinity, waves, currents, tides etc.). Nitrogen, Phosphorus and Silica controls, Residence time of elements in sea water. Marine Ecosystem: Mangroves, Coral Reefs.

Text books:

1. Introduction to Physical oceanography by M.P.M.Reddy.
2. Introduction to Physical oceanography by Robert.H.Stewart.
3. Introduction to dynamical oceanography by S.Pond and G.L.Pickard.

NM 1105 INTRODUCTION TO NAVAL ARCHITECTURE

Periods/week : 4 Sessional. : 30 Exam: 70 Credits: 3

History – Development of primitive floating vehicles / platforms. Evolution of ship types; evolution of materials used in ship construction. Contribution of the ships to civilisation, trade and discovery of the planet Earth.

Fundamentals of Floatation - Archimedes principle, laws of floatation and stability.

Classification of ships and other Marine platforms. Definition and general arrangement of typical ships and Marine platforms.

Ship terminology and their meaning. Ship lines and procedure to draw them.

Introduction to ship construction / production process. Visit to Shipyard. Economics of waterway transportation.

Domain of Naval Architecture Studies and role of a Naval Architect.

Challenges and state of the art.

Avenues for a Naval Architect.

Textbook:

Introduction to Naval Architecture by Eric Tupper- Butterworth
Heinemann Publications

NM 1106- WORKSHOP

Course Objectives: The engineering work shop practice is included to introduce some common shop practices and on hands on experience to appreciate the use of skill, tools, equipment and general practices to all the engineering students. This laboratory course is aimed to provide the practical exposure to the students in the fields of Carpentry, Fitting, Sheet Metal and house electrical wiring works to

1. Get hands on experience with the working skills in Carpentry trade.
2. Know how to work with Sheet Metal tools.
3. Get familiar with the working skills of Metal Fitting operations.
4. Get hands on experience with house hold electrical wiring.

Course Outcomes: By the end of this laboratory, the student

1. Can be able to work with Wood Materials in real time applications.
2. Can be able to build various parts with Sheet Metal in day-to-day life.
3. Can be able to apply Metal Fitting skills in various applications.
4. Can be able to apply this knowledge to basic house electrical wiring and repairs.

Carpentry: Any three jobs from – Half lap joint, Mortise and Tenon joint, Half – lap Dovetail joint, Corner Dovetail joint, Central Bridle joint.

Sheet Metal: Any three jobs from – Square tray, Taper tray(sides), Funnel, Elbow pipe joint.

Fitting: Any three jobs from – Square, Hexagon, Rectangular fit, Circular fit and Triangular fit.

House wiring: Any three jobs from – Tube light wiring, Ceiling fan wiring, Stair-case wiring, Corridor wiring.

References:

1. Elements of workshop technology, Vol.1 by S. K. and H. K. Choudary.
2. Work shop Manual / P.Kannaiah/ K.L.Narayana/ SciTech Publishers.

3. Engineering Practices Lab Manual, Jeyapooan, Saravana Pandian, 4/e Vikas.

NM 1107-PHYSICS LAB

Course Objectives:

This subject is common to all first year branches of UG engineering. At the end of the course the student is expected to

- To enable the students to acquire skill, technique and utilization of the Instruments
- Draw the relevance between the theoretical knowledge and to imply it in a practical manner with respect to analyze various electronic circuits and its components.
- To impart the practical knowledge in basic concepts of Wave optics, Lasers and Fiber optics.
- To familiarize the handling of basic physical apparatus like Vernier callipers, screw gauge, spectrometers, travelling microscope, laser device, optical fibre, etc.

Course Outcomes:

- Ability to design and conduct experiments as well as to analyze and interpret
- Ability to apply experimental skills to determine the physical quantities related to Heat, Electromagnetism and Optics
- The student will learn to draw the relevance between theoretical knowledge and the means to imply it in a practical manner by performing various relative experiments.

List of Experiments:

1. Determination of Radius of Curvature of a given Convex Lens By forming Newton's Rings.
2. Determination of Wavelength of Spectral Lines in the Mercury Spectrum by Normal Incidence method.
3. Study the Intensity Variation of the Magnetic Field along axis of Current Carrying Circular Coil.
4. Determination of Cauchy's Constants of a Given Material of the Prism using Spectrometer.
5. Determination of Refractive Index of Ordinary ray $m_{\text{---}}^{\circ}$ and Extraordinary $m_{\text{---}}^{\circ}$ ray.
6. Determination of Thickness Given Paper Strip by Wedge Method.
7. Calibration of Low Range Voltmeter.
8. Calibration of Low Range Ammeter.

9. Determination of Magnetic Moment and Horizontal Component of Earth's Magnetic Field.

10. Lees Method - Coefficient of thermal Conductivity of a Bad Conductor.

11. Carey Foster's Bridge – Verification of laws of Resistance and Determination Of Specific Resistance.

12. Melde's Apparatus – Frequency of electrically maintained Tuning Fork.

13. Photoelectric cell-Characteristics.

14. Planks Constants.

15. Laser- Diffraction.

NM 1108 SHIP WELDING LAB

Lab Periods/week : 3 Sessional. : 50 Exam: 50 Credits: 1.5

LIST OF EXPERIMENTS:

(Practical/hands on)

1. Arc welding of mild steel and stainless steel plates and thermal cycle, cooling rate, macrostructure and Micro structural characterization of welds and Arc welding safety(Lap Joints)

2. Arc welding of mild steel and stainless steel plates and thermal cycle, cooling rate, macrostructure and Micro structural characterization of welds and Arc welding safety(Butt Joints)

3. Arc welding of mild steel and stainless steel plates and thermal cycle, cooling rate, macrostructure and Micro structural characterization of welds and Arc welding safety(T-joint)

4. Arc welding of mild steel and stainless steel plates and thermal cycle, cooling rate, macrostructure and Micro structural characterization of welds and Arc welding safety(Flange Joints)

Study Experiments (Theoretical)

5. Spot welding and Spot Welding safety

6. TIG welding TIG welding safety.

7. Plasma welding and Plasma welding safety.

8. Submerged welding and Submerged welding safety.

NM 1201- MATHEMATICS-II

Course Objectives: The contents of this course fulfill the fundamental requirements of knowledge of Mathematics for learning Engineering subjects. The main objectives of student learning are :

1. The way of obtaining rank, eigen values and eigen vectors of a matrix.

2. To know the importance of Cayley-Hamilton theorem and getting canonical form from a given quadratic form.

3. To solve the system of equations by using direct and indirect methods.

4. To solve first order and higher order differential equations by various methods.

5. To obtain the Laplace transforms and inverse Laplace transforms for a given functions and their applications.

Course Outcomes: At the end of this course, the student will understand and be able to apply the basic principles of Linear Algebra, ODEs and Laplace Transforms to various engineering problems. Particularly, the student will be able to

1. Find rank, eigen values and eigen vectors of a matrix and understand the importance of Cayley-Hamilton theorem.

2. Reduce quadratic form to canonical forms and solving linear systems by direct and indirect methods.

3. Demonstrate solutions to first order differential equations by various methods and solve basic applications problems related to electrical circuits, orthogonal trajectories and Newton's law of cooling

4. Discriminate among the structure and procedure of solving higher order differential equations with constant and variable coefficients.

5. Understand Laplace transforms and its properties and finding the solution of ordinary differential equations.

Matrix Algebra, Ordinary Differential Equations and Laplace Transforms

(Linear Algebra) : Rank of a matrix- Echelon form, Normal Form - Solution of Linear System of Equations - Consistency of Linear System of Equations - Direct & Indirect Methods: Gauss elimination method, LU Factorization method, Gauss Seidal Method. Complex Matrices: Hermitian, Skew-Hermitian and Unitary Matrices and their Properties.

(Eigen Values and Eigen Vectors) : Eigen Values and Eigen Vectors of a Matrix - Cayley-Hamilton theorem - Inverse and Powers of a Matrix using Cayley-Hamilton's theorem and its applications. Diagonalization of a Matrix - Quadratic Forms - Reduction of Quadratic Form to Canonical Form - Nature of a Quadratic Form.

(Ordinary Differential Equations of First Order and its Applications) : Formation of ordinary differential equations (ODEs) - Solution of an ordinary differential equation - Equations of the first order and first degree - Linear differential equation - Bernoulli's equation - Exact differential equations - Equations reducible to exact equations - Orthogonal Trajectories - Simple Electric (LR & CR) Circuits - Newton's Law of Cooling - Law of Natural growth and decay.

(Differential Equations of Higher Order) : Solutions of Linear Ordinary Differential Equations with Constant Coefficients - Rules for finding the complimentary function - Rules for finding the particular integral - Method of variation of parameters - Cauchy's linear equation - Legendre's linear equation - Simultaneous linear differential equations.

(Laplace Transforms) : Introduction - Existence Conditions - Transforms of Elementary Functions - Properties of Laplace Transforms - Transforms of Derivatives - Transforms of Integrals - Multiplication by t^n - Division by t - Evaluation of integrals by Laplace Transforms - Inverse Laplace Transform - Applications of Laplace Transforms to Ordinary Differential Equations - Simultaneous Linear Differential Equations with Constant Coefficients - Second Shifting Theorem - Laplace Transforms of Unit Step Function, Unit Impulse Function and Laplace Transforms of Periodic Functions.

TEXT BOOK:

Scope and Treatment as in "Higher Engineering Mathematics", by Dr. B.S. Grewal, 43rd edition, Khanna publishers.

REFERENCE BOOKS:

7. Graduate Engineering Mathematics by V B Kumar Vatti., I.K. International publishing house Pvt. Ltd.

1. Advanced Engineering Mathematics by Erwin Kreyszig.
2. A text book of Engineering Mathematics, by N.P. Bali and Dr. Manish Goyal. Lakshmi Publications.
3. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.
4. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.

NM 1202 – Chemistry

Course Objectives:

- To apply the basic knowledge of Chemistry to the Engineering Discipline.
- To develop knowledge about water and its treatment for industrial and potable purposes.
- To develop understanding in the areas of Polymers, Mechanism of Corrosion of Metals and Corrosion Control Methods, Fuels, Lubricants and Nanomaterials for of conducting polymers, bio-degradable polymers and fiber reinforced plastics and apply the knowledge for solving existing challenges faced in various engineering and societal areas.

Course outcome:

- This course applies the basic concepts and principles studied in Chemistry to Engineering.

- It provides an application of chemistry to different branches of engineering

- The students will be able acquire knowledge in the areas of Water Chemistry, Polymers, Corrosion, Fuels and Lubricants and nanomaterials and suggest innovative solutions for existing challenges in these areas.

Water Chemistry

(8 Hrs)

Sources of Water – Impurities and their influence on living systems – WHO Limits – Hardness and its Determination – Boiler Troubles and their removal – Water Softening Methods – Lime-Soda, Zeolite and Ion Exchange - Municipal Water Treatment-Break Point Chlorination – Desalination of Sea Water – Reverse Osmosis Method, Electro-dialysis.

Polymers and Plastics

(8 Hrs)

Polymers: Definition – Types of Polymerization (Addition & Condensation) – Mechanisms of Addition Polymerization – Radical and Ionic – Thermodynamics of Polymerization Process. Plastics: Thermosetting and Thermoplastics – Effect of Polymer Structure on Properties of Cellulose Derivatives – Vinyl Resins – Nylon (6,6), Reinforced Plastics – Conducting Polymers.

Corrosion (8 Hrs)

Corrosion: Origin and Theory – Types of Corrosion: Chemical and Electrochemical; Pitting, Inter granular, Waterline, Stress – Galvanic Series – Factors Effecting Corrosion.

Corrosion Controlling Methods: Protective Coatings: Metallic Coatings, Electroplating and Electroless Plating – Chemical conversion Coatings – Phosphate, Chromate, Anodized, Organic Coatings – Paints and Special Paints.

Fuels and Lubricants (8 Hrs)

Solid Fuels: Wood and Coal, Ranking of Coal – Analysis (Proximate and Ultimate) Coke Manufacture – Otto Hoffmann's Process – Applications; Liquid Fuels: Petroleum Refining – Motor Fuels – Petrol and Diesel Oil – Knocking – Octane number – Cetane Number; Gaseous Fuels: Biogas, LPG and CNG – Characteristics – Applications; Rocket Fuels: Propellants – Classification – Characteristics

Lubricants: Classification – Mechanism – Properties of Lubricating Oils – Selection of Lubricants for Engineering Applications.

Nanomaterials (8 Hrs)

Nanomaterials, Properties and application of fullerenes, fullerols, Carbon nanotubes and nanowires. Synthesis - Top-down and Bottom-up approaches - Nanocomposites - Nanoelectronics- Applications of nanomaterials in catalysis, telecommunication and medicine.

Text Books:

1. Engineering Chemistry – PC Jain and M. Jain – Dhanpath Rai and Sons, New Delhi.

2. A Text book of Engineering Chemistry – S. S. Dara – S. Chand & Co. New Delhi.

Reference Books:

1. Engineering Chemistry – B. K. Sharma – Krishna Prakashan – Meerut.

2. Introduction to Nanoscience - S. M. Lindsay - Oxford University Press

3. Engineering Chemistry - B. L. Tembe, Kamaluddin and M. S. Krishnan, (NPTEL).

NM 1203 – ENGLISH

Course Objectives:

- To make students understand the explicit and implicit meanings of a text/topic;
- To give exposure to new words and phrases, and aid to use them in different contexts;
- To apply relevant writing formats to draft essays, letters, emails and presentations; and
- To adapt oneself to a given situation and develop a functional approach to finding solutions: adaptability and problem solving.

Course Outcomes:

- Students will be able to analyse a given text and discover the various aspects related to language and literature;
- Learn the various language structures, parts of speech and figures of speech;
- Develop one's reading and writing abilities for enhanced communication; and
- Learn to apply the topics in real-life situations for creative and critical use.

UNIT-1 Reading: *On the conduct of life:* William Hazlitt

Grammar: Prepositions

Vocabulary: Word Formation I: Introduction to Word Formation

Writing: Clauses and Sentences

Life skills: Values and Ethics

If: Rudyard Kipling

UNIT-2 Reading: The Brook: Alfred Tennyson

Grammar: Articles

Vocabulary: Word Formation II: Root Words from other Languages

Writing: Punctuation

Life skills: Self-Improvement

How I Became a Public Speaker: George Bernard Shaw

UNIT-3 Reading: The Death Trap: Saki

Grammar: Noun-Pronoun Agreement, Subject- Verb Agreement

Vocabulary: Word Formation III: Prefixes and Suffixes

Writing: Principles of Good Writing

Life skills: Time Management

On saving Time: Seneca

UNIT-4

Reading: Chinduyellama

Grammar: Misplaced Modifiers

Vocabulary: Synonyms, Antonyms

Writing: Essay Writing

Life skills: Innovation

Muhammad Yunus

UNIT-5

Reading: Politics and the English Language: George Orwell

Grammar: Clichés, Redundancies

Vocabulary: Common Abbreviations

Writing: Writing a Summary

Life skills: Motivation

The Dancer with a White Parasol: Ranjana Dave

Prescribed Textbook: Language and Life: A Skills Approach Board of Editors, Orient Blackswan Publishers, India. 2018.

Suggested Readings

1. Practical English Usage, Michael Swan. OUP. 1995.
2. Remedial English Grammar, F.T. Wood. Macmillan.2007
3. On Writing Well, William Zinsser. Harper Resource Book. 2001
4. Study Writing, Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
5. Communication Skills, Sanjay Kumar and PushpLata. Oxford University Press. 2011.
6. Exercises in *Spoken English*, Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

NM 1204-CPNM

Course Objectives:

- The course is designed to provide complete knowledge of C language.
- To provide students with understanding of code organization and functional hierarchical decomposition with using complex data types.
- To provide knowledge to the Students to develop logics which will help them to create programs, applications in C.
- This course aims to identify tasks in which the numerical techniques learned are applicable and apply them to write programs, and hence use computers effectively to solve the task.
- This course provides the fundamental knowledge which is useful in understanding the other programming languages.

Course Outcomes:

- Identify basic elements of C programming structures like data types, expressions, control statements, various simple functions and Apply them in problem solving.
- Apply various operations on derived data types like arrays and strings in problem solving.
- Design and Implement of modular Programming and memory management using Functions, pointers.
- Apply Structure, Unions and File handling techniques to Design and Solve different engineering programs with minimal complexity.
- Apply Numerical methods to Solve the complex Engineering problems.

SYLLABUS

1. Introduction to C: Basic structure of C program, Constants, Variables and data types, Operators and Expressions, Arithmetic Precedence and associativity, Type Conversions. Managing Input and Output Operations Formatted Input, Formatted Output.
2. Decision Making, Branching, Looping, Arrays & Strings: Decision making with if statement, Simple if statement, The if...else statement, Nesting of if...else statement, the else..if ladder, switch statement, the (?:) operator, the GOTO statement., The while statement, the do statement, The for statement, Jumps in Loops ,One, Two-dimensional Arrays, Character Arrays. Declaration and initialization of Strings, reading and writing of strings, String handling functions, Table of strings.
3. Functions: Definition of Functions, Return Values and their Types, Function Calls, Function Declaration, Category of Functions: No Arguments and no Return Values, Arguments but no Return Values, Arguments with

Return Values, No Argument but Returns a Value, Functions that Return Multiple Values. Nesting of functions, recursion, passing arrays to functions, passing strings to functions, the scope, visibility and lifetime of variables.

4. Pointers: Accessing the address of a variable, declaring pointer variables, initializing of pointer variables, accessing variables using pointers, chain of pointers, pointer expressions, pointers and arrays, pointers and character strings, array of pointers, pointers as function arguments, functions returning pointers, pointers to functions, pointers to structures-Program Applications

5. Structure and Unions: Defining a structure, declaring structure variables, accessing structure members, structure initialization, copying and comparing structure variables, arrays of structures, arrays within structures, structures within structures, structures and functions and unions, size of structures and bit-fields- Program applications.

6. File handling: Defining and opening a file, closing a file, Input/ Output operations on files, Error handling during I/O operations, random access to files and Command Line Arguments- Program Applications

7. Numerical Methods: Solutions of Algebraic and Transcendental Equations, Bisection Method, Newton Raphson Method. Newton's forward and backward Interpolation, Lagrange's Interpolation in unequal intervals. Numerical Integration: Trapezoidal rule, Simpson's 1/3 rules. Solutions of Ordinary First Order Differential Equations: Euler's Method, Modified Euler's Method and Runge-Kutta Method.

Text Book:

1. Programming in ANSI C, E Balagurusamy, 6th Edition. McGraw Hill Education (India) Private Limited.
2. Introduction to Numerical Methods, SS Sastry, Prentice Hall

Reference Books:

1. Let Us C ,YashwantKanetkar, BPB Publications, 5th Edition.
2. Computer Science, A structured programming approach using C", B.A.Forouzan and R.F.Gilberg, " 3rd Edition, Thomson, 2007.
3. The C –Programming Language' B.W. Kernighan, Dennis M. Ritchie, PHI.
4. Scientific Programming: C-Language, Algorithms and Models in Science, Luciano M. Barone (Author), Enzo Marinari (Author), Giovanni Organtini, World Scientific.

NM 1205 Basic Ship Theory

Periods/week : 4 Sessional. : 30 Exam: 70

Credits: 3

Examination Theory: 3hrs.

Introduction: Archimedes principle, principles of flotation, types of ships, nomenclature and geometry. Lines plan, and fairing of lines, displacement

and tonnage, TPC, coefficients of forms, wetted surface area. Calculation of area, volume, and first and second moments using Simpson's rule, center of gravity, effect of addition of mass, movement of mass and suspended mass.

Stability of ships and freeboard: Transverse stability of ships, statical stability at small angles of heel, calculation of BM, metacentric diagram, free surface effect, Inclining experiment, Bonjean curves, hydrostatic curves. Stability at large angles: Statical Stability Curve, angle of loll, wall sided formula, cross curves of stability, polar diagrams, metacentric evolute, particular cases of righting moment, dynamical stability, stability diagrams, effects of external heeling moments, stability criteria.

Trim and effects of changes in draught. Free board, Different types of free board, ships types based on free board, ILLC requirements, freeboard calculations.

Subdivision of ships: Causes and types flooding, volume and surface permeability due to bilging of side compartments. Added weight and buoyancy, methods of calculation, subdivision load lines, margin line, floodable length, permissible length, floodable length curves.

Launching: Launching arrangement, end launching, side launching, launching calculations, docking and grounding.

NM 1206- ENGLISH LANGUAGE LAB

Course Objectives:

- To make students recognize the sounds of English through Audio-Visual aids;
- To help students build their confidence and help them to overcome their inhibitions and self-consciousness while speaking in English;
- To familiarize the students with stress and intonation and enable them to speak English effectively; and
- To give learners exposure to and practice in speaking in both formal and informal contexts.

Course Outcomes:

- Students will be sensitized towards recognition of English sound patterns and the fluency in their speech will be enhanced;
- A study of the communicative items in the laboratory will help students become successful in the competitive world;
- Students will be able to participate in group activities like roleplays, group discussions and debates; and
- Students will be able to express themselves fluently and accurately in social as well professional context.

UNIT-I Introduction to Phonetics: The Sounds of English (Speech sound – vowels and consonants) - Stress and Intonation - Accent and Rhythm.

UNIT-II Listening Skills: Listening for gist and specific information - listening for Note taking, summarizing and for opinions - Listening to the speeches of eminent personalities.

UNIT-III Speaking Skills: Self-introduction - Conversation Skills (Introducing and taking leave) - Giving and asking for information - Role Play - Just A Minute (JAM) session - Telephone etiquette.

UNIT-IV Reading and Writing skills: Reading Comprehension – Précis Writing - E-Mail writing - Punctuation.

UNIT-V Presentation skills: Verbal and non-verbal communication - Body Language - Making a Presentation.

Reference Books:

1. Ashraf Rizvi. *Effective Technical Communication*. Tata McGraw Hill Education Private Limited, New Delhi.
2. *Speak Well*. Orient Blackswan Publishers, Hyderabad.
3. Allan Pease. *Body Language*. Manjul Publishing House, New Delhi.

NM 1207- CHEMISTRY LAB

Course Objectives:

- To develop the fine skills of quantitative determination of various chemical components through titrimetric analysis
- To prepare and use ionexchange/ zeolite columns for the removal of hardness of water
- To develop the skill of organic synthesis through the preparation of a polymer/ drug

Course Outcomes:

- The course provides quantitative determine the amount of various chemical species in solutions by titrations and conduct the quantitative determinations with accuracy
- The course provides to develop novel materials to be used as zeolite and prepare columns for removal of hardness of water
- The course provides to synthesise a polymer or a drug

List of Experiments

1. Determination of Sodium Hydroxide with HCl (Na_2CO_3 Primary Standard)

2. Determination of Alkalinity (Carbonate and Hydroxide) of water sample
3. Determination of Fe(II)/Mohr's Salt by Permanganometry
4. Determination of Oxalic Acid by Permanganometry
5. Determination of Chromium (VI) by Mohr's Salt Solution
6. Determination of Zinc by EDTA method
7. Determination of Hardness of Water sample by EDTA method
8. Determination of Chlorine in water by Iodometric Titration
9. Ionexchange/ Zeolite column for removal of hardness of water
10. Synthesis of Polymer/ drug

Reference Books:

1. Vogel's Quantitative Chemical Analysis – V – Edition – Longman.
2. Experiments in Applied Chemistry (For Engineering Students) – Sinita Rattan – S. K. Kataria & Sons, New Delhi

NM1208- CPNM LAB

Course Objectives:

- To impart writing skill of C programming to the students and solving problems.
- To write and execute programs in C to solve problems such as Modularize the problems into small modules and then convert them into programs.,
- To write and execute programs in C to solve problems such as arrays, files, strings, structures and different numerical methods.
- This reference has been prepared for the beginners to help them understand the basic to advanced concepts related to Objective-C Programming languages.

Course Outcomes:

- Understand various computer components, Installation of software. C programming development environment, compiling, debugging, and linking and executing a program using the development environment.
- Analyzing the complexity of problems, Modularize the problems into small modules and then convert them into programs.
- Construct programs that demonstrate effective use of C features including arrays, strings, structures, pointers and files.
- Apply and practice logical ability to solve the real world problems.
- Apply Numerical methods to Solve the complex Engineering problems.

SYLLABUS

1. Write a program to read x, y coordinates of 3 points and then calculate the area of a triangle formed by them and print the coordinates of the three points and the area of the triangle. What will be the output from your program if the three given points are in a straight line?
2. Write a program, which generates 100 random integers in the range of 1 to 100. Store them in an array and then print the arrays. Write 3 versions of the program using different loop constructs. (e.g. for, while, and do while).
3. Write a set of string manipulation functions e.g. for getting a sub-string from a given position, Copying one string to another, Reversing a string, adding one string to another.
4. Write a program which determines the largest and the smallest number that can be stored in different data types like short, int, long, float, and double. What happens when you add 1 to the largest possible integer number that can be stored?
5. Write a program, which generates 100 random real numbers in the range of 10.0 to 20.0, and sort them in descending order.
6. Write a function for transposing a square matrix in place (in place means that you are not allowed to have full temporary matrix).
7. First use an editor to create a file with some integer numbers. Now write a program, which reads these numbers and determines their mean and standard deviation.
8. Given two points on the surface of the sphere, write a program to determine the smallest arc length between them.
9. Implement bisection method to find the square root of a given number to a given accuracy.
10. Implement Newton Raphson method to det. a root of polynomial equation.
11. Given table of x and corresponding f(x) values, Write a program which will determine f(x) value at an intermediate x value by using Lagrange's interpolation/
12. Write a function which will invert a matrix.
13. Implement Simpson's rule for numerical integration.
14. Write a program to solve a set of linear algebraic equations.

Appendix "P" Item No.32

MASTER OF COMPUTER APPLICATIONS (M.C.A)

COURSE STRUCTURE AND SCHEME OF VALUATION W.E.F. 2020-21

I SEMESTER

Code	Name of the subject	Periods/week		Max. Marks		TotalCredits	
		Theory	Lab	Ext.	Int.		
MCA 1.1	Data Structures and Algorithms	4	—	70	30	100	4
MCA 1.2	Probability, Statistics & Queuing Theory	4	—	70	30	100	4
MCA 1.3	Computer Organization	4	—	70	30	100	4
MCA 1.4	Object Oriented Programming With JAVA	4	—	70	30	100	4
MCA 1.5	Operating Systems	4	—	70	30	100	4
MCA 1.6	Data Structures & Programming Lab	—	3	50	50	100	2
MCA 1.7	Computer Organization Lab	—	3	50	50	100	2

MCA 1.1 DATA STRUCTURES AND ALGORITHMS

Instruction: 3 Periods & 1 Tut/week Credits:4

Internal: 30 Marks

University Exam: 70 Marks Total: 100 Marks

Course Objectives

1. Assess how the choice of data structures and algorithm design methods impacts the performance of programs.
2. Choose the appropriate data structure and algorithm design method for a specified application.
3. Solve problems using data structures such as linear lists, stacks, queues, hash tables, binary trees, heaps, tournament trees, binary search trees, and graphs and writing programs for these solutions.
4. Solve problems using algorithm design methods such as the greedy method, divide and conquer, dynamic programming, backtracking, and branch and bound and writing programs for these solutions.

Course Outcomes

1. Describe how arrays, records, linked structures, stacks, queues, trees, and graphs are represented in memory and used by algorithm.
2. Demonstrate different methods for traversing trees.
3. Compare alternative implementations of data structures with respect to performance.
4. Discuss the computational efficiency of the principal algorithms for sorting, searching, and hashing.

SYLLABUS

1. Introduction to Data Structures and Algorithms: Review of C Programming, , Abstract Data Types, Meaning and Definition of Data Structures, Efficiency of Algorithms, Asymptotic Notations, Time complexity estimation using O notation, Average, Best case and Worst case complexities, Analysis of recursive algorithms, Arrays Operations, single and Multi-dimensional array Representation in memory

2. Stacks: Stack as an Abstract Data Type, Primitive Operations, Implementing Stack Operations using Arrays, Infix, Postfix and Prefix: Definitions, Evaluation and Conversions. Queues: Queue as an Abstract Data Type, Operations, Implementation using Arrays, Types of Queues, circular Queue, applications.

3. Linked List: singly linked list, Circular Lists: Insertion, Deletion and Concatenation Operations, Doubly Linked Lists, Multiply linked lists, applications, Implementation of Stacks, Queues and priority Queues using Linked Lists, Dynamic Memory Management, applications .

4. Trees and Binary Trees - Definitions and Terminology, representation of Trees, Binary Tree Terminology, Representation and Traversal, Threaded Binary Trees and their Traversal, Trees and their Applications; Tree Searching: Insertion and Deletion of a node from a Binary Search Tree, AVL Tree operations, Applications

5. Searching and Hashing: Basic Searching, Sequential Searching and its Efficiency, Transpose Sequential search, Binary Search, Interpolation Search, Hash Table structure, Hash Functions, Linear open addressing, chaining, applications

6. Sorting: General Background: Efficiency of Sorting, Bubble Sort, Selection Sorting, Insertion sort, Shell Sort and Quick Sort, Heap Sort, Merge Radix Sorts and their Efficiency

7. Graphs and Their Application: Definition of Graphs, Representation of Graphs, Transitive closure, Linked Representation of Graphs, Graph Traversal and Spanning Forests, Topological sorting of nodes, Undirected Graphs and their Traversals, Applications of Graphs, Minimal Spanning Trees.

Textbooks

1. Data Structures and Algorithms – Concepts, Techniques and Algorithms by G.A.V.Pai , Tata McGraw Hill Publishing

2. Data Structures Using C by Yaddish Langsam, Moshe J. Augenstein and Aaron M.Tanenbaum, Prentice Hall Of India (Low priced Edition)

Reference Books

1. Data Structures using C by E. Balagurusamy, McGraw Hill Education India Pvt Limited

2. Data Structures, Algorithms and Applications with C++, Sahani McGraw Hill.

MCA 1.2 PROBABILITY, STATISTICS & QUEUING THEORY

Instruction: 3 Periods & 1 Tut/week Credits:4

Internal: 30 Marks

University Exam: 70 Marks Total: 100 Marks

Course objectives

1. to provide foundations of probabilistic and statistical analysis
2. to provide an understanding on concepts of probability, random variables, probability distributions, sampling, estimation, hypothesis testing, regression, correlation, multiple regression, hypothesis testing, sample test, queuing methods
3. to explore applications of probabilistic and statistical tools to solve real world problems.

Course outcomes

After completion of the course the student should be able to:

1. define and explain basic concepts in probability theory and how to translate real-world problems into probability models
2. solve standard problems that include random variables, discrete and continuous probability distributions
3. perform Test of Hypothesis and construct a confidence interval to estimate population parameters
4. compute and interpret the results of Correlation Analysis, Multivariate Regression, Chi-Square test for Independence and Goodness of Fit
5. explain basic concepts in Markov processes, M/M/1 and M/M/C queueing systems.

SYLLABUS

1. Probability: Definitions of probability, Addition theorem, Conditional probability, Multiplication theorem, Bayes' Theorem of Probability and Geometric Probability.
2. Random variables and their properties: Discrete Random Variable, Continuous Random Variable, Probability Distribution, Joint Probability Distributions their Properties, Transformation Variables, Mathematical Expectations, Probability Generating Functions.
3. Probability Distributions: Discrete Distributions : Binomial, Poisson Negative Binomial Distributions And Their Properties; Continuous Distributions : Uniform, Normal, Exponential Distributions And Their Properties.
4. Multivariate Analysis : Correlation, Correlation Coefficient, Rank Correlation, Regression Analysis, Multiple Regression, Attributes, Coefficient Of Association, Chi Square Test For Goodness Of Fit, Test For Independence.
5. Estimation: Sample, Populations, Statistic, Parameter, Sampling Distribution, Standard Error, Un-biasedness, Efficiency, Maximum Likelihood Estimator, Notion & Interval Estimation.
6. Testing of Hypothesis: Formulation of Null hypothesis, critical region, level of significance, power of the test;

7. Sample Tests: Small Sample Tests : Testing equality of means, testing equality of variances, test of correlation coefficient, test for Regression Coefficient; Large Sample tests: Tests based on normal distribution

8. Queuing Theory : Queue description, characteristics of a queuing model, study state solutions of M/M/1: Model, M/M/1 ; N Model, M/M/C: Model, M/M/C: N Model , Case studies

Text Books

1. Probability & Statistics for Engineers and Scientists, Walpole, Myers, Myers, Ye. Pearson Education.
2. Probability, Statistics and Random Processes T.Veerarajan Tata McGraw – Hill

Reference Book

1. Probability & Statistics with Reliability, Queuing and Computer Applications, Kishor S. Trivedi, Prentice Hall of India ,1999

MCA 1.3 COMPUTER ORGANIZATION

Instruction: 3 Periods & 1 Tut/week Credits:4

Internal: 30 Marks

University Exam: 70 Marks Total: 100 Marks

Course objectives

1. to introduce students to the foundations of computer organization and architecture including register transfer logic and arithmetic operations
2. to explore the different types of addressing modes and memory organization
3. to expose students to the basic architecture and functionality of processing, memory and I/O organization in a computer system.
4. to introduce students to the design and implementation of simple CPU and micro-sequencer.

Course outcomes

After completion of the course the student should be able to:

1. describe the internal organization of a computer, CPU, memory unit, input/outputs and the functional units of a processor
2. manipulate representations of numbers stored in digital computers
3. explain addressing modes, instruction formats and program control statements
4. understand the theory and architecture of central processing unit and micro-sequencer.

SYLLABUS

1. Introduction to Computer Organization, CPU Organization, Memory subsystem Organization, and Interfacing, I/O Subsystem Organization and Interfacing, a relative Simple Computer, An8085 Based Computer

2. Computer arithmetic & Digital Logic Fundamentals: Unsigned, Notation, Signed Notation, Binary Code Decimal, Specialized Arithmetic Hardware, Floating Point Numbers, The IEEE 754 Floating Point Standard; Boolean Algebra, Basic functions, Mapping Boolean Functions, Combinatorial Logic, Combinational Circuits, Sequential circuits.

3. Register Transfer Languages: Micro Operations and Register Transfer Language, RTL Specification, Digital systems, More Complex Digital Systems, VHDL-VHSIC Hardware Description Language

4. Instruction Set architecture: Levels of Programming Languages,< Assembly Language Instructions, Instruction Set Architecture Design, A Relatively Sample Instruction Set Architecture, 8085 Microprocessor Instruction Set Architecture.

5. CPU Design: Specifying a CPU, Design & Implementation of a Very Simple CPU, Short comings of the simple CPUs, Internal Architecture of the 8085 microprocessor.

6. Microprocessor Control Unit Design: Basic Micro-sequencer Design, Design and Implementation of very simple Micro-sequencer, Reducing the number of Micro Instructions, Micro-programmed controls Hardware Control, A(Mostly) Micro-coded CPU, The Pentium Microprocessor.

7. Memory & I/O Organization: Hierarchical Memory systems, Cache Memory Systems, Virtual Memory., Memory Management in a Pentium/Windows Personal computer, Input/output Organization, Organization of Asynchronous Data Transfers, Programmed I/O, Interrupts, Directory Memory Access, I/O Processors, Serial Communications, Serial Communication Standards.

Text Book

1. Computer Systems Organization & Architecture, John D. Carpinelli, Addison Wesley Longman, Inc ./ Pearson Education , 1993

Reference Books

1. Computer System Architecture, M. Morris Mano, Third Edition, Pearson Education, 2007

2. Computer Architecture and organization: Design Principles and Applications, B. Govindarajalu, TMH Publishing Company Ltd., 2004

3. Fundamentals of Computer organization and Design, Sivarama P. Dandamudi Springer International Edition, 2004

MCA 1.4 OBJECT ORIENTED PROGRAMMING WITH JAVA

Instruction: 3 Periods & 1 Tut/week Credits:4

Internal: 30 Marks

University Exam: 70 Marks Total: 100 Marks

Course Objectives

1. To understand Object Oriented Programming concepts, class hierarchy, characteristics of Java, inheritance and polymorphism and become familiar with the relationship between classes and objects in a Java program.

2. Learn programming based on JAVA 7 and above.

3. To write efficient and effective applications in Java, Java's event handling model, graphical user interface (GUI), swing component set, understand the relationship between the AWT and Swing.

4. Have a better understanding of Java's event model and design, build simple Graphical User Interfaces (GUI)s, Networking, Java Database Connectivity with JDBC™, Servlets, JavaServer Pages (JSP).

Course outcomes

1. The course aims to make the students learn programming in Java. Java language elements and characteristics, including data types, operators, and control structures are discussed in order to make the students develop Java applications.

2. The course also intended for students who would like to learn how to develop internet based applications, graphical user interface (GUI), and graphics in both AWT and SWING.

3. Advanced Java topics discussed helps students writing programs for Java database connectivity with JDBC; Manipulating databases with JDBC; Programming for Internet, JavaServer pages.

SYLLABUS

1. Introduction to Computers, Programming, and Java; Elementary Programming; Selections; Mathematical Functions, Characters, and Strings; Loops;

2. Methods; Single-Dimensional Arrays; Multidimensional Arrays; Objects and Classes; Object-Oriented Thinking;

3. Inheritances and Polymorphism; Exception Handling and Text I/O; Abstract Classes and Interfaces.

4. JavaFX Basics; Event-Driven Programming and Animations;

5. JavaFX UI Controls and Multimedia; Multithreading and Parallel Programming;
6. Networking; Java Database Programming ;
7. Servlets; JavaServer Pages.

Text Book

1. Introduction to Java Programming Comprehensive version, Y. Daniel Liang, Tenth Edition, Pearson Education, Inc.

Reference Books

1. Object Oriented Programming Through Java, P. Radha Krishna, CRC Press.
2. Java And Object Oriented Programming Paradigm, Debasish Jana, PHI Learning Pvt. Ltd.

MCA 1.5 OPERATING SYSTEMS

Instruction: 3 Periods & 1 Tut/week Credits:4

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course objectives

1. to provide overview of types of operating systems, operating system calls and services
2. to introduce the notion of a process and various stages of processes, including scheduling, creation, and termination
3. to explore inter-process communication using shared memory and message passing and to introduce the critical-section problem
4. to introduce CPU scheduling and various CPU-scheduling algorithms
5. to develop a description of deadlocks and different methods for preventing or avoiding deadlocks
6. to explore various techniques of allocating memory to processes, how paging works, the concepts of virtual memory, demand paging and page-replacement algorithms
7. to describe the details of implementing local file systems and directory structures and to introduce the characteristics of mass-storage devices, disk scheduling.

Course outcomes

After completion of the course the student should be able to:

1. describe the basic concepts of operating systems, including structure and components
2. explain how memory, I/O devices, files, processes and threads are managed, and evaluate the performance of various scheduling algorithms

3. explain the concepts covered in concurrency control, including mutual exclusion and synchronization, deadlock and starvation

4. understand key concepts on physical and virtual memory, scheduling, I/O and file systems and mass storage structures.

SYLLABUS

1. Introduction to Operating Systems: Over view of Operating Systems, Types Of Operating Systems, Operating System Structures, Operating-System Services, System Calls, Virtual Machines, Operating System Design and Implementation.

2. Process Management: Process Concepts, Operations On Processes, Cooperating Processes, Threads, Inter Process Communication, Process Scheduling, Scheduling Algorithms, Multiple - Processor Scheduling. Thread Scheduling.

3. Process Synchronization: The Critical Section Problem, Semaphores, And Classical Problems Of Synchronization, Critical Regions, Monitors, Synchronization examples

4. Deadlocks: principles of Deadlocks,-System Model, Deadlocks Characterization, Methods For Handling Deadlocks, Deadlock- Prevention, Avoidance, Detection,& Recovery from Deadlocks

5. Memory Management: Logical Versus Physical Address, Swapping, contiguous memory allocation, paging, structure of the page table , segmentation, , Virtual Memory, Demand Paging, Page Replacement Algorithms, Thrashing

6. File System Implementation: Concept of a file, Access Methods, Directory Structure, Protection, File System Structure, Allocation Methods, Free Space Management, Directory Management, Device Drivers

7. Mass-storage structure: overview of Mass-storage structure, Disk structure, disk attachment, disk scheduling, swap-space management.

Text Book

1. Operating Systems, Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Wiley John Publ., Seventh Edition.

Reference Books

1. Operating Systems, William Stallings 5th Edition - PHI
2. Operating Systems: A Design-Oriented Approach', Charles Crowley, 'Tata Hill Co.,1998 edition.

3. Modern Operating Systems, Andrew S.Tanenbaum, , 2nd edition, 1995, PHI.

4. Operating Systems - A concept based approach, Dhamdhere, 2nd Edition, TMH, 2006.

5. Understanding the Linux Kernel, Daniel P Bovet and Marco Cesati, 3rd Edition,' Reilly, 2005.

MCA 1.6 DATA STRUCTURES AND PROGRAMMING LAB

Instruction: 3 Periods/week Credits:2

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

Course Objectives

1. To implement stacks and queues using arrays and linked lists.
2. To develop programs for searching and sorting algorithms.
3. To write programs using concepts of various trees.
4. To implement programs using graphs.

Course Outcomes

1. Student will be able to write programs to implement stacks and queues.
2. Ability to implement various searching and sorting techniques.
3. Ability to implement programs using trees and graphs.

List of Programs

1. Write a program for sorting a list using Bubble sort and then apply binary search.
2. Write a program to implement the operations on stacks.
3. Write a program to implement the operations on circular queues.
4. Write a program for evaluating a given postfix expression using stack.
5. Write a program for converting a given infix expression to postfix form using stack.
6. Write a program for implementing the operations of a priority queue using dynamic allocation.
7. Write a program for the representation of polynomials using circular linked list and for the addition of two such polynomials
8. Write a program for quick sort
9. Write a program for Merge sort.

10. Write a program for Heap sort

11. Write a program to create a binary search tree and for implementing the in order, preorder, post order traversal using recursion

12. a)Write a program for finding the transitive closure of a digraph

b)Write a program for finding the shortest path from a given source to any vertex in a digraph using Dijkstra's algorithm.

MCA 1.7 COMPUTER ORGANIZATION LAB

Instruction: 3 Periods/week Credits:2

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

Course objectives

1. to design and analyze the operational behavior of IC gates, multiplexers, decoders, flip-flops, counters, shift registers, binary adders and subtractors and ALU
2. to implement assembly language programming using various trainers

3. to make students familiar with Pentium class PC architecture

Course outcomes

After completion of the course the student should be able to:

1. analyze the operational behavior of various digital logic units such as multiplexers, decoders, flip-flops, counters, shift registers, binary adders and subtractors and ALU

2. write assembly language code using various trainers

3. understand Pentium class PC architecture.

I - Cycle: Digital Logic Design Experiments

1. TTL Characteristics and TTL IC Gates

2. Multiplexers & Decoders

3. Flip-Flops

4. Counters

5. Shift Registers

6. Binary Adders & Subtractors

7. A L U

II - CYCLE: 8085 Assembly Language Programming

1. 8085 Assembly Language Programming according to theory course microprocessors-I using the following trainers:

Keyboard Monitor of 8085µP Trainer

Serial Monitor of 8085µP Trainer with Terminal

8085 Line Assembler of 8085µP Trainer with PC as Terminal

8085 Cross Assembler using In-Circuit Emulator (ICE) with 8085µP Trainer and PC as Terminal

Graded Problems are to be used according to the syllabus of COMPUTER ORGANIZATION

2. PENTIUM CLASS PC ARCHITECTURE FAMILIARIZATION
HARDWARE & SOFTWARE PARTS DEMONSTRATION

II Semester

Code	Name of the subject	Periods/week		Max. Marks		TotalCredits	
		Theory	Lab	Ext.	Int.		
MCA 2.1	Web Technologies	4	—	70	30	100	4
MCA 2.2	Data Base Management Systems	4	—	70	30	100	4
MCA 2.3	Artificial Intelligence	4	—	70	30	100	4
MCA 2.4	Business Analytics	4	—	70	30	100	4
MCA 2.5	Elective-I	4	—	70	30	100	4
MCA 2.6	Web Technologies Lab	—	3	50	50	100	2
MCA 2.7	Data Base Management Systems Lab	—	3	50	50	100	2

Elective I

Computer Graphics/Embedded Systems/Formal Languages and Automata Theory/Management Accountancy

MCA 2.1 WEB TECHNOLOGIES

Instruction: 3 Periods & 1 Tut/week Credits:4

Internal: 30 Marks

University Exam: 70 Marks Total: 100 Marks

Course objectives

1. to familiarize students with the formats and languages used in modern web-pages including HTML, CSS, XML, Javascript, DOM
2. to establish database connectivity using JDBC and implement embedded SQL
3. to introduce students to the concepts of servlet, JSP, client request handling and response and MVC architecture.

Course outcomes

After completion of the course the student should be able to:

1. understand and be able to analyse any real time web application
2. acquire working knowledge to develop web applications using both client side and server side scripting and retrieving data from databases

3. appreciate the importance of MVC architecture pattern in development of web applications.

SYLLABUS

1. Introduction to HTML , Core Elements , Links and Addressing, Images , Text , Colors and Background, Lists, Tables and Layouts , Frames, Forms , Cascading Style Sheets.

2. Introduction to Java Scripts, Elements of Objects in Java Script, Dynamic HTML with Java Script

3. Document type definition, XML Syntax, XML Schemas, Document Object model, Presenting XML, Using XML Processors

4. JDBC OBJECTS- JDBC Driver Types, JDBC Packages, Database Connection, Statement Objects, Result Set.

5. JDBC and Embedded SQL - Tables, Inserting Data into Tables , Selecting Data from a Table, Meta Data ,Updating Table , Deleting data from Table , Joining Table , Calculating Data, Grouping and Ordering Data , Sub queries ,View.

6. Introduction to Servlet, Servlet Life Cycles, Servlet Basics, Tomcat Web Server, Configuring Apache Tomcat, Handling Client Request and Response, Handling Cookies, Session Tracking

7. Introduction to JSP, Benefits of JSP, Basic Syntax, Invoking Java code with JSP Scripting Elements, JSP Page Directive, Including Files in JSP Pages,

8. Introduction to Java Beans, Using JAVA Bean Components in JSP Documents, MVC Architecture.

Text Books

1. Web Programming, building internet applications, 2nd Ed., Chris Bates, Wiley Dreamtech
2. The complete Reference HTML and DHTML, Thomas A. Powey
3. The complete Reference J2ME, James Keogh
4. Core Servlets and Java Server Pages, Marty Hall Larry Brown, Second Edition

Reference Books

1. Internet , World Wide Web , How to program, Dietel , Nieto, PHI/PEA
2. Web Technologies, Godbole, Kahate, 2nd Ed., TMH

MCA 2.2 DATA BASE MANAGEMENT SYSTEMS

Instruction: 3 Periods & 1 Tut/week Credits:4

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course objectives

1. to introduce students to the database concepts of relational model, relational algebra, SQL and various database design architectures
2. to understand conceptual database design, ER diagrams, functional dependencies and standard database design practices such as normalization
3. to familiarize students with database application design tools including embedded SQL, JDBC, cursors and stored procedures
4. to understand transaction management, concurrency control and recovery systems.

Course outcomes

After completion of the course the student should be able to:

1. apply formal database ideas of ER diagrams, functional dependencies and normalization in development of real world database applications
2. be familiar with modern database application design tools and interfaces
3. understand the notion of concurrency, its importance in transactions and various recovery techniques.

SYLLABUS

1. Database Systems: Introduction to the Database Systems, Concepts of Relational Models and Relational Algebra. SQL: Introduction to SQL Queries, Integrity Constraints, Joins, Views, Intermediate and Advanced SQL features and Triggers.
2. Database Design: Overview of the Design process, E-R Models, Functional dependencies and other kinds of dependencies, Normal forms, Normalization and Schema Refinement.
3. Database Application Design and Development: User Interfaces and Tools, Embedded SQL, Dynamic SQL, Cursors and Stored procedures, JDBC, Security and Authorization in SQL, Internet Applications.
4. Query Evaluation: Overview, Query processing, Query optimization, Performance Tuning.
5. Database System Architectures: Centralized and Client-Server Architecture, Server system Architecture, Parallel and Distributed database,

Object based databases and XML. Advanced data types in databases. Cloud based data storage systems.

6. Transaction Management: Overview of Transaction Management, Transactions, Concurrency control, Recovery systems, Advanced Transaction Processing.

7. Case Studies: Postgre SQL, Oracle, IBM DB2 Universal Database, Microsoft SQL Server.

Text Book

1. Database System Concepts, Avi Silberschatz , Henry F. Korth , S. Sudarshan McGraw- Hill, Sixth Edition, ISBN 0-07-352332-1.

Reference Book

1. Database Management Systems, Raghu Ramakrishnan, Johannes Gehrke, McGraw-Hill.

MCA 2.3 ARTIFICIAL INTELLIGENCE

Instruction: 3 Periods & 1 Tut/week Credits:4

Internal: 30 Marks

University Exam: 70 Marks Total: 100 Marks

Course objectives

1. to introduce students to the key concepts in AI, standard AI problems and techniques
2. to formulate AI problems as state space search and understand the standard search techniques including BFS, DFS, heuristic search techniques, hill climbing, Best-First Search, A* Algorithm, AO* Algorithm, Constraint Satisfaction, Means-Ends Analysis
3. to understand how knowledge is represented in computers, the various structured representations and symbolic logic
4. explore the key ideas in Expert Systems and Natural Language Processing.

Course outcomes

After completion of the course the student should be able to:

1. understand AI problem characteristics and state space approach for solving AI problem. The student will have learned several optimal search strategies and the use of heuristics
2. understand relational, inferential, inheritable and procedural knowledge and the corresponding knowledge representation approaches
3. acquire AI problem solving approaches to natural language processing, planning and expert systems.

SYLLABUS

1. Introduction to Artificial Intelligence: Artificial Intelligence, AI Problems, AI Techniques, The Level of the Model, Criteria For Success. Defining the Problem as a State Space Search, Problem Characteristics , Production Systems, , Production System Characteristics

2. Search: Issues in The Design of Search Programs, Un-Informed Search, BFS, DFS; Heuristic Search Techniques: Generate-And- Test, Hill Climbing, Best-First Search, A* Algorithm, Problem Reduction, AO*Algorithm, Constraint Satisfaction, Means-Ends Analysis.

3. Knowledge Representation: Procedural Vs Declarative Knowledge, Representations and Mappings, Approaches to Knowledge Representation, Issues in Knowledge Representation, Logic Programming Forward Vs Backward Reasoning,

4. Symbolic Logic: Propositional Logic, First Order Predicate Logic: Representing Instance and is- a Relationships, Computable Functions and Predicates, Syntax & Semantics of FOPL, Normal Forms, Unification &Resolution, Representation Using Rules, Natural Deduction.

5. Structured Representations of Knowledge: Semantic Nets, Partitioned Semantic Nets, Frames, Conceptual Dependency, Conceptual Graphs, Scripts, Matching Techniques, Partial Matching, Fuzzy Matching Algorithms and RETE Matching Algorithms.

6. Reasoning under Uncertainty: Introduction to Non-Monotonic Reasoning, Truth Maintenance Systems, Statistical Reasoning: Bayes Theorem, Certainty Factors and Rule-Based Systems, Bayesian Probabilistic Inference, Bayesian Networks, Dempster-Shafer Theory, Fuzzy Logic & Fuzzy Systems.

7. Experts Systems: Overview of an Expert System, Structure of an Expert Systems, Different Types of Expert Systems- Rule Based, Model Based, Case Based and Hybrid Expert Systems, Knowledge Acquisition and Validation Techniques, Black Board Architecture, Knowledge Building System Tools, Expert System Shells

8. Natural Language Processing: Role of Knowledge in Language Understanding, Approaches Natural Language Understanding, Steps in The Natural Language Processing, Syntactic Processing and Augmented Transition Nets, Semantic Analysis, NLP Understanding Systems; Planning, Components of a Planning System, Goal Stack Planning, Hierarchical Planning, Reactive Systems.

Text Book

1. Artificial Intelligence, Elaine Rich, McGraw-Hill Publications

Reference Books

1. Introduction To Artificial Intelligence & Expert Systems, Patterson, PHI

2. Artificial Intelligence, George F Luger, Pearson Education Publications

3. Artificial Intelligence, Robert Schalkoff, McGraw-Hill Publications

MCA 2.4 BUSINESS ANALYTICS

Instruction: 3 Periods & 1 Tut/week Credits:4

Internal: 30 Marks

University Exam: 70 MarksTotal: 100 Marks

Course objectives

1. to introduce students to problem solving with Business Analytics and the use of spreadsheets for descriptive analytics, data queries and visualization

2. to introduce students to statistical sampling, sampling distributions, confidence intervals and statistical inference

3. to familiarize students with various types of regression including simple linear regression and multiple linear regression

4. to introduce students to key concepts in statistical forecasting models for time series data

5. to familiarize students with predictive decision modeling, model analysis and developing spreadsheet applications including building linear optimization models on spreadsheets.

Course outcomes

After completion of the course the student should be able to:

1. describe data and models used for Business Analytics and apply various descriptive analytic techniques to analyze data

2. estimating population parameters, interval estimates, construct confidence intervals and perform hypothesis testing

3. estimate and interpret the parameters of simple linear regression and multiple linear regression

4. apply forecasting models for various time series data including stationary time series, time series with linear trend and time series with seasonality

5. implement models on spreadsheets, develop user-friendly applications and build linear poptimization models on spreadsheets.

SYLLABUS

1. Foundations of Business Analytics: Evolution of Business Analytics, Scope, data and models for Business Analytics, problem solving with Business Analytics, Analytics on spreadsheets, Excel functions for Database queries, Add-ons for Business Analytics. Descriptive Analytics: Data visualization, creating charts in MS Excel, Data Queries, Tables, sorting and

filtering, Data summarization with statistics, Data exploration using Pivot tables

2. Statistical Sampling: methods, estimating population parameters, sampling error, sampling distributions, interval estimates, confidence intervals, using confidence intervals for decision making, prediction intervals

Statistical Inference: Hypothesis testing, one-sample Hypothesis testing, two-tailed test of Hypothesis for mean, two-sample Hypothesis testing, Analysis of variance, chi-square test for independence

3. Trendliness and Regression: Modelling Relationships and trends in data, Simple linear regression, least squares regression, regression on analysis of variance, testing hypothesis for regression coefficients, Confidence intervals for regression coefficients, Residual analysis and regression assumptions, Multiple linear regression, building regression models, regression with categorical independent variables with two or more levels, regression with nonlinear terms, advanced techniques for regression modelling

4. Forecasting Techniques: Qualitative and judgemental forecasting, statistical forecasting models, forecasting models for stationery time series, forecasting models for time series with linear trend, forecasting models for time series with seasonality, selecting appropriate time-series-based forecasting models, regression forecasting with casual variables, practice of forecasting

5. Spreadsheet modeling and Analysis: Strategies for predictive decision modelling, Implementing models on spreadsheet, spreadsheet applications in Business analytics, Model assumptions, complexity and realism, developing user-friendly applications, analyzing uncertainty and model assumptions, model analysis using analytics solver platform

6. Linear Optimization & Applications: Building Linear Optimization Models on spreadsheets, solving Linear Optimization models, Graphical interpretation of linear optimization, Using optimization models of prediction and insight, Types of constraints in optimization models, process selection models, Blending Models, Portfolio Investment models

Text Book

1. "Business Analytics: Methods, Models, and Decisions" James R. Evans, Pearson Publications, Second edition

Reference Book

1. "Business Analytics: The Science of Data-Driven Decision Making", U.Dinesh Kumar, Wiley Publications

MCA 2.5 Elective - I COMPUTER GRAPHICS

Instruction: 3 Periods & 1 Tut/week Credits:4

Internal: 30 Marks

University Exam: 70 Marks Total: 100 Marks

Course Objectives

1. Provides a comprehensive introduction to computer graphics with a foundation in Graphics Applications.
2. A thorough introduction to computer graphics techniques.
3. To give the basics of Geometric Transformations and projections.
4. To introduce three dimensional concepts and object representations with color models and basics of computer animation.

Course Outcomes

1. The students will understand graphics principles and graphics hardware.
2. The students can demonstrate geometrical transformations.
3. The students can create interactive graphics applications and demonstrate computer graphics animation.

SYLLABUS

1. Introduction: Computer Graphics and their applications: Computer Aided Design, Computer Art, Entertainment, Education and Training, Graphical User Interfaces; Overview of Graphics systems: Video Display Devices, Raster Scan Systems, Random Scan Systems, Graphics Monitors And Workstations, Input Devices, Hard Copy Devices, Interactive Input Methods, Windows and Icons, Virtual Reality Environments, Graphics Software

2. Output primitives: Points and Lines, , Line and Curve Attributes, Color and Gray scale levels, Antialiasing, Loading the Frame buffer, Line function, Line Drawing Algorithms, Circle Generating Algorithms, Ellipse Generating Algorithms, Pixel Addressing, Area Fill Attributes, Filled Area Primitives, Filled Area Functions, Cell Array, Character Generation, Character Attributes, Bundled Attributes, Curve Functions, Parallel Curve Algorithms.

3. Two Dimensional Transformations: Basic 2D Transformations, Matrix Representations, Homogeneous Coordinates, Composite Transformations, Other Transformations, Transformations between Coordinate Systems, Affine Transformations.

4. Three Dimensional Transformations & Projections: Translation, Rotation, Scaling, Other Transformations, Composite Transformations, 3D Transformation Functions, Modeling and Coordinate Transformations, Need for projections, Parallel & Perspective projections, General Projection Transformations.

5. Viewing Pipeline and Clipping operations : Viewing Pipeline ,Viewing Coordinates & Reference frames, Window-to-Viewport Coordinate Transformation, Two Dimensional Viewing Functions, , Three Dimensional Viewing, View Volumes, Clipping and its Operations, Types of clipping

operations- Point Clipping, Line Clipping, Polygon Clipping,, Curve Clipping,, Text and Exterior Clipping.

6. Three Dimensional Concepts and Object representations: 3D display methods, 3D Graphics, Polygon Surfaces, Curved Lines and Surfaces, Quadratic Surfaces, Super Quadrics, Blobby Objects, SplineRepresentations, Cubic Spline methods, Bézier Curves and Surfaces, B-Spline Curves and Surfaces.

7. Color Models and Basics of Computer Animation: Intuitive color concepts, Basics of RGB Color model, YIQ Color Model, CMY & HSV Color models. Design of animation Sequences, Raster Animations, Key Frame systems: Morphing, A Simple program on Animation.

Text Book

1. Computer Graphics, Donald Hearn & M. Pauline Baker, Pearson Education, New Delhi.

Reference Books

1. Procedural Elements for Computer Graphics, David F.Rogers, Tata Mc Graw Hill Book Company, NewDelhi, 2003.

2. Computer Graphics: Principles & PracticeinC, J.D.Foley, S.KFeiner, AVanDam F.H John Pearson Education, 2004.

3. Computer Graphics using Open GL, Franscis S Hill Jr, Pearson Education, 2004.

4. Computer Vision and Image Processing: A Practical Approach using CVIP tools, S.E. Umbaugh, Prentice Hall, 1998.

MCA 2.5 Elective-I EMBEDDED SYSTEMS

Instruction: 3 Periods & 1 Tut/week Credits:4

Internal: 30 Marks University Exam: 70 MarksTotal: 100 Marks

Course objectives

1. to make students familiar with embedded system architecture, Microprocessor Architecture, Round–Robin Architecture and typical hardware of an embedded system

2. to understand the concept of shared data and semaphores, message queues and RTOS design

3. to understand how to get the embedded software into target system and testing on host machine.

Course outcomes

After completion of the course the student should be able to:

1. describe embedded system architecture and its typical hardware

2. understand tasks and task states, shared data and semaphores, message queues

3. test embedded software on host machines using instruction set simulators

SYLLABUS

1. Examples of Embedded Systems – Typical Hardware – Memory – Microprocessors – Busses – Direct Memory Access – Introduction to 8051 Microcontroller – Architecture-Instruction set – Programming

2. Microprocessor Architecture – Interrupt Basics – The Shared-Data problem – Interrupt Latency.

3. Round–Robin Architecture - Round–Robin with Interrupts Architecture - Function-Queue- Scheduling Architecture – Real-Time Operating Systems Architecture – Selection of Architecture.

4. Tasks and Task States – Tasks and Data – Semaphores and Shared Data – Semaphore Problems – Semaphore variants.

5. Message Queues – Mailboxes – Pipes – Timer Functions – Events – Memory Management – Interrupt Routines in RTOS Environment.

6. RTOS design – Principles – Encapsulation Semaphores and Queues – Hard Real- Time Scheduling Considerations – Saving Memory Space – Saving Power.

7. Host and Target Machines – Linker/Locator for Embedded Software- Getting Embedded Software into the Target System.

8. Testing on your Host Machine – Instruction Set Simulators – Laboratory Tools used for Debugging.

Text Book

1. The 8051 Microcontroller Architecture, Programming & Applications, Kenneth J. Ayala, Penram International.

2. An Embedded Software Primer, David E. Simon, Pearson Education , 2005.

Reference Book

1. Embedded Systems: Architecture , Programming and Design, Raj Kamal, Tata McGraw-Hill Education, 2008

MCA 2.5 Elective - I FORMAL LANGUAGES & AUTOMATA THEORY

Instruction: 3 Periods & 1 Tut/week Credits:4

Internal: 30 Marks University Exam: 70 MarksTotal: 100 Marks

Course objectives

1. to introduce students to the concepts in automata theory and theory of computation to design grammars and recognizers for different formal languages

2. to employ finite state machines to solve problems in computing

3. to introduce context free grammars and Turing Machines and their properties as the basis for the formal expressivity of computer languages
4. to understand the concepts of tractability and decidability, the concepts of NP-completeness and NP-hard problems.

Course outcomes

After completion of the course the student should be able to:

1. think analytically for problem solving situations in related areas of theory in computer science
2. describe the language accepted by an automata or generated by a regular expression or a context-free grammar
3. understand the functioning of Finite-State Machines, Deterministic Finite-State Automata, Nondeterministic Finite-State Automata and Pushdown Automata and Turing Machines.

SYLLABUS

1. Finite Automata and Regular Expressions: Basic Concepts of Finite State Systems, Deterministic and Non-Deterministic Finite Automata, Finite Automata with λ -moves, Regular Expressions, Mealy and Moore Machines, Two-Way Finite Automata, Applications of FSM.
 2. Regular sets & Regular Grammars: Basic Definitions of Formal Languages and Grammars, Regular Sets and Regular Grammars, Closure Properties of Regular Sets, Pumping Lemma for Regular Sets, Decision Algorithm for Regular Sets, Myhill-Nerode Theorem, Minimization of Finite Automata.
 3. Context Free Grammars and Languages: Context Free Grammars and Languages, Derivation Trees, Simplification of Context Free Grammars, Normal Forms, Pumping Lemma for CFL, Closure properties of CFL's, Decision Algorithm for CFL.
 4. Push down Automata: Informal Description, Definitions, Push-Down Automata and Context free Languages, Parsing and Push-Down Automata.
 5. Turing Machines: The Definition of Turing Machine, Design and Techniques for Construction of Turing Machines, Combining Turing Machines.
 6. Universal Turing Machines and Undecidability : Universal Turing Machines. The Halting Problem, Variants of Turing Machines, Restricted Turing Machines , Decidable & Undecidable Problems - Post Correspondence Problem.
 7. Chomsky Hierarchy of Languages: Regular Grammars, Unrestricted Grammars, Context Sensitive languages, Relationship between Classes of Languages.
- Text Book

1. Introduction to Automata Theory, Languages and Computations – J.E. Hopcroft, & J.D. Ullman , Pearson Education Asia.

Reference Books

1. Introduction to languages and theory of computation – John C. Martin (MGH)
2. Theory of Computation, KLP Mishra and N. Chandra Sekhar, IV th Edition, PHI
3. Introduction to Theory of Computation – Michael Sipser (Thomson Nrools/Cole)

MCA 2.5 Elective - I MANAGEMENT ACCOUNTANCY

Instruction: 3 Periods & 1 Tut/week Credits:4

Internal: 30 Marks

University Exam: 70 Marks Total: 100 Marks

Course objectives

1. to introduce students to fundamental concepts in accounting, double entry book keeping and the basic books of accounts
2. to analyze financial statements by using ratio analysis and Fund Flow Statement
3. to explore the basic principles of budgetary control, marginal costing and break-even analysis
4. to familiarize students with computerized accounting systems

Course outcomes

After completion of the course the student should be able to:

1. prepare Trading, Profit And Loss Account And Balance Sheet of sole proprietary concerns
2. calculate key financial indicators using ratio analysis and prepare Fund Flow Statement
3. understand the key concepts in marginal costing and construct Break Even Chart.

SYLLABUS

1. Principles Of Accounting : Nature And Scope Of Accounting, Double Entry System Of Accounting, Introduction To Basic Books Of Accounts Of Sole Proprietary Concern, Closing Of Books Of Accounts And Preparation Of Trial Balance.
2. Final Accounts : Trading, Profit And Loss Accounts And Balance Sheet Of Sole Proprietary Concern With Normal Closing Entries. (With numerical problems)
3. Ratio Analysis: Meaning, Advantages, Limitations, Types of Ratio and Their Usefulness. (Theory only) Fund Flow Statement: Meaning Of The Term Fund, Flow Of Fund, Working Capital Cycle, Preparation and Inter-preparation Of Statement.

4. Costing: Nature, Importance And Basic Principles. Budget and Budgetary Control: Nature And Scope, Importance Method Of Finalization And Master Budget, Functional Budgets.

5. Marginal Costing : Nature, Scope, Importance, Construction Of Break Even Chart, Limitations And Uses Of Break Even Chart, Practical Applications Of Marginal Costing.(with numerical problems)

6. Introduction To Computerized Accounting System: Coding Logic And Codes Required, Master Files, Transaction Files, Introduction To Documents Used For Data Collection, Processing Of Different Files And Outputs Obtained.

Text Books

1. Introduction to Accountancy. T.S.Grewal.
2. Management Accountancy, S .P.Jain.

Reference Book

1. Introduction To Accounting, G.Agarwal

MCA 2.6 WEB TECHNOLOGIES LAB

Instruction: 3 Periods/week Credits:2

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

Course objectives

1. to introduce students to design of web pages learn and practice client and server side programming
2. to understand database connectivity and implement web enabling of databases
3. to apply multimedia effects on web pages.

Course outcomes

After completion of the course the student should be able to:

1. design web pages using modern web constructs and client and server side programming.
2. enable database connectivity to websites
3. apply multimedia effects on web pages design using Flash.

List of programs

1. Design of the Web pages using various features of HTML and DHTML
2. Client server programming using Servlets, ASP and JSP on the server side and java script on the client side
3. Web enabling of databases
4. Multimedia effects on web pages design using Flash.

5. Case Study: Design & Development of Websites with Database Connectivity and Multimedia Effects

Reference Books

1. Internet and Web Technologies by Raj Kamal, Tata McGraw-Hill
2. Programming the World Wide Web by Robert W. Sebesta, Pearson Education.

MCA 2.7 DATABASE MANAGEMENT SYSTEMS LAB

Instruction: 3 Periods/week Credits:2

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

Course Objectives

1. To introduce to a commercial DBMS such as ORACLE.
2. To learn and practice SQL commands for schema creation, data manipulation.
3. To learn conceptual and physical database design based on a case study.
4. To apply database design stages by studying a case study.

Course Outcomes

1. The student is exposed to a commercial RDBMS environment such as ORACLE.
2. The student will learn SQL commands for data definition and manipulation.
3. The student understands conceptual through physical data base design.
4. The student takes up a case study and applies the design steps.

Features of a commercial RDBMS package such as ORACLE/DB2, MS Access, MYSQL & Structured Query Language (SQL) used with the RDBMS.

I Laboratory Exercises should include

1. Defining Schemas for Applications,
2. Creation of Database,
3. Writing SQL Queries,
4. Retrieve Information from Database,
5. Creating Views
6. Creating Triggers
7. Normalization up to Third Normal Form
8. Use of Host Languages,
9. Interface with Embedded SQL,

10. Use of Forms

11. Report Writing

II Some sample applications are given below

1. Accounting Package for Shops,
2. Database Manager for Magazine Agency or Newspaper Agency,
3. Ticket Booking for Performances,
4. Preparing Greeting Cards & Birthday Cards
5. Personal Accounts - Insurance, Loans, Mortgage Payments, Etc.,
6. Doctor's Diary & Billing System
7. Personal Bank Account
8. Class Marks Management
9. Hostel Accounting
10. Video Tape Library,
11. History of Cricket Scores,
12. Cable TV Transmission Program Manager,
13. Personal Library.
14. Sailors Database
15. Suppliers and Parts Database

III Semester

Code	Name of the subject	Periods/week		Max. Marks		TotalCredits	
		Theory	Lab	Ext.	Int.		
MCA 3.1	Computer Networks	4	—	70	30	100	4
MCA 3.2	Python Programming	4	—	70	30	100	4
MCA 3.3	Software Engineering	4	—	70	30	100	4
MCA 3.4	Data Warehousing & DataMining	4	—	70	30	100	4
MCA 3.5	Elective-II	4	—	70	30	100	4
MCA 3.6	Network Programming Lab	—	3	50	50	100	2
MCA 3.7	Python Programming Lab	—	3	50	50	100	2

Elective II

Image Processing/Mobile Computing/ Network Security and Cryptography/E-Commerce

MCA 3.1 COMPUTER NETWORKS

Instruction: 3 Periods & 1 Tut/week Credits:4

Internal: 30 Marks

University Exam: 70 Marks Total: 100 Marks

Course objectives

1. to introduce to the students the basic requirements of network hardware, software and its architecture.

2. to familiarize the students with layered architecture of the network software and hierarchical nature of the network physical infrastructure

3. to study various network interconnecting devices and other associated network hardware

4. to introduce advanced networking concepts, wireless and wireless sensor networks.

Course outcomes

After completion of the course the student should be able to:

1. understand the design and estimate the requirements for practical setup of a given network scenario and size

2. realize the operation, maintenance and management of the internet by mapping the theoretical networking concepts to the real-time network scenarios

3. demonstrate the applications of wireless networks and overview of advanced networking concepts

4. identify different networking devices and their usage and functionality.

SYLLABUS

1. Introduction to Computer Networks: Introduction, Network Hardware, Network Software, Reference Models, Data Communication Services & Network Examples, Internet Based Applications.

2. Data Communications: Transmission Media, Wireless Transmission, Multiplexing, Switching, Transmission in ISDN, Broad Band ISDN, ATM Networks,

3. Data Link Control, Error Detection & Correction, Sliding Window Protocols, LANs & MANs: IEEE Standards for LANs & MANs-IEEE Standards 802.2, 802.3, 802.4, 802.5, 802.6, High Speed LANs.

4. Design Issues in Networks: Routing Algorithms, Congestion Control Algorithms, Network Layer in the Internet, IP Protocol, IP Address, Subnets, and Internetworking.

5. Internet Transport Protocols: TRANSPORT Service, Elements of Transport Protocols, TCP and UDP Protocols, Quality of Service Model, Best Effort Model, Network Performance Issues.

6. Overview of DNS, SNMP, Electronic Mail, FTP, TFTP, BOOTP, HTTP Protocols, World Wide Web, Firewalls.

7. Network Devices: Over View of Repeaters, Bridges, Routers, Gateways, Multiprotocol Routers, Brouters, Hubs, Switches, Modems, Channel Service Unit CSU, Data Service Units DSU, NIC, Wireless Access Points, Transceivers, Firewalls, Proxies.

8. Overview of Cellular Networks, Ad-hoc Networks, Mobile Ad-hoc Networks, Sensor Networks.

Text Book

1. Computer Networks, Andrews S Tanenbaum,, Edition 5, PHI, ISBN:-81-203-1165-5

Reference Books

1. Data Communications and Networking , Behrouz A Forouzan , Tata McGraw- Hill Co Ltd , Second Edition, ISBN: 0-07-049935-7

2. Computer networks, Mayank Dave, CENGAGE.

3. Computer networks, A system Approach, 5th ed, Larry L Peterson and Bruce S Davie, Elsevier.

4. An Engineering Approach to Computer Networks-S.Keshav, 2nd Edition, Pearson Education.

5. Understanding communications and Networks, 3rd Edition, W.A. Shay, Thomson.

MCA 3.2 PYTHON PROGRAMMING

Instruction: 3 Periods & 1 Tut/week Credits:4

Internal: 30 Marks

University Exam: 70 Marks Total: 100 Marks

Course Objectives

1. To develop skills on procedural oriented and object oriented programming in Python.

2. To understand and apply different data wrangling techniques using Python.

3. To perform data analysis using python libraries like NumPy, Pandas and exploratory data analysis using Matplotlib

Course Outcomes

At the end of the course, a student should be able to:

1. acquire programming knowledge on Basics of Python

2. acquire programming knowledge on Text and File Handling

3. develop Python programs to Mean, Median, Mode, Correlation

4. acquire programming knowledge on NumPy, Pandas Library

5. acquire programming knowledge on Graph Visualizations in Python and Data Analysis using Python

SYLLABUS

1. Introduction to Python: Rapid Introduction to Procedural Programming, Data Types: Identifiers and Keywords, Integral Types, Floating Point Types

Strings: Strings, Comparing Strings, Slicing and Striding Strings, String Operators and Methods, String formatting with str.format

Collections Data Types: Tuples, Lists, Sets, dictionaries, Iterating and copying collections

2. Python Control Structures, Functions and OOP:Control Structures and Functions: Conditional Branching, Looping, Exception Handling, Custom Functions Python Library Modules: random, math, time, os, shutil, sys, glob, re, statistics,creating a custom module

Object Oriented Programming: Object Oriented Concepts and Terminology, Custom Classes, Attributes and Methods, Inheritance and Polymorphism, Using Properties to Control Attribute Access

File Handling: Writing and Reading Binary Data, Writing and Parsing Text Files

3. NumPy Arrays and Vectorized Computation: NumPy arrays, Array creation, Indexing and slicing, Fancy indexing, Numerical operations on arrays, Array functions, Data processing using arrays, Loading and saving data, Saving an array, Loading an array, Linear algebra with NumPy, NumPy random numbers

4. Data Analysis with Pandas: An overview of the Pandas package, The Pandas data structure-Series, The DataFrame, The Essential Basic Functionality: Reindexing and altering labels , Head and tail, Binary operations, Functional statistics , Function application Sorting, Indexing and selecting data, Computational tools, Working with Missing Data, Advanced Uses of Pandas for Data Analysis - Hierarchical indexing, The Panel data

5. Data Analysis Application Examples: Data munging,Cleaning data, Filtering, Merging data, Reshaping data, Data aggregation, Grouping data

6. Data Visualization: The matplotlib API primer-Line properties, Figures and subplots, Exploring plot types-Scatter plots, Bar plots, Histogram plots, Legends and annotations, Plotting functions with Pandas

Text Books

1. Programming in Python 3: A Complete Introduction to Python Language, Mark Summerfield, Second Edition, Addison-Wesley Publications

2. Python: End-to-End Data Analysis Learning Path, Module 1: Getting Started with Python Data Analysis , Phuong VothiHong , Martin Czygan, , Packt Publishing Ltd

Reference Books

1. Learning Python, 5th Edition, Mark Lutz, Orielly Publications

2. Python for Data Analysis, Wes McKinney, O'Reilly Publications
3. How to Think Like a Computer Scientist: Learning with Python 3 Documentation 3rd Edition, Peter Wentworth, Jeffrey Elkner, Allen B. Downey, Chris Meyers
4. Core Python Programming, Second Edition, Wesley J. Chun, Prentice Hall
5. Python Cookbook – Recipes for Mastering Python 3, 3rd Edition, David Beazley, Brian K. Jones, O'Reilly

MCA 3.3 SOFTWARE ENGINEERING

Instruction: 3 Periods & 1 Tut/week Credits:4

Internal: 30 Marks

University Exam: 70 Marks Total: 100 Marks

Course objectives

1. to explain the importance of OOSE in Software development.
2. to explain the importance of Requirements Engineering.
3. to explain the role of UML and Testing in Software Development.
4. to explain the entire Software Development Process with aid of case studies.

Course outcomes

After completion of the course the student should be able to:

1. define a problem and perform Requirements Engineering.
2. draw UML diagrams for the requirements gathered
3. implement the designed problem in Object Oriented Programming Language and
4. test whether all the requirements specified have been achieved or not.

SYLLABUS

1. Introduction to Software Engineering: Nature Of The Software, Types Of Software , Software Engineering Projects, Software Engineering Activities, Software Quality, Introduction To Object Orientation, Concepts Of Data Abstraction, Inheritance & Polymorphism, Software Process Models- Waterfall Model, The Opportunistic Model , The Phased Released Model, The Spiral Model, Evolutionary Model, The Concurrent Engineering Model
2. Requirements Engineering: Domain Analysis, Problem Definition And Scope, Requirements Definition, Types Of Requirements, Techniques For Gathering And Analyzing Requirements, Requirement Documents, Reviewing, Managing Change In Requirements.
3. Unified Modeling Language & Use Case Modeling: Introduction To UML, Modeling Concepts, Types Of UML Diagrams With Examples; User-

Centred Design, Characteristics Of Users, Developing Use Case Models Of Systems, Use Case Diagram, Use Case Descriptions, The Basics Of User Interface Design, Usability Principles, User Interfaces.

4. Class Design and Class Diagrams: Essentials Of UML Class Diagrams, Associations And Multiplicity, Other Relationships, Generalization, Instance Diagrams, Advanced Features Of Class Diagrams, Interaction And Behavioural Diagrams: Interaction Diagrams, State Diagrams, Activity Diagrams, Component And Deployment Diagrams.

5. Software Design And Architecture: The Process Of Design, Principles Leading To Good Design, Techniques For Making Good Design Decisions, Writing A Good Design Document., Pattern Introduction, Design Patterns: The Abstraction-Occurrence Pattern, General Hierarchical Pattern, The Play-Role Pattern, The Singleton Pattern, The Observer Pattern, The Delegation Pattern, The Adaptor Pattern, The Façade Pattern, The Immutable Pattern, The Read-Only Interface Pattern And The Proxy Pattern; Software Architecture Contents Of An Architecture Model, Architectural Patterns: The Multilayer, Client-Server, Broker, Transaction Processing, Pipe & Filter And MVC Architectural Patterns

6. Software Testing: Overview Of Testing, Testing Concepts, Testing Activities, Testing Strategies, Unit Testing, Integration Testing, Function Testing, Structural Testing, Class Based Testing Strategies, Use Case/Scenario Based Testing, Regression Testing, Performance Testing, System Testing, Acceptance Testing, Installation Testing, OO Test Design Issues, Test Case Design, Quality Assurance, Root Cause Analysis, Post-Mortem Analysis.

7. Software Project Management: Introduction To Software Project Management, Activities Of Software Project Management, Structure Of Project Plan, Software Engineering Teams, Software Cost Estimation, Project Scheduling, Tracking And Monitoring.

Text Book

1. Object-Oriented Software Engineering Practical software development using UML and Java by Timothy C. Lethbridge & Robert, Langanieri McGraw-Hill

Reference Books

1. Object-Oriented Software Engineering: Using UML, Patterns and Java, Bernd Bruegge and Allen H. Dutoit, 2nd Edition, Pearson Education Asia.

2. Software Engineering: A Practitioner's Approach, Roger S Pressman.

3. A Practical Guide to Testing Object-Oriented Software, John D. McGregor; David A. Sykes, Addison-Wesley Professional.

MCA 3.4 DATA WAREHOUSING & DATA MINING

Instruction: 3 Periods & 1 Tut/week Credits:4

Internal: 30 Marks

University Exam: 70 Marks Total: 100 Marks

Course objectives

1. To understand the evolution of data warehousing and data mining systems
2. To understand extracting, cleaning and transformation of data into a warehouse.
3. To learn the principles of statistics, information theory, machine learning and other areas AI and implementation of data mining techniques.
4. To understand pattern mining using classification and clustering methods.

Course outcomes

After completion of the course the student should be able to:

1. The student understands the differences between OLTP and OLAP.
2. The student learns how data cube technology supports summarization and querying high dimensional data.
3. The student is introduced to similarity, distance, information gain and other performance and error metrics used for evaluation of mining results.
4. The student is introduced to various approaches to association rule mining, supervised and unsupervised learning and the corresponding classification and clustering approaches involving decision trees, Bayesian approaches, model based and agglomerative approaches.

SYLLABUS

1. Introduction to Data Mining: Motivation and importance, What is Data Mining, Relational Databases, Data Warehouses, Transactional Databases, Advanced Database Systems and Advanced Database Applications, Data Mining Functionalities, Interestingness of a pattern Classification of Data Mining Systems, Major issues in Data Mining.
2. Data Warehouse and OLAP Technology for Data Mining: Data Warehouse, Multi- Dimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Development of Data Cube Technology, Data Warehousing to Data Mining

3. Data Preprocessing: Pre-process the Data, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation

4. Data Mining Primitives, Languages and system Architectures, Data Mining Primitives: What defines a Data Mining Task?, A Data Mining query language, Designing Graphical Use Interfaces Based on a Data Mining Query language, Architectures of Data Mining Systems

5. Concept Description: Characterization and comparison, Concept Description?, Data Generalization and summarization-based Characterization, Analytical Characterization: Analysis of Attribute Relevance, Mining Class Comparisons: Discriminating between different Classes, Mining Descriptive Statistical Measures in large Databases

6. Mining Association rule in large Databases, Association Rule Mining, Mining Single- Dimensional Boolean Association Rules from Transactional Databases, Mining Multilevel Association Rules from Relational Databases, Mining Multidimensional Association Rules from Relational Databases and Data Warehouses, From Association Mining to Correlation Analysis, Constraint-Based Association Mining

7. Classification and prediction, Concepts and Issues regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Classification by Back- propagation, Classification Based on Concepts from Association Rule Mining, Other Classification Methods like k-Nearest Neighbor Classifiers, Case- Based Reasoning, Generic Algorithms, Rough Set Approach, Fuzzy Set Approaches, Prediction, Classifier Accuracy

8. Cluster Analysis: Cluster Analysis, Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods.

Text Book

1. Data Mining Concepts and Techniques, Jiawei Han and Kamber, Morgan Kaufman Publications

Reference Books

1. Introduction to Data Mining, Adriaan, Addison Wesley Publication
2. Data Mining Techniques, A.K.Pujari, University Press

MCA 3.5 Elective-II IMAGE PROCESSING

Instruction: 3 Periods & 1 Tut/week Credits:4

Internal: 30 Marks

University Exam: 70 Marks Total: 100 Marks

Course objectives

1. to explain fundamentals of image processing concepts

2. to provide mathematical foundation of image enhancement, image compression and image segmentation.

3. to explain about morphology and its applications in image processing.

4. to explain various methods and techniques for image transformation.

Course outcomes

After completion of the course the student should be able to:

1. develop algorithms for fundamental concepts in Image processing.

2. perform image enhancement, image compression and image segmentation using various methods.

3. implement image transformation techniques

SYLLABUS

1. Fundamentals of Image Processing: Image Acquisition, Image Model, Sampling, Quantization, Relationship between pixels, distance measures, connectivity, Image Geometry, Photographic film. Histogram: Definition, decision of contrast basing on histogram, operations basing on histograms like image stretching, image sliding, Image classification. Definition and Algorithm of Histogram equalization.

2. Image Transforms: A detail discussion on Fourier Transform, DFT, FFT, properties, WALSH Transform, WFT, HADAMARD Transform, DCT.

3. Image Enhancement: (by SPATIAL Domain Methods) Arithmetic and logical operations, pixel or point operations, size operations, Smoothing filters-Mean, Median, Mode filters – Comparative study, Edge enhancement filters – Directorial filters, Sobel, Laplacian, Robert, KIRSCH Homogeneity & DIFF Filters, prewitt filter, Contrast Based edge enhancement techniques. – Comparative study, Low Pass filters, High Pass filters, sharpening filters. – Comparative Study, Comparative study of all filters, Color image processing.

4. Image enhancement: (By FREQUENCY Domain Methods) -esign of Low pass, High pass, EDGE Enhancement, smoothening filters in Frequency Domain. Butter worth filter, Homomorphic filters in Frequency Domain Advantages of filters in frequency domain, comparative study of filters in frequency domain and spatial domain.

5. Image compression: Definition: A brief discussion on – Run length encoding, contour coding, Huffman code, compression due to change in domain, compression due to quantization Compression at the time of image transmission. Brief discussion on:- Image Compression standards.

6. Image Segmentation: Definition, characteristics of segmentation.

7. Detection of Discontinuities, Thresholding Pixel based segmentation method. Region based segmentation methods – segmentation by pixel aggregation, segmentation by sub region aggregation, histogram

based segmentation, split and merge technique. Use of motion in segmentation (spatial domain technique only)

8. Morphology: Dilation, Erosion, Opening, closing, Hit-and-Miss transform, Boundary extraction, Region filling, connected components, thinning, Thickening, skeletons, Pruning Extensions to Gray – Scale Images Application of Morphology in I.P.

Text Book

1. Digital Image Processing, Rafael C. Gonzalez and Richard E. Woods Addison Wesley

Reference Books

1. Fundamentals of Electronic Image Processing by Arthyr –R – Weeks, Jr.(PHI)

2. Image processing, Analysis, and Machine vision by Milan Sonka vaclan Halavac Roger Boyle, Vikas Publishing House.

MCA 3.5 Elective II MOBILE COMPUTING

Instruction: 3 Periods & 1 Tut/week Credits:4

Internal: 30 Marks

University Exam: 70 Marks Total: 100 Marks

Course objectives

1. to introduce students to infrastructure, principles, technologies, and applications of mobile computing and wireless IP

2. to familiarize students with wireless communication and networking principles, that support connectivity to cellular networks, wireless internet and sensor devices

3. understand the data issues in mobile computing including data replication and data dissemination.

Course outcomes

After completion of the course the student should be able to:

1. describe the infrastructure, principles, technologies, and applications of mobile computing technologies

2. understand wireless LANs, topologies and key concepts in wireless networking

3. understand key database issues in mobile computing, adaptive clustering and various data delivery mechanisms such as push-based mechanisms, pull-based mechanisms.

SYLLABUS

1. Introduction to Mobile Communications and Computing: Introduction to cellular concept, Frequency Reuse, Handoff, GSM: Mobile services, System architecture, Radio interface, Protocols, Localization and calling, Handover, Security, and New data services, Introduction to mobile computing, novel applications, limitations, and architecture.

2. Wireless LANs: Introduction, Advantages and Disadvantages of WLANs, WLAN Topologies, Introduction to Wireless Local Area Network standard IEEE 802.11, Comparison of IEEE 802.11a, b, g and n standards, Wireless PANs, Hiper LAN, Wireless Local Loop

3. Wireless Networking: Introduction, Various generations of wireless networks, Fixed network transmission hierarchy, Differences in wireless and fixed telephone networks, Traffic routing in wireless networks, WAN link connection technologies, X.25 protocol, Frame Relay, ATM, Virtual private networks, Wireless data services, Common channel signaling, Various networks for connecting to the internet.

4. Database Issues: Data management issues, data replication for mobile computers, adaptive clustering for mobile wireless networks, file system, disconnected operations.

5. Data Dissemination: Communications asymmetry, classification of new data delivery mechanisms, push-based mechanisms, pull-based mechanisms, hybrid mechanisms, selective tuning (indexing) techniques.

6. Mobile IP and Wireless Application **Protocol**: Introduction to Mobile IP, Introduction to Wireless Application Protocol, Application layer.

Text Books

1. Gottapu Sasibhushana Rao, "Mobile Cellular Communication", Pearson Education, First Edition, 2013.

2. Stojmenovic and Cacute, "Handbook of Wireless Networks and Mobile Computing", Wiley, 2002.

MCA 3.5 Elective II NETWORK SECURITY AND CRYPTOGRAPHY

Instruction: 3 Periods & 1 Tut/week Credits:4

Internal: 30 Marks

University Exam: 70 Marks Total: 100 Marks

Course objectives

1. introduce students to key concepts in confidentiality and data integrity and issues involved in network security
2. to familiarize students with various cryptographic techniques
3. introduce students to number theory and algorithms in Public Key Cryptography
4. explore different types of security threats in IP, web, systems, electronic mail and their remedies.

Course outcomes

After completion of the course the student should be able to:

1. understand the importance of network and data security in the Internet and in the distributed environments
2. apply various cryptographic techniques in different contexts

3. identify the different types of network security issues and their remedies.

SYLLABUS

1. Introduction: Confidentiality — Data Integrity — Authentication — Non-Repudiation— Overview of Issues involved.

2. Classical Encryption Techniques: Monoalphabetic, Substitution Methods, Polyalphabetic Substitution Methods — Permutation Methods — Cryptanalysis of these Methods.

3. Modern Encryption Techniques: Simplified DES — DES — Triple DES — Block Cipher, Design Principles — Block Cipher Modes of Operation. IDEA — Security Issues Involved with these methods.

4. Confidentiality Using Conventional Encryption: Placement of Encryption — Traffic Confidentiality — Key Distribution — Random Number, Generation.

5. Introduction to Number Theory: (Basics Pertaining to Security Related Algorithms).

6. Public Key Cryptography: Principles — RSA Algorithm. Message Authentication and Hash Functions — Hash and MAC Algorithms. Digital Signatures and Authentication Protocols — Authentication Applications

7. Basic Overview of :Electronic Mail Security — IP Security — WEB Security

8. System Security : Intruders, Viruses and Worms – Firewalls.

Text Book

1. Cryptography and Network Security, William Stallings. (Second Edition) Pearson Education Asia

Reference Books

1. Network Security: The Complete Reference by Roberta Bragg, Mark Phodes-Ousley, Keith Strassberg Tata Mcgraw-Hill

2. Handbook of Applied Cryptography.

MCA 3.5 Elective-II E-COMMERCE

Instruction: 3 Periods & 1 Tut/week Credits:4

Internal: 30 Marks

University Exam: 70 Marks Total: 100 Marks

Course objectives

1. introduce students to various application of e-commerce in commerce, organizational and consumer domains
2. familiarize students with types of Electronic Payment Systems, their design principles and the risks in these systems
3. introduce the key concepts of Electronic Data Inter Change and Intra Organizational Commerce

4. explore the advertising, marketing and multimedia concepts in e-commerce.

Course outcomes

After completion of the course the student should be able to:

1. be familiar with the key application areas of e-commerce in different domains
2. understand the types of Electronic Payment Systems and risks involved in these systems
3. understand key concepts in Electronic Data Inter Change and Intra Organizational Commerce including Work Flow Automation and Supply Chain Management
4. be familiar with advertising, marketing and multimedia concepts in e-commerce such as information based marketing, consumer search, information retrieval and filtering.

SYLLABUS

1. Introduction: Electronic Commerce-Frame Work, Anatomy of E-Commerce Applications, E-Commerce Consumer Applications, E-Commerce Organization Applications. Consumer Oriented Electronic Commerce - Mercantile Process Models.

2. Electronic Payment Systems – Types of Electronic Payment Systems, Digital Token-Based, Smart Cards, Credit Cards, Risks in Electronic Payment Systems, Designing Electronic Payment Systems

3. Electronic Data Inter Change, Inter Organizational Commerce - EDI, EDI Implementation, Value Added Networks.

4. Intra Organizational Commerce, Macro Forces And Internal Commerce, Work Flow Automation and Coordination, Customization And Internal Commerce, Supply Chain Management.

5. Business Cases for Document Library, Digital Document Types, Corporate Data Ware-Houses.

6. Advertising And Marketing: Information Based Marketing, Advertising On Internet, Online Marketing Process, Market Research. Consumer Search and Resource Discovery, Information Search and Retrieval, Commerce Catalogues, Information Filtering.

7. Multimedia-Key Multimedia Concepts, Digital Video and Electronic Commerce, Desktop Video Processing, Desktop Video Conferencing.

Text Book

1. Frontiers of Electronic Commerce, Kalakata and Whinston, Pearson.

Reference Books

1. E-Commerce fundamentals and Applications, Hendry Chan, Raymond Lee, Tharam Dillon, Elizabeth Chang, John Wiley.

2. E-Commerce, S.Jaiswal, Galgotia.

3. E-Commerce, Efrain Turbon, Jae Lee, David King, H.Michael Chang.

4. E-Commerce - Business, Technology and Society, Kenneth C.Taudon, Carol Guyerico Traver.

MCA 3.6 NETWORK PROGRAMMING LAB

Instruction: 3 Periods/week Credits:2

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

Course objectives

1. identification of well known ports on a remote system and providing user interface to contact them
2. development of chat application including one-to-one and broadcast
3. development of HTTP server and retrieval of data from remote database by executing SQL queries
4. sending and receiving mails using mail clients including POP and SMTP
5. transfer of files between systems and development of TFTP client

Course outcomes

After completion of the course the student should be able to:

1. identifying well known ports on a remote system and be able to simulate Telnet
2. develop chat application by opening socket connections
3. develop HTTP server to implement GET, POST, HEAD, DELETE commands and retrieve data from remote database
4. send email using SMTP commands and retrieve and manipulate mail box using POP commands
5. transfer files between two systems without protocols and develop a TFTP client.

List of programs

1. Identifying well known ports on a Remote System :By trying to listen to the various well known ports by opening client connections. If the exception does not occur then the remote port is active else the remote port is inactive.
2. Writing a Chat application :
 - i. One-One: By opening socket connection and displaying what is written by one party to the other.

ii. Many-Many (Broad cast): Each client opens a socket connection to the chat server and writes to the socket. Whatever is written by one party can be seen by all other parties.

3. Data retrieval from a Remote database: At the remote database a server listens for client connections. This server accepts SQL queries from the client, executes it on the database and sends the response to the client.

4. Mail Client: i. POP Client : Gives the server name , user name and password retrieve the mails and allow manipulation of mail box using POP commands. ii. SMTP Client : Gives the server name, send e-mail to the recipient using SMTP commands

5. Simulation of Telnet: Provide a user interface to contact well-known ports, so that client- server interaction can be seen by the user.

6. Simple file transfer between two systems (without protocols): By opening socket connection to our server on one system and sending a file from one system to another.

7. TFTP- Client: To develop a TFTP client for file transfer. (Unix Network programming- Stevens.)

8. HTTP-Server: Develop a HTTP server to implement the following commands. GET, POST, HEAD, DELETE. The server must handle multiple clients.

Reference Books

1. Java Network Programming, Harol, Orielly Publications
2. An Introduction to Computer Networking, Kenneth C. Mansfield Jr and James L. Antonakos, Pearson Education Asia

MCA 3.7 PYTHON PROGRAMMING LAB

Instruction: 3 Periods/week Credits:2

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

Course objectives

1. familiarize students with key data structures in Python including lists and dictionaries and apply them in context of searching, sorting, text and file handling
2. introduce students to calculation of statistical measures using Python such as measures of central tendency, correlation
3. familiarize students with important Python data related libraries such as Numpy and Pandas and use them to manipulate arrays and dataframes
4. introduce students to data visualization in Python through creation of line plots, histograms, scatter plots, box plots and others

5. implementation of basic machine learning tasks in Python including pre-processing data, dimensionality reduction of data using PCA, clustering, classification and cross-validation.

Course outcomes

After completion of the course the student should be able to:

1. implement searching, sorting and handle text and files using Python data structures such as lists and dictionaries
2. calculate statistical measures using Python such as measures of central tendency, correlation
3. use Python data related libraries such as Numpy and Pandas and create data visualizations
4. implement basic machine learning tasks pre-processing data, compressing data, clustering, classification and cross-validation.

SYLLABUS

1. Python Programs on lists & Dictionaries
2. Python Programs on Searching and sorting
3. Python Programs on Text Handling
4. Python Programs on File Handling
5. Python Programs for calculating Mean, Mode, Median, Variance, Standard Deviation
6. Python Programs for Karl Pearson Coefficient of Correlation, Rank Correlation
7. Python Programs on NumPy Arrays, Linear algebra with NumPy
8. Python Programs for creation and manipulation of DataFrames using Pandas Library
9. Write a Python program for the following.
 - Simple Line Plots,
 - Adjusting the Plot: Line Colors and Styles, Axes Limits, Labeling Plots,
 - Simple Scatter Plots,
 - Histograms,
 - Customizing Plot Legends,
 - Choosing Elements for the Legend,
 - Boxplot
 - Multiple Legends,
 - Customizing Colorbars,
 - Multiple Subplots,
 - Text and Annotation,
 - Customizing Ticks

10. Python Programs for Data preprocessing: Handling missing values, handling categorical data, bringing features to same scale, selecting meaningful features

11. Python Program for Compressing data via dimensionality reduction: PCA

12. Python Programs for Data Clustering

13. Python Programs for Classification

14. Python Programs for Model Evaluation: K-fold cross validation

Reference Books

1. Core Python Programming, Second Edition, Wesley J. Chun, Prentice Hall

2. Chris Albon, "Machine Learning with Python Cookbook-practical solutions from preprocessing to Deep learning", O'REILLY Publisher, 2018

3. Mark Summerfield, Programming in Python 3—A Complete Introduction to the Python Language, Second Edition, Addison Wesley

4. Phuong Vo.T.H, Martin Czygan, Getting Started with Python Data Analysis, Packt Publishing Ltd

5. Armando Fandango, Python Data Analysis, Packt Publishing Ltd

6. Magnus Vilhelm Persson and Luiz Felipe Martins, Mastering Python Data Analysis, Packt Publishing Ltd

7. Sebastian Raschka & Vahid Mirjalili, "Python Machine Learning", Packt Publisher, 2017

IV Semester

Code	Name of the subject	Periods/week		Max. Marks		Total Credits	
		Theory	Lab	Ext.	Int.		
MCA 4.1	Data Science	4	—	70	30	100	4
MCA 4.2	Elective III	4	—	70	30	100	4
MCA 4.3	Project Work	—	6	50	50	100	14

Elective III

Internet of Things (IoT) / Machine Learning / Cloud Computing / Distributed Systems

MCA 4.1 DATA SCIENCE

Instruction: 3 Periods & 1 Tut/week Credits: 4

Internal: 30 Marks

University Exam: 70 Marks Total: 100 Marks

Course objectives

1. introduce students to the process involved in data science projects
2. familiarize students with basics of preparation, exploration and visualization of data

3. introduce students to modeling methods such as clustering, classification, regression and model evaluation

4. introduce students to recommendation engines and various methods in time series forecasting

5. familiarize students with basics of anomaly detection and feature selection.

Course outcomes

After completion of the course the student should be able to:

1. describe about Data Science and its process
2. differentiate between the classification and regression methods
3. apply clustering and evaluate the methods
4. understand and analyze the text mining and time series forecasting applications.
5. assess different feature selection methods and use in applications.

SYLLABUS

1. Introduction: Data Science, Data Science Process: Process, Data, Data Preparation, Modeling. Data Exploration: Objectives, Types of data, Descriptive Statistics, Data Visualization, Roadmaps for data Exploration

2. Classification Methods: K-Nearest Neighbors, Decision Trees, Rule Induction, Naive Bayesian, Ensemble Learners Regression Methods: Linear Regression, Logistic Regression

3. Clustering: k-means, DBSCAN, Self-Organizing Maps Model Evaluation: Confusion Matrix, ROC and AUC, Lift Curves, Implementation

4. Recommendation Engines: Concepts, Collaborative Filtering, Content Based Filtering, Hybrid Recommendation Time Series Forecasting: Decomposition, Smoothing, Regression and Machine Learning Methods, Performance Evaluation

5. Anomaly Detection: Concepts, Distance and Density based Outlier Detection, Local Outlier Factor Feature Selection: Classifying Feature Selection Methods, PCA, and Information Theory based Filtering; Chi-Square based Filtering, Wrapper type feature selection.

Text Book

1. Vijay Kotu, BalaDeshpande, Data Science Concepts and Practice, Second Edition, Morgan Kaufmann Publishers, An imprint of Elsevier, 2019

References

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly 2014

2. Joel Grus, Data Science from scratch, Second Edition, O'Reilly 2019.

MCA 4.2 Elective-III Internet of Things (IoT)

Instruction: 3 Periods & 1 Tut/week Credits:4

Internal: 30 Marks

University Exam: 70 Marks Total: 100 Marks

Course objectives

1. provide students a conceptual framework and architectural view of IoT
2. introduce students to design principles for connected devices and for web connection
3. familiarize students with acquiring, organizing and processing of data and analytics using cloud platform and IoT cloud-based services
4. introduce students to key concepts in sensors, RFIDs, and wireless sensor networks
5. introduce students to prototyping embedded devices for IoT and various IoT supported hardware platforms.

Course outcomes

After completion of the course the student should be able to:

1. describe the framework, architecture of IoT, technology behind IoT and the key components that makeup an IoT system
2. understand the design principles for connected devices, for web connection and web communication protocols for connected devices
3. collect, store, organize and process data using IoT cloud-based services and appreciate the role of big data, cloud computing and data analytics in a typical IoT system
4. understand key concepts in sensors, RFIDs, and wireless sensor networks including applications in industrial IoT and automotive IoT,
5. understand embedded computing basics, prototyping, designing software for IoT applications and various IoT supported hardware platforms including Raspberry pi, ARM Cortex Processors.

SYLLABUS

1. Internet of Things - An Overview: Internet of Things, IoT Conceptual Framework, IoT Architectural View, Technology Behind IoT, Sources of IoT, M2M Communication, Examples of IoT.
2. Design Principles for Connected Devices: IoT/M2M Systems Layers and Designs Standardization, Communication Technologies, Data Enrichment, Data Consolidation and Device Management at Gateway
3. Design Principles for Web connection: Web Communication Protocols for Connected Devices, Message Communication Protocols for Connected Devices, Web Connectivity for Connected-Devices Network using Gateway, SOAP, REST, HTTP RESTful and Web Socket's

4. Data Acquiring, Organizing, Processing and Analytics: Data Acquiring and Storage, Organizing the Data, Transactions, Business Processes, Integration and Enterprise Systems, Analytics, Knowledge Acquiring, Managing and Storing Processes; Data Collection, Storage and Computing Using a Cloud Platform; Cloud Computing Paradigm for Data Collection, Storage and Computing, everything as a Service and Cloud Service Models, IoT Cloud-Based Services Using the Xively.

5. Sensors, Participatory Sensing, RFIDs, and Wireless Sensor Networks: Sensor Technology, Participatory Sensing, Industrial IoT and Automotive IoT, Sensor Data Communication Protocols, Radio Frequency Identification Technology, Wireless Sensor Networks Technology.

6. Prototyping the Embedded Devices for IoT and M2M: Embedded Computing Basics, Embedded Platforms for Prototyping, Things Always Connected to the Internet; Prototyping and Designing the Software for IoT Applications; Prototyping Embedded Device Software, Devices, Gateways, Internet and Web/Cloud Services Software-Development, Prototyping Online Component APIs and Web APIs Key Concepts.

7. Overview of IoT supported Hardware platforms: Raspberry pi, ARM Cortex Processors, Arduino and Intel Galileo IoT Case Studies; Design Layers, Design Complexity and Designing Using Cloud PaaS; IoT/IIoT Applications in the Premises, Supply-Chain and Customer Monitoring.

Text Books

1. Internet of Things by Raj Kamal, McGrawhill Publications 2017.
2. Internet of Things Principles and Paradigms by Rajkumar Buyya and Amir Vahid Dastjerdi, Morgan Kaufmann, 2016

MCA 4.2 Elective-III MACHINE LEARNING

Instruction: 3 Periods & 1 Tut/week Credits:4

Internal: 30 Marks

University Exam: 70 Marks Total: 100 Marks

Course objectives

1. introduce students to the approaches to machine learning and related algorithms
2. familiarize students with ideas of concept learning, version spaces and issues regarding data sources
3. understand representation and learning using Decision Trees, Neural Networks, Genetic Algorithms
4. introduce students to Bayesian approaches and key concepts of Expectation Maximization

5. introduce students to inductive and analytical learning problems and related concepts of inductive bias, using prior knowledge to initialize the hypothesis.

Course outcomes

After completion of the course the student should be able to:

1. describe learning tasks and various approaches, algorithms in machine learning
2. understand concept learning, version spaces and related concepts of bias-free learning and active queries
3. represent and formulate problems in Decision Trees, Neural Networks, Genetic Algorithms
4. understand the basics of Bayes theorem and key concepts of Expectation Maximization in Bayesian approaches.

SYLLABUS

1. Introduction: Introduction to Machine Learning, learning task-illustration, Approaches to Machine Learning, Machine Learning algorithms- Theory, Experiment in biology and Psychology.

2. Concept Learning: Introduction, Concept Learning Task- Notation, Concept Learning Search, Version spaces, Candidate Elimination Algorithm, Inductive Bias, Biased hypothesis Space, Unbiased Learner, Bias-free Learning, Active queries, Mistake bound/PAC model – basic results. Overview of issues regarding data sources, success criteria

3. Decision Tree Learning: Decision Tree Representation, Basic decision Tree Learning, Inductive bias in Decision tree Learning, Issues in Decision Tree Learning, Minimum Description Length Principle, Occam's razor, Learning with active queries

4. Neural Network Learning: Neural Network Representation, Problems for Neural Network Learning, Perceptions and gradient descent, Multi Layer Network and Back propagation Algorithm, Illustrative Example of Back Propagation Algorithm- Face Recognition, Advanced Topics in ANN.

5. Bayesian Approaches: Basics of Bayes Theorem and Concept Learning, Expectation Maximization, Minimum Description Length Principle, Naive Bayes Classifier, Bayesian Belief Networks, EM Algorithm, K-Means Algorithm, Hidden Markov Models Instance-Based Techniques; Lazy vs. eager generalization, k nearest neighbor, Locally Weight Representation, Case-based Reasoning

6. Analytical Learning: Inductive and Analytical Learning problems, Learning with perfect Domain Theory, Explanation Based Learning, Inductive Bias in EBL, Search Control Knowledge with EBL, Inductive-

Analytical Approaches to Learning, Using prior Knowledge for Initialize the Hypothesis, and Altering Search objective, FOCL Algorithm.

7. Genetic Algorithms: Representation of Hypothesis as GA,, Genetic Operators, Fitness function and Selection, Hypothesis Space search, Genetic Programming, Models of Evolution and Learning, Parallelizing GA, Different search methods for induction.

Text Books

1. Machine Learning, Tom Mitchell , McGraw Hill,1997
2. The Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani & Jerome Friedman, Springer Verlag, 2001

Reference Books

1. Pattern Classification, Richard O. Duda, Peter E. Hart and David G. Stork, John Wiley & Sons Inc.,2001
2. Neural Networks for Pattern Recognition, Chris Bishop, Oxford University Press, 1995

MCA 4.2 Elective-III CLOUD COMPUTING

Instruction: 3 Periods & 1 Tut/week Credits:4

Internal: 30 Marks

University Exam: 70 Marks Total: 100 Marks

Course objectives

1. introduce students to the benefits, limitations, security concerns and regulatory issues in cloud computing
2. familiarize students with the hardware and infrastructure in cloud computing
3. provide the driving forces for Software as a Service, mobile device integration, local clouds and thin clients
4. introduce students to migrating to the cloud and best practices for migration.

Course outcomes

After completion of the course the student should be able to:

1. describe the benefits and limitations of cloud computing
2. identify the architecture and infrastructure of cloud computing including web APIs, cloud storage and deployment methods of cloud computing
3. understand the driving forces for Software as a Service
4. understand the concepts in development, troubleshooting, management of cloud computing applications
5. describe the best practices in cloud computing and understand how cloud computing might evolve in future.

SYLLABUS

1. Cloud Computing Basics - Cloud Computing Overview, Applications, Intranets and the Cloud, First Movers in the Cloud. The Business Case for Going to the Cloud - Cloud Computing Services, Business Applications, Deleting Your Datacenter, Salesforce.com, Thomson Reuters.

2. Organization and Cloud Computing - When You Can Use Cloud Computing, Benefits, Limitations, Security Concerns, Regulatory Issues, Cloud Computing with the Titans - Google, EMC, NetApp, Microsoft, Amazon, Salesforce.com, IBM Partnerships.

3. Hardware and Infrastructure - Clients, Security, Network, Services. Accessing the Cloud - Platforms, Web Applications, Web APIs, Web Browsers. Cloud Storage - Overview, Cloud Storage Providers, Standards - Application, Client, Infrastructure, Service.

4. Software as a Service - Overview, Driving Forces, Company Offerings, Industries Software plus Services - Overview, Mobile Device Integration, Providers, Microsoft Online.

5. Developing Applications - Google, Microsoft, Intuit QuickBase, Cast Iron Cloud, Bungee Connect, Development, Troubleshooting, Application Management.

6. Local Clouds and Thin Clients - Virtualization in Your Organization, Server Solutions, Thin Clients, Case Study: McNeilus Steel.

7. Migrating to the Cloud - Cloud Services for Individuals, Cloud Services Aimed at the Mid- Market, Enterprise-Class Cloud Offerings, Migration, Best Practices and the Future of Cloud Computing - Analyze Your Service, Best Practices, How Cloud Computing Might Evolve.

Text Book

1. Cloud Computing-A Practical Approach, Anthony T. Velte, Toby J. Velte, Robert Elsenpeter. McGrawHill.

MCA 4.2 Elective III Distributed Systems

Instruction: 3 Periods & 1 Tut/week Credits:4

Internal: 30 Marks

University Exam: 70 Marks Total: 100 Marks

Course objectives

1. introduce students to the principles, architecture of distributed databases

2. understand the concepts of global queries, fragment queries and equivalence transformations

3. familiarize students with concepts of atomicity, concurrency control for distributed transactions and distributed deadlocks

4. introduce students to multidatabase concurrency control and multidatabase recovery.

Course outcomes

After completion of the course the student should be able to:

1. describe the key principles, architecture and integrity constraints in distributed databases

2. transform global queries into fragment queries and understand strategies for optimized access

3. understand the management of distributed transactions, concurrency control for distributed transactions, distributed deadlocks, detection and resolution of inconsistency

4. describe multidatabase concurrency control, multidatabase recovery and database interoperability

SYLLABUS

1. Features of Distributed versus Centralized Databases, Principles Of Distributed Databases, Levels Of Distribution Transparency, Reference Architecture for Distributed Databases , Types of Data Fragmentation, Integrity Constraints in Distributed Databases.

2. Translation of Global Queries to Fragment Queries, Equivalence Transformations for Queries, Transforming Global Queries into Fragment Queries, Distributed Grouping and Aggregate Function Evaluation, Parametric Queries.

3. Optimization of Access Strategies, A Framework for Query Optimization, Join Queries, General Queries.

4. The Management of Distributed Transactions, A Framework for Transaction Management, Supporting Atomicity of Distributed Transactions, Concurrency Control for Distributed Transactions, Architectural Aspects of Distributed Transactions.

5. Concurrency Control, Foundation of Distributed Concurrency Control, Distributed Deadlocks, Concurrency Control based on Timestamps, Optimistic Methods for Distributed Concurrency Control.

6. Reliability, Basic Concepts, Nonblocking Commitment Protocols, Re-liability and concurrency Control, Determining a Consistent View of the Network, Detection and Resolution of Inconsistency, Checkpoints and Cold Restart, Distributed Database Administration, Catalog Management in Distributed Databases, Authorization and Protection

7. Architectural Issues, Alternative Client/Server Architectures, Cache Consistency Object Management, Object Identifier Management, Pointer Swizzling, Object Migration, Distributed Object Storage, Object Query

Processing, Object Query Processor Architectures, Query Processing Issues, Query Execution , Transaction Management, Transaction Management in Object DBMSs , Transactions as Objects.

8. Database Integration, Scheme Translation, Scheme Integration, Query Processing Query Processing Layers in Distributed Multi-DBMSs, Query Optimization Issues. Transaction Management Transaction and Computation Model Multidatabase Concurrency Control, Multidatabase Recovery, Object Orientation And Interoperability Object Management Architecture CORBA and Database Interoperability Distributed Component Model COM/OLE and Database Interoperability, PUSH-Based Technologies.

Text Books

1. Distributed Database Principles and Systems, Stefano Ceri, Giuseppe Pelagatti, McGraw-Hill

2. Principles of Distributed Database Systems, M.Tamer Ozsu, Patrick Valduriez - Pearson Education.

3. Distributed Database Principles and Systems, Stefano Ceri, Giuseppe Pelagatti, McGraw-Hill.

Reference Book

1. Principles of Distributed Database Systems, M.Tamer Ozsu, Patrick Valduriez - Pearson Education.

IV Semester Project Guidelines

Code	Name of the subject	Periods/week		Max. Marks		TotalCredits	
		Theory	Lab	Ext.	Int.		
MCA 4.3	Project Work	—	—	50	50	100	14

1. Three Stages In Project adjudication: Stage I: Presentation of Concept Note & Problem Approval by Guide Stage II; Progress Approval by System Demonstration with results Internal -50 Marks Stage III: Final Presentation with Documentation & External Viva-Voce - 50 Marks

2. Candidates can do their thesis work within the department or in association with any industry/research organization. In case of thesis done in association with an industry/research organization, one advisor (Guide) should be from the department and one advisor(CO-Guide) should be from the industry/research organization.

3. A publication of a paper on the thesis work in a National/International Conference proceedings with presentation certificate or a paper on the thesis work be communicated to a National/International Journal & accepted for publication for the submission of thesis at the end of 4th semester is desirable. The external examiner shall be nominated by the Chairman, Board of Examiners in ITCA as per the norms of the University.

Code	Name of the subject	Periods/week		Max. Marks		TotalCredits	
		Theory	Lab	Ext.	Int.		
Total	(Complete Course)	68	24	1540	860	2400	94

Appendix "Q" Item No.34

ARCHITECTURE

M.PLANNING: SPECIALIZATION IN ENVIRONMENTAL PLANNING

(Evening Course)

(With Effective from 2020-2021 Admitted Batch and onwards)

FIRST SEMESTER

Sl. Code Credits	Subject No.	Hrs.Per		EE/ EJ	IA Week	Max. (Marks)	Exam (Marks)	Credits	
		T	P					T	P
1	EPC1.1 Planning History and Theory	3	—	70	30	100	3	3	— 3
2	EPC1.2 Socio-Economic basis for Planning	3	—	70	30	100	3	3	— 3
3	EPC1.3 Planning Techniques	3	—	70	30	100	3	3	— 3
4	EPC1.4 Infrastructure and Transport Planning	3	—	70	30	100	3	3	— 3
5	EPC1.5 Housing Environments and Planning	3	—	70	30	100	3	3	— 3
6	EPC1.6 Demography and Statistical Applications	3	—	70	30	100	3	3	— 3
7	EPC1.7 Planning Studio	—	12	150	250	400	VV	—	6 6
	Film Appreciation			—	50				
	Literature Review			—	50				
	Area Appreciation			50	50				
	Site Planning			50	50				
	Statutory Development Plan			50	50				
Sub-Total		18	12	570	430	1000		18	6 24

SECOND SEMESTER

1	EPC2.1 Theory of Environmental Planning	3	—	70	30	100	3	3	— 3
2	EPC2.2 Environmental Design	3	—	70	30	100	3	3	— 3
3	EPC2.3 Environmental Monitoring and Assessment	3	—	70	30	100	3	3	— 3
4	EPC2.4 Environmental Impact Assessment	3	—	70	30	100	3	3	— 3
5	EPC2.5 Environmental Monitoring and Assessment(Lab)	—	3	—	100	100	—	—	3 3
6	EPC2.6 Remote Sensing and GIS for Environmental Planning	3	—	70	30	100	3	3	— 3

7 EPC2.7	Environmental Planning Studio –I Environmental Planning Studio (Regional Issues)	—	12	150	250	400	VV	—	6	6
Mandatory Training of Six Weeks after Second Semester during Summer Vacation (Non-Audit)										
Sub-Total		18	12	500	500	1000		15	9	24

EE/ EJ: End Exam / External Jury IA: Internal Assessment VV: Viva-Voce

THIRD SEMESTER

Sl. Code Credits	Subject No.	Hrs.Per	EE/ EJ	IA Week	Max. (Marks)	Exam (Marks)	Credits (Marks)	(Hrs.)
		T P					T P	
1 EPC3.1	Environmental Economics and Auditing	3 —	70	30	100	3	3 —	3
2 EPC3.2	Environmental Protection and Management	3 —	70	30	100	3	3 —	3
3 EPC3.3	Environmental Legislation, Evaluation and Practices	3 —	70	30	100	3	3 —	3
4 EPC3.4	Advanced EIATechniques	3 —	70	30	100	3	3 —	3
5 EPC3.5	Planning Legislation	3 —	70	30	100	3	3 —	3
6 EPC3.6	RS & GIS Lab	— 3	50	50	100	VV	— 3	3
7 EPC3.7	Environmental Planning Studio-II Environmental Planning Studio (Sectoral Issues)	— 12	150	250	400	VV	— 6	6
7 EPT3.0	Review of Six Weeks Mandatory Training during Summer Vacation after Second Semester							
Sub-Total		15 15	550	450	1000		15 9	24

FOURTH SEMESTER

1 EPC4.1	Formulation, Financing and Management of Developed Projects	3 —	70	30	100	3	3 —	3
2 EPC4.2	Seminar on Emerging Environmental Concepts	3 —	70	30	100	3	3 —	3
3 EPC4.3	Thesis	— 24	300	500	800	VV	— 12	12
Sub-Total		6 24	440	560	1000	—	6 12	18
Grand Total		57 63	2060	1940	4000		54 36	90

EE/ EJ: End Exam / External Jury IA: Internal Assessment VV: Viva-Voce

Note:

- 1) Credits for Theory: One Credit for one hour of teaching per week.
- 2) Credits for Practical: One Credit for two hours of practical per week.
- 3) Six Weeks Training after Second Semester during the summer vacation is Mandatory for which the review will be held in third semester.

Appendix "R" Item No.36

Under Graduate Degree Course

B.Tech in Computer Science & Engineering

(Scheme and Syllabus for : 2nd Year 1st & 2nd Semesters)

Computer Science and Systems Engineering

II/IV B.Tech (Four Year Course) &

II/VI B.Tech (Six Year Double Degree Course)

(With effect from 2020-2021 admitted batch onwards)

B.Tech. (CSE) II Year I-Semester Scheme of Instruction and Examination

Course Credits	Category code	Course Title	Hours per	Internal	External	Total	
Marks			L T P	week	Marks	Marks	
CS2101	BS	Probability, Statistics and Queuing Theory	3 1 0	30	70	100	3
CS 2102	PC	Elements of Electronics Engineering	3 1 0	30	70	100	3
CS 2103	PC	Computer Organization And Architecture	3 1 0	30	70	100	3
CS 2104	PC	Operating Systems	3 1 0	30	70	100	3
CS 2105	PC	Object Oriented Programming through Java	3 1 0	30	70	100	3
CS 2106	PC	Computer Organization Lab	0 0 3	50	50	100	1.5
CS 2107	PC	Object Oriented Programming (through Java) Lab	0 0 3	50	50	100	1.5
CS 2108	PC	Operating Systems Lab	0 0 3	50	50	100	1.5
CS 2109	SC	Intellectual Property Rights (MC)	1 0 2	50	50	100	2
CS 2110	MC	Environmental Science	0 0 0	-	100	100	0
Total							21.5

II/IV B.Tech (Four Year Course) &

II/VI B.Tech (Six Year Double Degree Course)

(With effect from 2020-2021 admitted batch onwards)

B.Tech. (Cse) II Year II-semester Scheme of Instruction and Examination

Course Credits	Category code	Course Title	Hours per week	Internal Marks	External Marks	Total Marks
			L T P			
CS2201	ES	Microprocessors	3 1 0	30	70	100
CS2202	PC	Design and Analysis of Algorithms	3 1 0	30	70	100
CS2203	PC	Database Management Systems	3 1 0	30	70	100
CS2204	PC	Formal Languages and Automata	3 1 0	30	70	100
CS2205	HSS	Managerial Economics	3 1 0	30	70	100
CS2206	PC	Algorithms Lab	0 0 3	50	50	100
CS2207	PC	Database Management Systems Lab	0 0 3	50	50	100
CS 2208	SC	Java Technologies	1 0 2	50	50	100
CS2209	MC	Professional Ethics and Universal Human Values	0 0 0	0	100	100
CS2210	MC	NSS / NCC	0 0 2	-	-	-
Total Credits						20

Summer Internship (Community Service)

CS 2101 : PROBABILITY, STATISTICS & QUEUEING THEORY Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 HoursCredits: 3
Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course objectives

1. to provide foundations of probabilistic and statistical analysis
2. to provide an understanding on concepts of probability, random variables, probability distributions, sampling, estimation, hypothesis testing, regression, correlation, multiple regression, hypothesis testing, sample test, queueing methods
3. to explore applications of probabilistic and statistical tools to solve real world problems.

Course outcomes

After completion of the course the student should be able to:

1. define and explain basic concepts in probability theory and how to translate real-world problems into probability models

2. solve standard problems that include random variables, discrete and continuous probability distributions

3. perform Test of Hypothesis and construct a confidence interval to estimate population parameters

4. compute and interpret the results of Correlation Analysis, Multivariate Regression, Chi-Square test for Independence and Goodness of Fit

5. explain basic concepts in Markov processes, M/M/1 and M/M/C queueing systems.

SYLLABUS

1. Probability: Definitions of probability, Addition theorem, Conditional probability, Multiplication theorem, Bayes Theorem of Probability and Geometric Probability.

2. Random variables and their properties: Discrete Random Variable, Continuous Random Variable, Probability Distribution, Joint Probability Distributions their Properties, Transformation Variables, Mathematical Expectations, Probability Generating Functions.

3. Probability Distributions: Discrete Distributions : Binomial, Poisson Negative Binominal Distributions And Their Properties; Continuous Distributions : Uniform, Normal, Exponential Distributions And Their Properties.

4. Multivariate Analysis : Correlation, Correlation Coefficient, Rank Correlation, Regression Analysis, Multiple Regression, Attributes, Coefficient Of Association, Chi Square Test For Goodness Of Fit, Test For Independence.

5. Estimation: Sample, Populations, Statistic, Parameter, Sampling Distribution, Standard Error, Un- biasedness, Efficiency, Maximum Likelihood Estimator, Notion & Interval Estimation.

6. Testing of Hypothesis: Formulation of Null hypothesis, critic al region, level of significance, power of the test;

7. Sample Tests: Small Sample Tests : Testing equality of .means, testing equality of variances, test of correlation coefficient, test for Regression Coefficient; Large Sample tests: Tests based on normal distribution

8. Queueing Theory : Queue description, characteristics of a queueing model, study state solutions of M/M/1: Model, M/M/1 ; N Model, M/M/C: Model, M/M/C: N Model , Case studies

Text Books

1. Probability & Statistics for Engineers and Scientists, Walpole, Myers, Myers, Ye. Pearson Education.

2. Probability, Statistics and Random Processes T.Veerarajan Tata McGraw – Hill

Reference Book

1. Probability & Statistics with Reliability, Queuing and Computer Applications, Kishor S. Trivedi, Prentice Hall of India ,1999

CS 2102 : ELEMENTS OF ELECTRONICS ENGINEERING **Common with 6years integrated B.Tech(CSE)+M.Tech**

Instruction: 3Periods/week, Univ. Exam: 3 Hours Credits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives

1. Introduce students to basics of semiconductors, their classification and properties
2. To provide theory of PN junction diode, its characteristics and applications
3. To introduce basics of rectifying circuits and bipolar junction transistor
4. To provide basics of transistor biasing, transistor amplifiers and field effect transistors

Course Outcomes

By the end of the course, the student should be able to:

1. Explain the basics of semiconductors and their classification
2. Understand the theory of PN junction diode, rectifying circuits and bipolar junction transistor
3. Explain the concepts of transistor biasing, transistor amplifiers and field effect transistors

1. Introduction to Electronics and Semiconductors: Energy band theory, Conduction in Insulators, Semiconductors and metals, Electron emission from metals, Classification of semiconductors, Carrier concentration in an intrinsic semiconductor, Properties of intrinsic semiconductor, Drift and diffusion currents.

2. Semi Conductor Diode: Theory of PN junction diode, Open circuited PN junction, V-I characteristics of a PN diode, Diode current equation, Transition and diffusion capacitances, Break down in PN diode, Applications of PN diodes. Zener diode, Zener regulator, Tunnel diode, Schottky diode.

3. Rectifying circuits: Half wave and full wave rectifiers, Bridge rectifiers, Efficiency, Ripple and regulation of each rectifier, Capacitor filters.

4. Bipolar Junction Transistor :- Introduction, construction, Operation of PNP and NPN Transistors – Transistor Circuit configurations-

Characteristics of a CE configurations – h parameters, low frequency small signal equivalent circuit of a Transistor.

5. Transistor Biasing and thermal stabilization: Transistor Biasing, Stabilization, Different methods of transistor biasing – Fixed bias, Collector feedback bias – self bias – Bias compensation.

6. Transistor Amplifiers: CE, CB, CC amplifier configurations – Multistage amplifier – A Two Stage RC coupled amplifier – frequency response curve and bandwidth.

7. Field Effect Transistors: Junction Field Effect Transistors (JFET) – JFET characteristics, JFET Parameters, Small signal equivalent circuit – MOSFETS – Depletion and Enhancement MOSFETS.

Text Books:

1. Electronic Device and Circuits by Sanjeev Gupta.

Reference Books:

1. Electronic Device and Circuits Theory by Robert L. Boylestad
Electronic Device and Circuits by David. A. Bell

CS 2103 : COMPUTER ORGANIZATION AND ARCHITECTURE

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 Hours Credits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives:

1. To study about structure and functional components of a computer.
2. Understanding the hierarchical organization of a computer system which consists of instruction set of commands.
3. Learn about the architecture of a computer from a programming view.
4. To design a balance system that minimizes performance and utilization of all elements.

Course Outcomes:

1. Knowledge about major components of a computer such as processor, memory and I/O modules along with their interconnections internally with outside world.
2. Detailed idea about architecture of central processing unit, functions of control unit, memory, I/O devices and their issues.
3. simple and multiple processor organization and their issues.

SYLLABUS

1. Register Transfer and Micro operations: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Micro

operations, Logic Micro operations, Shift Micro operations, Arithmetic Logic Shift Unit.

2. Basic Computer Organization and Design : Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instructions, Input- Output and Interrupt, Complete Computer Description, Design of Basic Computer, Design of Accumulator Logic.

3. Micro programmed Control: Control Memory, Address Sequencing, Micro program Example, Design of Control Unit.

4. Central Processing Unit: Introduction, General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer (RISC), Architecture and Programming of 8085 Microprocessor.

5. Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processors.

6. Input/output Organization: Peripheral Devices, I/O interface, Asynchronous data transfer, Modes of transfer, priority Interrupt, Direct memory access, Input-Output Processor (IOP), Serial Communication.

7. Memory Organization: Memory Hierarchy, Main memory, Auxiliary memory, Associate Memory, Cache Memory, and Virtual memory, Memory Management Hardware.

Text Books:

1. Computer System Architecture, M. Morris Mano, Prentice Hall of India Pvt. Ltd., Third Edition, Sept. 2008.

2. Computer Architecture and Organization, P. Chakraborty.

3. Microprocessor Architecture, Programming and Applications with the 8085 by Ramesh S Gaonkar

Reference Books:

1. Computer Architecture and Organization, William Stallings, PHI Pvt. Ltd., Eastern Economy Edition, Sixth Edition, 2003.

2. Computer Organization and Architecture, Linda Null, Julia Lobur, Narosa Publications ISBN 81-7319-609-5

3. Computer System Architecture", John. P. Hayes.

CS 2104 : OPERATING SYSTEMS

Common with 6 years integrated B.Tech(CSE)+M.Tech

Instruction: 3 Periods/week, Univ. Exam: 3 Hours Credits: 4

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course objectives:

1. To understand evolution of Operating System.

2. To understand operating system as a layer of abstraction above physical hardware that facilitates usage convenience and efficient resource management of computer system resources.

3. To learn design and implementation of policies and mechanisms for OS subsystem.

4. To investigate case studies to understand the design philosophies / paradigm for popular multiuser or single user operating system.

Course Outcomes:

1. The student understands OS evolution, its structure and services provided by it.

2. Learn process life cycle, process scheduling objectives, policies and mechanisms, process synchronization, inter process communication, deadlocks and other process subsystem related concepts.

3. Learn memory hierarchy, allocation and deallocation policies and mechanism for main and auxiliary memory, file system design and implementation issues.

4. investigate UNIX/ LINUX and Windows OS platforms w.r.t similarities and differences in design philosophies.

SYLLABUS

1. Introduction to Operating Systems: Over View of Operating Systems, Types of Operating Systems, Operating System Structures, Operating System Services, System Calls, Virtual Machines, Operating System Design and Implementation.

2. Process Management: Process Concepts, Operations on Processes, Cooperating Processes, Threads, Inter Process Communication, Process Scheduling, Scheduling Algorithms, Multiple- Processor Scheduling, Thread Scheduling.

3. Process Synchronization: The Critical Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classical Problems of Synchronization, Critical Regions, Monitors.

4. Deadlocks: System Model, Deadlock Characterization, Methods For Handling Deadlocks, Deadlock Prevention, Avoidance, Deadlock Detection, Recovery from Deadlocks

5. Memory Management: Logical versus Physical Address, Swapping, contiguous memory allocation, paging, structure of the page table, segmentation, Virtual Memory, Demand Paging, Page Replacement, Allocation of Frames, Thrashing, Memory-Mapped files

6. File Systems, Implementation, and Secondary-storage Structure : Concept of file, Access Methods, Directory Structure, Protection, File System

Structure, Allocation Methods, Free Space Management, Directory Management, Device Drivers, overview of Mass-storage structure, Disk structure, disk attachment, disk scheduling, swap-space management.

7. Case study: Overview of LINUX, Windows Operating systems

TextBook:

1. Operating Systems, Abraham Silberschatz, Peter Baer Galvin, and GregGagne, John Wiley Publ., SeventhEdition.

1. Operating Systems;A Practical Approach.Rajiv Chopra.

Reference Books:

1. Modern Operating Systems, Andrew S. Tanenbaum, ,2nd edition, 1995,PHI.

2. Operating Systems, William Stallings 5th Edition -PHI

3. Operating Systems: A Design-Oriented Approach', Charles Crowley, 'TataHill Co.,1998 edition.

CS2105 : OBJECT ORIENTED PROGRAMMING through JAVA

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods+1Tut/week, Univ. Exam: 3 Hours Credits: 4

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Learning Objectives:

* This subject will help to improve the analytical skills of object oriented programming

* Overall development of problem solving and critical analysis

* Formal introduction to Java programming language

Learning Outcome:

On successful completion of this course, the student should be able to:

* Show competence in the use of the Java programming language in the development of small to medium-sized application programs that demonstrate professionally acceptable coding and performance standard

* Understand the basic principles of the object-oriented programming

* Demonstrate an introductory understanding of graphical user interfaces, multi- threaded programming, and event-driven programming.

SYLLABUS

1. Introduction to Java : Basics of Java programming, Data types, Variables, Operators, Control structures including selection, Looping, Java methods, Overloading, Math class, Arrays in java.

2. Objects and Classes : Basics of objects and classes in java, Constructors, Finalizer, Visibility modifiers, Methods and objects, Inbuilt classes like String, Character, StringBuffer, File, this reference

3. Inheritance and Polymorphism : Inheritance in java, Super and sub class, Overriding, Object class, Polymorphism, Dynamic binding, Generic programming, Casting objects, Instance of operator, Abstract class, Interface in java, Package in java, UTIL package.

4. Event and GUI programming : Event handling in java, Event types, Mouse and key events, GUI Basics, Panels, Frames, Layout Managers: Flow Layout, Border Layout, Grid Layout, GUI components like Buttons, Check Boxes, Radio Buttons, Labels, Text Fields, Text Areas, Combo Boxes, Lists, Scroll Bars, Sliders, Windows, Menus, Dialog Box, Applet and its life cycle, Introduction to swing

5. I/O programming : Text and Binary I/O, Binary I/O classes, Object I/O, Random Access Files.

6. Multithreading in java : Thread life cycle and methods, Runnable interface, Thread synchronization, Exception handling with try-catch-finally, Collections in java, Introduction to JavaBeans and Network Programming.

Reference Books:

1 Introduction to Java Programming (Comprehensive Version), Daniel Liang, Seventh Edition, Pearson.

2 Programming in Java, Sachin Malhotra & Saurabh Chaudhary, Oxford University Press.

3 Murach's Beginning Java 2, Doug Lowe, Joel Murach and Andrea Steelman, SPD.

4 Core Java Volume-I Fundamentals, Eight Edition, Horstmann & Cornell, Pearson Education.

5 The Complete Reference, Java 2 (Fourth Edition), Herbert Schild, TMH.

6 Java Programming, D. S. Malik, Cengage Learning.

CS 2106 : DIGITAL ELECTRONICS & MICROPROCESSORS LAB

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 HoursCredits: 2

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

Course Objective:

1. To learn the about logic gates, half adders, full adders and flip - flops.

2. To learn about the microprocessor programming.

3. To learn about the microprocessor interfacing with stepper motor, R-2R ladder.

Course Outcomes:

1. The student understands the logic gates, half adders, full adders and flip-flops to design a circuit.
2. The student develops the skill of writing microprocessor programming.
3. The student understands the interfacing of microprocessor with stepper motor, R-2R ladder.

1. DIGITAL EXPERIMENTS : a. Verification of truth tables of OR, AND, NOT, NAND, NOR, EX-OR gates (By using 7400-series) b. Construction of gates using NAND, NOR gates. c. Construction of Half and Full adders and verifying their truth tables. d. Operation and verifying truth tables of flip-flops- RS, D, and JK using ICs. e. Construction of Decade counters (7490). f. 4-bit parallel adder using combinational circuits. g. Decade counter using JK flip flops. h. Up/Down counter using JK flip flop. i. Up/Down counter using 7493.

2. MICROPROCESSOR (Intel 8085) Programming : a. Binary addition & subtraction. (8-bit & 16-bit) b. Multiplication & division. c. Picking up largest/smallest number. d. Arranging –ascending/descending order. e. Decimal addition (DAA) & Subtraction. f. Time delay generation

Text Book:

8. Microprocessor Architecture, Programming and Applications with the 8085 by Ramesh Gaonkar

9. Computer System Architecture, M. Morris Mano, Prentice Hall of India Pvt. Ltd., Third Edition, Sept. 2008.

CS 2107 : OBJECT ORIENTED PROGRAMMING Through JAVA LAB

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 HoursCredits: 1.5

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

Course Objectives:

1. To develop programs using basic OOPS concepts such as classes and objects.
2. To implement programs using Inheritance concepts.
3. To implement programs using Exception handling.
4. To develop programs using operator overloading concepts.

Course Outcomes:

1. Student will be able to use OOPs concepts.
2. Ability to apply Inheritance concepts to several problems.
3. Ability to use Exception Handling concepts.

List of Programs:

1. Program to define a structure of a basic JAVA program
2. Program to define the data types, variable, operators, arrays and control structures.
3. Program to define class and constructors. Demonstrate constructors.
4. Program to define class, methods and objects. Demonstrate method overloading.
5. Program to define inheritance and show method overriding.
6. Program to demonstrate Packages.
7. Program to demonstrate Exception Handling.
8. Program to demonstrate Multithreading.
9. Program to demonstrate I/O operations.
10. Program to demonstrate Network Programming.
11. Program to demonstrate Applet structure and event handling.
12. Program to demonstrate Layout managers.

CS 2108 : OPERATING SYSTEMS LAB

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 Hours Credits: 1.5

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

Course Objectives:

1. To learn about UNIX/LINUX operating system, its intervals.
2. To learn system programming for UNIX/LINUX Operating System.
3. To understand UNIX/LINUX shell and its programming.
4. To understand resource management policies and mechanisms and their performance evaluation.

Course Outcomes:

1. The student practices UNIX commands, Vi editor, shell commands.
2. The student develops skill in writing C programs using system calls for process management, inter process communication and other aspects.
3. The student learns shell programming and develops skill for writing scripts for batch level tasks.
4. The student learns to simulate OS resource management aspects like process scheduling , page replacement and others to evaluate performance.

Module I :

1. OS lab familiarization, Home Assignment on Unix commands, Vi editor
2. Simple C programs using command line arguments, system calls, library function calls, make utility
3. C programs using fork system call to create processes and study parent, child process mechanism
4. C programs to create process chaining, spawning
5. C programs to handle errors using errno, perror() function
6. C programs to use pipe system call for inter process communication

Module II

1. Familiarization of Unix shell programming
2. Simple shell programming exercises
3. Shell programming using decision making constructs
4. Shell programming using loop constructs
5. Shell programming for file and directory manipulation

Module III

1. C programs to study process scheduling implementing FCFS, Shortest Job First, and Round Robin algorithms
2. C programs to study page replacement implementing FIFO, Optimal, and LRU page replacement algorithms
3. C programs to study deadlock avoidance and detection
4. C Programs to simulate free space management

References:

1. Unix concepts and applications by Sumitabha Das, TMH Publications.
2. Unix programming by Stevens, Pearson Education.
3. Shell programming by Yashwanth Kanetkar.
4. Operating System Concepts by Silberschatz, and Peter Galvin.

CS 2109 : INTELLECTUAL PROPERTY RIGHTS

Common with 6 years integrated B.Tech(CSE)+M.Tech

Instruction: 3 Periods/week, Univ. Exam: 3 Hours Credits: 2

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objective:

1. To introduce the students to Intellectual Property Rights (IPR) which is a key component in modern knowledge management processes
2. To create consciousness on IPR in students at an early stage of their education so that they develop an appreciation for ethical and rightful use of existing knowledge
3. To make them understand how to take ownership of knowledge they may develop as a result of their creative innovations, take ownership and either drive themselves in becoming entrepreneurs or become responsible knowledge users in society
4. To expose students some of the recent debates on the societal implications of IPR and its role in national/international trade and socio-economic development.

Course outcome:

Learners will be able to

1. identify the types of intellectual property protection available for their research outcome
2. conduct patent search and analyze patentability of the invention
3. understand the basic structure of Patent document
4. understand the registration and prosecution of different IPs
5. understand the basics of IP commercialization and techno/commercial/legal issues in IPR commercialization

SYLLABUS

1. Introduction : Concept of property, Intellectual Property (IP) and Intellectual Property Rights (IPR), Importance of IP, Value creation through IP, Advantages of IP protection, Competitive advantage, Promotion of social good, Prevention of duplicates, counterfeit products and IP
2. Evolution of IP system : Historical view of IP system in India and abroad, Legal basis and rationale behind development of IP system, WTO and TRIPS agreement, Role of WIPO
3. Types of IPR : Major forms of IP in India and globally, Acts enacted in India related to IP
4. Patent : Concept, Life of patent, Rights of Patentee, Criteria of patentability- novelty, non-obviousness, and utility, Non-patentable inventions
5. Patent filing and prosecution : Prior art search, Process of obtaining a patent in India, Provisional and complete specification, Convention application, Patent Cooperation Treaty (PCT), Patent Infringement and Enforcement
6. Trademark : Types of trademarks, Trademark and Brand, Trademark Registration, Trademark Infringement

7. Copyright : Copyrights and related rights, Copyright registration, Copyright infringement, Section 52 of Indian Copyright Act

8. Industrial Design : What is Industrial design, Design registration, Design infringement

9. Trade Secret : What are Trade Secrets, How trade secrets are maintained in trade and business

10. Other forms of IP : Semiconductor Integrated Circuits Layout Design, Geographical Indications, Protection of Plant Varieties & Farmers' right, Traditional knowledge

11. IP commercialization : Licensing & Royalty; Technology Transfer; IP assignment, Compulsory License

12. Emerging areas : Patinformatics, IP and bank loan, IP insurance, IP audit, IP valuation, IP management, Use of artificial intelligence in IP enforcement, Open innovation

Text Books

1. Ganguli Prabuddha, Gearing up for Patents The Indian Scenario", Universities Press (1998)

2. Ganguli Prahuddha "Intellectual Property Rights-Unleashing the Knowledge Economy". Tata McGraw Hill (2001)

3. Geographical Indications of Goods Act 1990 Ganguli Prabuddha "Geographical Indications-its evolving contours accessible in http://ips.nminsoda/files/2012/05/main_book_pdf (2009)

Reference Books

1. Ganguli Prabuddha and Jahade Siddharth, "Nanotechnology Intellectual Property Rights Research, Design, and Commercialisation", CRC Press, Taylor and Francis Group, USA (2012)

2. Beyond Intellectual Property: Toward Traditional Resource Rights for Indigenous Peoples and Local Communities [Paperback] J. Darrell A. Posey and Graham Dotfield, IDRC Books; annotated edition (June (1996)

3. Netanel Neil Weinstock, Copyright's Paradox, Oxford University Press (2010)

4. The Indian Patents Act 1970 (as amended in 2005)

5. The Indian Copyright Act 1950 as amended in 2017)

6. Indian Trademarks Act 1999

7. The Indian Industrial Designs Act 2000

8. The Protection of Plant Varieties and Farmers' Right Act 2001

9. Inventing the Future: An Introduction to Patents for small and medium sized enterprises, WIPO publication No 917 www.wipo.int/ebookshop

10. Looking Good: An Introduction to Industrial Designs for Small and Medium sized Enterprises; WIPO publication No.498 www.wipo.int/ebookshop

CS 2110 : ENVIRONMENTAL SCIENCE

Common with 6 years integrated B.Tech(CSE)+M.Tech

Instruction: 2 Periods/week, Univ. Exam: 3 Hours Credits: 0

Internal: 0 Marks University Exam: 100 Marks Total: 100 Marks

Course Objectives

The objectives of the Environmental Science course are to

- Familiarize the fundamental aspects of environment and the environmental management
- Provide information of some of the important international conventions which will be useful during the future endeavors after graduation.
- Make realize the importance of natural resources management for the sustenance of the life and the society.
- Apprise the impact of pollution getting generated through the anthropogenic activities on the environment
- Provide the concept of Sustainable Development, energy and environmental management
- Impart knowledge on the new generation waste like e-waste and plastic waste.

Course Outcomes

After completion of the course the students will have

- Knowledge on the fundamental aspects of environment and the environmental management
- The knowledge on the salient features of the important international conventions
- Understanding of the importance of natural resources management for the sustenance of the life and the society.
- Familiarity on various forms of pollution and its impact on the environment.
- Understand the elements of Sustainable Development, energy and environmental management
- Knowledge on the new generation waste like e-waste and plastic waste.

SYLLABUS

1. Introduction: Structure and functions of Ecosystems-Ecosystems and its Dynamics-Value of Biodiversity-impact of loss of biodiversity, Conservation of bio-diversity. Environmental indicators - Global environmental issues and their impact on the ecosystems.

Salient features of International conventions on Environment: Montreal Protocol, Kyoto protocol, Ramsar Convention on Wetlands, Stockholm Convention on Persistent Organic Pollutants, United Nations Framework Convention on Climate Change (UNFCCC),

2. Natural Resources Management: Importance of natural resources management-Land as resource, Land degradation, Soil erosion and desertification, Effects of usage of fertilizer, herbicides and pesticide-watershed management.

3. Forest resources: Use and over-exploitation, Mining and dams – their effects on forest ecosystems and the living beings.

4. Water resources: Exploitation of surface and groundwater, Floods, droughts, Dams:benefits and costs.

5. Mineral Resources: Impact of mining on the environment and possible environmental management options in mining and processing of the minerals.

Sustainable resource management (land, water, and energy), and resilient design under the changing environment.

6. Environmental Pollution: Local and Global Issues. Causes, effects and control measures. Engineering aspects of environmental pollution control systems.

7. Air pollution: impacts of ambient and indoor air pollution on human health. Water pollution: impacts water pollution on human health and loss of fresh water resources. Soil pollution and its impact on environment. Marine pollution and its impact on blue economy. Noise pollution.

8. Solid waste management: Important elements in solid waste management- Waste to energy concepts. Air (prevention and control of pollution) Act, Water (prevention and control of pollution) Act and their amendments. Salient features of Environmental protection Act, 1986.

9. Sustainable Development: Fundamentals of Sustainable Development– Sustainability Strategies and Barriers – Industrialization and sustainable development. Circular economy concepts in waste (solid and fluid) management.

10. Energy and Environment: Environmental Benefits and challenges, Availability and need of conventional energy resources, major environmental problems related to the conventional energy resources, future possibilities of energy need and availability. Solar Energy: process of photovoltaic energy

conversion, solar energy conversion technologies and devices, their principles, working and applications, disposal of solar panel after their usage. Biomass energy: Concept of biomass energy utilization, types of biomass energy, conversion processes, Wind Energy, energy conversion technologies, their principles, equipment and suitability in context of India.

11. Management of plastic waste and E-waste: Sources, generation and characteristics of various e- and plastic wastes generated from various industrial and commercial activities; Waste management practices including onsite handling, storage, collection and transfer. E-waste and plastic waste processing alternatives. E-Waste management rules and Plastic waste management rules, 2016 and their subsequent amendments.

Text Books:

1. Bharucha, Erach (2004). Textbook for Environmental Studies for Undergraduate Courses of all Branches of Higher Education, University Grants Commission, New Delhi.

2. Basu, M., Xavier, S. (2016). Fundamentals of Environmental Studies, Cambridge University Press, India

3. Masters, G. M., & Ela, W. P. (1991). Introduction to environmental engineering and science. Englewood Cliffs, NJ: Prentice Hall.

4. Enger, E. and Smith, B., Environmental Science: A Study of Interrelationships, Publisher: McGraw-Hill Higher Education; 12th edition, 2010.

Reference Books:

1. Sharma, P. D., & Sharma, P. D. (2005). Ecology and environment. Rastogi Publications

2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.

3. Clark R.S. (2001). Marine Pollution, Clanderson Press Oxford (TB)

4. Jadhav, H & Bhosale, V.M. (1995). Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.

5. MoEF&CC, Govt. of India, CPCB: E-waste management rules, 2016 and its amendments 2018.

6. MoEF&CC, Govt. of India, CPCB: Plastic waste management rules, 2016.

III/IV B.TECH (FOUR YEAR COURSE) &

II/VI B.TECH (SIX YEAR DOUBLE DEGREE COURSE)

(With effect from 2020-2021 admitted batch onwards)

B.TECH. (CSE) II YEAR II-SEMESTER SCHEME OF INSTRUCTION AND EXAMINATION

Course Category	Credits	code	Course Title	Hours per	Internal	External	Total	
Marks				L T P	week	Marks	Marks	
CS2201	ES		Microprocessor	3 1 0	30	70	100	3
CS2202	PC		Design and Analysis of Algorithms	3 1 0	30	70	100	3
CS2203	PC		Database Management Systems	3 1 0	30	70	100	3
CS2204	PC		Formal Languages and Automata	3 1 0	30	70	100	3
			Theory					
CS2205	HSS		Managerial Economics	3 1 0	30	70	100	3
CS2206	PC		Algorithms Lab	0 0 3	50	50	100	1.5
CS2207	PC		Database Management	0 0 3	50	50	100	1.5
			Systems Lab					
CS 2208	SC		Java Technologies	1 0 2	50	50	100	2
CS2209	MC		Professional Ethics and	2 0 0	-	100	100	0
			Universal Human Values					
CS2210	MC		NSS / NCC	0 0 2	-	-	-	0
Total Credits							20	

Summer Internship (Community Service)

CS2201 : MICROPROCESSORS

Instruction: 3Periods/week, Univ. Exam: 3 Hours Credits: 3
Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives:

1. To discuss the architectures of 8085, 8086 microprocessors, their instruction sets and related ALP programs.
2. To discuss interfacing semiconductor memories, interfacing peripheral to Intel 8086.
3. To study interfacing data converters to 8086 and discuss about micro controller 8051 architecture.

Course Outcomes:

1. Understand the basic architectures of 8085 and 8086 microprocessors.
2. Ability to write ALP programs using instruction sets.
3. Understand the various interfacing concepts and micro controllers.

SYLLABUS

1. Introduction to Microprocessors and Microcomputers: A Brief Architecture and Programming of 8085Microprocessor.

2. Architecture: Instruction Set and Programming of 8086 Microprocessor

3. Interfacing Semiconductor Memories and I/O Devices: Semiconductor Memories:ClassificationInternal Organization& Functional Description, Interfacing SRAMs and EPROMs to8086, Interfacing Characteristics of I/Devices, I/O Device addressing methods, I/O DeviceProgramming Methods.

4. Interfacing Peripherals to Intel8086 -1: Parallel I/O Interface-8255,Serial I/O Interface –8251, Timer Interface -8253/8254

5. Interfacing Peripheral to Intel 8086 -2: Keyboard/ Display Interface-8279,InterruptControllerInterface–8259

6. Interfacing Data Converters to 8086: D/A Conversion Methods, A/D Conversionmethods, Interfacing DAC, InterfacingADC.

7. Introduction to Micro controllers: Intel 8051Architecture andProgramming

Textbooks:

1. Microprocessor Architecture, Programming, and Applications with the8085 Ramesh S.Gaonkar, 4thEdition, PenramInternational,1999
2. The 80x86 Family, Design, Programming and Interfacing, John E.Uffenbeck, 3rdEdition,Pearson Education Inc.,2002
3. KennethJ.Ayala, 8051 Microcontroller Architecture, Programming AndApplications,2ndEdition, Penram InternationalPublications,1999

Reference Books:

1. BARRY B. BREY,The Intel Microprocessors 8086/8088,80186/80188, 80286, 80386 and 80486, Pentium, Pentium Pro Processor, Pentium II, Pentium III, Pentium 4, Architecture, Programming and Interfacing, 8thEdition, Pearson Education Inc., 2009
2. alter A. Tribel and Avtar Singh, The 8088 and 8086 Microprocessors, Programming, interfacing,Software, Hardware, and Applications, 4thEdition, Pearson Education Inc.,20033.MicroprocessorsandInterfacing, Programming and Hardware, 2ndEdition, Douglass V. Hall,TMH Edition,1999
3. SanjayK Bose, Hardware and Software of Personal Computers, New Age International (P)Ltd.,1991 MykePredko, Programming and Customizing the 8051 Microcontroller, TMH,1999

CS 2202 : DESIGN & ANALYSISOFALGORITHMS

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods + 1 tutorial/week, Univ. Exam: 3 Hours Credits: 4
 Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives:

On completing this course student will be able to

1. Solve problems using algorithm design methods such as the greedy method, divide and conquer, dynamic programming, backtracking, and branch and bound and writing programs for these solutions
2. Analyze the asymptotic performance of algorithms.
3. Demonstrate a familiarity with major algorithms and data structures.
4. Synthesize efficient algorithms in common engineering design situations.

Course Outcomes:

1. Students will be able to justify the correctness of algorithms using inductive proofs and invariants
2. Analyze worst-case running times of algorithms using asymptotic analysis.
3. Describe various paradigms of design use them appropriately when an algorithmic design situation calls for it.
4. Students will be able to Compare between different data structures. Pick an appropriate data structure for a design situation.

SYLLABUS

1. Introduction– Fundamentals of algorithmic problem solving – important problemtype. Fundamentals of analysis of algorithms and efficiency – Analysis framework– Asymptotic Notations and Basic Efficiency classes – Mathematical Analysis ofNon- recursiveAlgorithms–Mathematical Analysis of recursive Algorithms–Empirical Analysis of Algorithms – Algorithm Visualization
2. BruteForce–SelectionSortandBubblesort–Sequential Search and Brute–Force String Matching – Closest Pair and Convex-Hull Problems by Brute Force – Exhaustive Search Divide-and-Conquer–Merge sort–Quick sort–BinarySearch–BinaryTreeTraversals and Related Properties – Multiplication of large integers and Strassen's Matrix Multiplication– Closest-Pair Convex-Hull Problems by Divide- and –Conquer
3. Decrease – and – Conquer – Insertion Sort – Depth-First Search and Breadth-FirstSearch- Topological Sorting–Algorithms for Generating Combinatorial Objects–Decrease-by-a Constant-Factor Algorithms – Variable-Size-DecreaseAlgorithms.
4. Transform-and-Conquer – Presorting – Gaussian Elimination – Balanced Search Trees– Heaps and Heap sort – Horner's Rule and Binary

Exponentiation – ProblemReduction Space and Time Tradeoffs – Sorting by Counting – Input Enhancement in stringMatching – Hashing –B-Trees

5. Dynamic Programming – Computing a Binomial Coefficient – Warshall'sandFloyd's Algorithm – Optimal Binary Search Trees - The Knapsack Problem and MemoryFunctions

6. Greedy Technique – Prim's Algorithm – Kruskal's Algorithm – Dijkstra's Algorithm– Huffman Trees Limitations of Algorithm Power – Lower-Bound Arguments –Decision Trees – P, NP and NP – complete problems – Challenges of NumericalAlgorithms

7. Coping with the Limitations of Algorithms Power – Backtracking – Branch-and-Bound– Approximation Algorithms for NP-hard Problems – Algorithms for solvingNonlinear Equations.

TextBook:

1. Introduction to Design & Analysis of Algorithms by Anany Levitin, Pearson Education, New Delhi, 2003
2. Fundamentals of Computer Algorithms, Horowitz and Sahni, Galgothiapublications.

ReferenceBooks:

1. Introduction to Algorithms by Thomas H. Corman, Charles E. Leiserson, Ronald R. Rivest&Clifford Stein, Prentice Hall of India, New Delhi, NewDelhi.

CS 2203 : DATABASE MANAGEMENT SYSTEMS

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3 Periods/week, Univ. Exam: 3 Hours Credits: 3
 Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives:

1. To learn the evolution of DBMS Versus File systems, data models, and layers of abstraction.
2. To understand conceptual and physical aspects of database design.
3. To learn formal and commercial query language specifications.
4. To understand concurrency control, recovery management, and other related issues.

Course Outcomes:

1. The student will understand ER-modeling for conceptual database design and relational model.
2. The student is introduced to formal and commercial query languages : Relational Algebra, calculus and SQL.

3. The student will learn schema refinement and normalization.
4. The Student understands locking protocols concurrency control, and crash recovery methods.

SYLLABUS

1. Introduction: File system versus a DBMS , Advantages of a DBMS, Describing and Storing Data in a DBMS, The Relational model, Levels of abstraction, Data Independence, Transaction management, Structure of a DBMS.

2. Introduction to Database Design and The Relational Model: Database Design and ER Diagrams, Entities, Attributes and Entity Sets, Relationships & Relationship Sets, Additional Features of the ER Model, Conceptual Design with ER Model, Introduction to the Relational Model, Integrity Constraints over Relations, Enforcing Integrity Constraints, Querying Relational Data, Logical Database Design: ER to Relational, Introduction to Views, Destroying/ Altering Tables and Views.

3. Relational Algebra and SQL: Preliminaries, Relational Algebra, The form of a Basic SQL Query, UNION, INTERSECT and EXCEPT, Nested Queries, Aggregate Operators, Null Values, Complex Integrity Constraints in SQL, Triggers and Active Databases, Embedded SQL, Dynamic SQL, JDBC.

4. Database Design: Schema Refinement and Normal Forms, Introduction to Schema Refinement, Functional Dependencies, Reasoning about FD's, Normal Forms, Properties of Decomposition, Normalization, Other kinds of Dependencies.

5. Transaction Management: The ACID Properties, Transactions & Schedules, Concurrent Execution of Transactions, Lock-Based Concurrency Control.

6. Concurrency Control: 2PL, Serializability and Recoverability, Introduction to Lock Management, Lock Conversions, Dealing with Deadlocks, Specialized Locking Techniques, Concurrency Control without Locking.

7. Crash Recovery: Introduction to ARIES, The Log, Other Recovery-Related Structures, The Write-Ahead Log Protocol, Check pointing, Recovering from a System Crash, Media Recovery.

Text Books:

1. Database Management Systems; Raghu Ramakrishnan, Johannes Gehrke 4th Edition, McGraw-Hill

2. Database Management Systems; Raghu Ramakrishnan, Johannes Gehrke.

Reference:

1. Database System Concepts; A. Silberschatz, H. Korth 5th Edition, McGraw-Hill

CS2204 : FORMAL LANGUAGES & AUTOMATA THEORY

Common with 6 years integrated B.Tech(CSE)+M.Tech

Instruction: 3 Periods/week, Univ. Exam: 3 Hours Credits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course objectives:

1. To introduce the concepts in automata theory and theory of computation to design grammars and recognizers for different formal languages.

2. To employ finite state machines to solve problems in computing.

3. To introduce finite state machines, context free grammars and Turing Machines and their properties as the basis for the formal expressivity of computer languages for solving linguistic decision problems.

4. To understand the concepts of tractability and decidability, the concepts of NP-completeness and NP-hard problem and also the challenges for Theoretical Computer Science and its contribution to other sciences.

Course outcomes:

1. Ability to think analytically and intuitively for problem solving situations in related areas of theory in computer science

2. Ability to describe the language accepted by an automata or generated by a regular expression or a context-free grammar;

3. Ability to Understand the functioning of Finite-State Machines, Deterministic Finite-State Automata, Nondeterministic Finite-State Automata and Pushdown Automata and Turing Machines.

SYLLABUS

1. Definitions of alphabet, strings, language, grammar, types of grammar, types of machines, generation of languages from grammar, construction of grammar from the given description of languages

2. Definition of finite state machine, Definite state machine, indefinite state machine, representations in mathematical diagram, tabular etc., id of finite state machine's, design of finite state machine from the given description, elimination of λ -transitions , indefinite state machine to definite state machine, optimization of finite state machine

3. Conversion of regular grammar to finite state machine, finite state machine to regular grammar, discussion of pumping lemma, systematic way of construction of finite state machine

4. Definition of regular expression, regular algebra, minimization of regular expressions, closure properties, construction of regular expression from the given description, regular expression to finite state machine, finite state machine to regular expression, construction of regular expression for the given finite state machine- a systematic way using Arden's theorem

5. Definition of push down machine, push down machine, types of push down machine's, push down machine to context free grammar, context free grammar to push down machine, design methodology of various push down machine's, push down machine by empty stack, push down machine by final states, conversion from one type to other type, applications of push down machine's

6. Parsing tree, bottom-up parsing, top-down parsing, types of context free grammar's, left-most and right most derivations, productions, reductions, optimization of context free grammar's, elimination of ϵ productions, unit productions, normal forms- cnf, gnf

7. Definition of Turing machine, ways of representing Turing machine's- tabular form, diagram, mathematical form, quintuples etc., design of Turing machine, id of Turing machine, types of Turing machine, halting problem, church's thesis, universal Turing machine, Gödel number, definitions of recursive functions- prf, rf, decidability. NOTE: Theorem proofs are eliminated

Text books:

1. Introduction to automata theory, languages and computation, John.E.H.P croft/ Rajeev Motwani & JD Ullman—pearson education- III edition

2. Theory of computation, K.L.P.Mishra and N.Chandrasekhar, PHI

Reference Books :

1. Theory of computation, formal languages and automata theory, G P Saradhi Varma, B.Thirupathi Rao –Sci Tech publications.

CS 2205 : MANAGERIAL ECONOMICS

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 Hours Credits:3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives:

· To bring about an awareness about the nature of Managerial Economics and its linkages with other disciplines.

- To understand the Micro and Macro Environment of Business.
- To familiarize the prospective engineers with the concepts and tools of Managerial Economics with an objective to understand the real world of business.

Course Outcomes:

After completion of the course, student will be able to:

- Understand the various economic activities in business and industry.
- Analyse the real world business problems.
- Make optimal business decisions for the effective and efficient management of Organisations.

SYLLABUS

Significance of Economics and Managerial Economics: Economics: Definitions of Economics- Wealth, Welfare and Scarcity definitions Classification of Economics- Micro and Macro Economics.

Managerial Economics: Definition, Nature and Scope of Managerial Economics, Differences between Economics and Managerial Economics, Main areas of Managerial Economics, Managerial Economics with other disciplines.

Demand and Utility Analysis: Demand - Definition, Meaning, Nature and types of demand, Demand function, Law of demand - Assumptions and limitations. Exceptional demand curve. Elasticity of demand - Definition, Measurement of elasticity, Types of Elasticity

(Price, Income, Cross and Advertisement), Practical importance of Price elasticity of demand, Role of income elasticity in business decisions, Factors governing Price Elasticity of demand.

Utility Analysis: Utility- Meaning, Types of Economic Utilities, Cardinal and Ordinal Utility, Total Utility, Marginal Utility, The law of Diminishing Marginal Utility and its Limitations.

Theory of Production and Cost analysis: Production - Meaning, Production function and its assumptions, use of production function in decision making; Cost analysis - Nature of cost, Classification of costs - Fixed vs. Variable costs, Marginal cost, Controllable vs. Non - Controllable costs, Opportunity cost, Incremental vs. Sunk costs, Explicit vs. Implicit costs, Replacement costs, Historical costs, Urgent vs. Postponable costs, Escapable vs. Unavoidable costs, Economies and Diseconomies of scale.

Market Structures : Definition of Market, Classification of markets; Salient features or conditions of different markets - Perfect Competition, Monopoly, Duopoly , Oligopoly, Importance of kinked demand curve ;Monopolistic Competition.

Pricing and Business Cycles :

Pricing Analysis : Pricing – Significance; Different Pricing methods- Cost plus pricing, Target pricing, Marginal cost pricing, Going -rate pricing, Average cost pricing, Peak load pricing , Pricing of joint Products, Pricing over the life cycle of a Product, Skimming pricing Penetration pricing, Mark-up and Mark- down pricing of retailers.

Business cycles - Definition, Characteristics, Phases, Causes and Consequences; Measures to solve problems arising from Business cycles.

Text Books:

1. Sankaran,S., Managerial Economics, Marghan Publications, 2015, Chennai.
2. Aryasri, A.R., Managerial Economics and Financial Analysis, MC Graw Hill Education, New Delhi,2015.

Reference Books:

1. Dwivedi, D.N., Managerial Economics, Vikhas Publishing House Pvt. Ltd. 6th Edition, New Delhi,2004.
2. Dewett, K.K., Modern Economic Theory, S.Chand & Company Ltd., New Delhi, 2005.

CS 2206 : ALGORITHMS LAB

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 Hours Credits: 1.5

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

Laboratory Outcomes:

The student should be able to:

- Design algorithms using appropriate design techniques (brute-force, greedy, dynamic programming, etc.)
- Implement a variety of algorithms such as sorting, graph related, combinatorial, etc., in a high level language.
- Analyze and compare the performance of algorithms using language features.
- Apply and implement learned algorithm design techniques and data structures to solve real-world problems.

The laboratory component will emphasize two areas:

Implementation of algorithms covered in class: This will involve running the algorithms under varying input sets and measuring running times, use of different data structures for the same algorithm (wherever applicable) to see its effect on time and space, comparison of different algorithms for the same problem etc.

Design of Algorithms: This will involve design and implementation of algorithms for problems not covered in class but related to topics covered in class. The exact set of algorithms to design and implement is to be decided by the instructor. In addition, there will be at least one significantly large design project involving some real world application. An efficient design of the project should require the use of multiple data structures and a combination of different algorithms/techniques.

Programs List:

1. a. Create a Java class called Student with the following details as variables within it.

- (i) USN
- (ii) Name
- (iii) Programme
- (iv) Phone

Write a Java program to create nStudent objects and print the USN, Name, Programme, and Phone of these objects with suitable headings.

b. Write a Java program to implement the Stack using arrays. Write Push(), Pop(), and Display() methods to demonstrate its working.

2.a. Design a superclass called Staff with details as StaffId, Name, Phone, Salary. Extend this class by writing three subclasses namely Teaching (domain, publications), Technical (skills), and Contract (period). Write a Java program to read and display at least 3 staff objects of all three categories.

b. Write a Java class called Customer to store their name and date_of_birth. The date_of_birth format should be dd/mm/yyyy. Write methods to read customer data as and display as using StringTokenizer class considering the delimiter character as "/".

3. a. Write a Java program to read two integers a and b. Compute a/b and print, when b is not zero. Raise an exception when b is equal to zero.

b. Write a Java program that implements a multi-thread application that has three threads. First thread generates a random integer for every 1 second; second thread computes the square of the number and prints; third thread will print the value of cube of the number.

4. Sort a given set of n integer elements using Quick Sort method and compute its time complexity. Run the program for varied values of n > 5000 and record the time taken to sort. Plot a graph of the time taken versus n on graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using Java how the divide-and-conquer method works along with its time complexity analysis: worst case, average case and best case.

5. Sort a given set of n integer elements using Merge Sort method and compute its time complexity. Run the program for varied values of $n > 5000$, and record the time taken to sort. Plot a graph of the time taken versus n on graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using Java how the divide-and-conquer method works along with its time complexity analysis: worst case, average case and best case.

6. Implement in Java, the 0/1 Knapsack problem using (a) Dynamic Programming method (b) Greedy method.

7. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm. Write the program in Java.

8. Find Minimum Cost Spanning Tree of a given connected undirected graph using Kruskal's algorithm. Use Union-Find algorithms in your program

9. Find Minimum Cost Spanning Tree of a given connected undirected graph using Prim's algorithm.

10. Write Java programs to : (a) Implement All-Pairs Shortest Paths problem using Floyd's algorithm. (b) Implement Travelling Sales Person problem using Dynamic programming.

11. Design and implement in Java to find a subset of a given set $S = \{S_1, S_2, \dots, S_n\}$ of n positive integers whose SUM is equal to a given positive integer d . For example, if $S = \{1, 2, 5, 6, 8\}$ and $d = 9$, there are two solutions $\{1, 2, 6\}$ and $\{1, 8\}$. Display a suitable message, if the given problem instance doesn't have a solution. 12. Design and implement in Java to find all Hamiltonian Cycles in a connected undirected Graph G of n vertices using backtracking principle.

REFERENCES:

1. T. H. Cormen, C. L. Leiserson, R. L. Rivest, and C. Stein, Introduction to Algorithms, MIT Press.
2. J. Kleinberg and E. Tardos, Algorithm Design, Addison-Wesley.
3. Harry R. Lewis and Larry Denenberg, Data Structures and Their Algorithms, Harper Collins.
4. A. Gibbons, Algorithmic Graph Theory, Cambridge University Press.
5. Michael T. Goodrich and Roberto Tamassia, Algorithm Design: Foundations, Analysis, and Internet Examples, John Wiley.
6. R. Sedgewick, Algorithms in C (Parts 1-5), Addison Wesley.
7. M. H. Alsuwaiyel, Algorithm Design Techniques and Analysis, World Scientific.
8. Gilles Brassard and Paul Bratley, Algorithmics : theory and practice, Prentice-Hall.

9. Udi Manber, Introduction to Algorithms: A Creative Approach, Addison-Wesley.

10. Sara Baase and Allen Van Gelder, Computer Algorithms: Introduction to Design and Analysis, Addison-Wesley.

CS 2207 : DATABASE MANAGEMENT SYSTEMS LAB

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 Hours Credits: 1.5

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

Course Objectives:

1. To introduce to a commercial DBMS such as ORACLE.
2. To learn and practice SQL commands for schema creation, data manipulation.
3. To learn conceptual and physical database design based on a case study.
4. To apply database design stages by studying a case study.

Course Outcomes:

1. The student is exposed to a commercial RDBMS environment such as ORACLE.
2. The student will learn SQL commands for data definition and manipulation.
3. The student understands conceptual through physical data base design.
4. The student takes up a case study and applies the design steps.

Features of a commercial RDBMS package such as ORACLE/DB2, MS Access, MYSQL & Structured Query Language (SQL) used with the RDBMS.

I. Laboratory Exercises Should Include:

- a. Defining Schemas for Applications,
- b. Creation of Database,
- c. Writing SQL Queries,
- d. Retrieve Information from Database,
- e. Creating Views
- f. Creating Triggers
- g. Normalization up to Third Normal Form
- h. Use of Host Languages,
- i. Interface with Embedded SQL,
- j. Use of Forms

- k. ReportWriting
- II. Some sample applications are givenbelow:
 1. Accounting Package for Shops,
 2. Database Manager for Magazine Agency or NewspaperAgency,
 3. Ticket Booking forPerformances,
 4. Preparing Greeting Cards &BirthdayCards
 5. Personal Accounts - Insurance, Loans, Mortgage Payments,Etc.,
 6. Doctor's Diary &BillingSystem
 7. Personal BankAccount
 8. Class MarksManagement
 9. HostelAccounting
 10. Video TapeLibrary,
 11. History of CricketScores,
 12. Cable TV Transmission ProgramManager,
 13. Personal Library.
 14. SailorsDatabase
 15. Suppliers and PartsDatabase
10. Computer Architecture and Organization, P.Chakraborty.

CS 2209 : PROFESSIONAL ETHICS AND UNIVERSAL HUMAN VALUES

Common with 6years integrated B.Tech(CSE)+M.Tech and B.Tech(IT)
 Instruction: 3Periods/week, Univ. Exam: 3 HoursCredits:3
 Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives:

The objective of the course is Six fold:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- This course will illuminate the students in the concepts of laws and its applicability to engineers
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection, Development of commitment and courage to act and also enable the students to imbibe and internalize the Values and Ethical Behaviour in the personal and professional lives
- To enable the students to imbibe the Values and Ethical Behavior in the personal and Professional lives

· The students will learn the rights and responsibilities Individual, employee, team member and a global citizen

Course Outcomes:

By the end of the course Student will be able to:

- Grasp the meaning of the concept – Law and also Get an overview of the laws relating to Engineers and also Apprehend the importance of being a law abiding person and They would have better critical ability
- Self-explore by using different techniques to live in harmony at various levels
- Analyze themselves and understand their position with respect to the moral and ethical character needed for a successful and satisfactory work life
- Students are expected to become more aware of themselves and their surroundings (family, society, nature)
- They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
- They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society)

SYLLABUS

Need, Basic Guidelines, Content and Process for Value Education

·Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation - as the process for self-exploration, Continuous Happiness and Prosperity - A look at basic Human Aspirations, Right understanding, Relationship and Physical Facility - the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels. Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking, Include practice sessions and case studies.

Understanding Harmony in the Human Being - Harmony in Myself!

· Understanding human being as: a co-existence of the sentient 'I' and the material 'Body', the needs of Self ('I') and 'Body' - happiness and physical facility, the Body as an instrument of 'I' (I being the doer, seer and enjoyer), the characteristics and activities of 'I' and harmony in 'I', the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail, P to ensure Sanyam and

Health, Include practice sessions and case studies. Understanding Harmony in the Family and Society - Harmony in Human – Human Relationship

- Understanding values in human-human relationship: meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship, the meaning of Trust; Difference between intention and competence, the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship, the harmony in the society (society being an extension of family), Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society, Universal Order from family to world family, Include practice sessions and case studies. Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

- Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature recyclability and self-regulation in nature, Understanding Existence as Co-existence of mutually interacting units in all – pervasive space, Holistic perception of harmony at all levels of existence, Include practice sessions and case studies.

Concept of Law and Law of Torts

- Understanding Essentials of a Valid Contract and the basics of contract law protecting rights and obligations, Introduction to the Law of Torts and the basics to protect oneself and the company Law affecting the Workplace Employers Responsibilities/Duties Hiring Practices, Introduction to Intellectual Property Law, Professional Code of Conduct for Engineers, Relationship between Law and Ethics, Include practice sessions and case studies.

Implications of the above Holistic Understanding of Harmony on Professional Ethics

- Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually

enriching institutions and organizations, Include practice sessions and case studies.

Text Books

1. R R Gaur, R Asthana, G P Bagaria, “A Foundation Course in Human Values and Professional Ethics”, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1

2. R R Gaur, R Asthana, G P Bagaria, “Teachers’ Manual for A Foundation Course in Human Values and Professional Ethics”, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

3. R. Subramanian, “Professional Ethics”, Oxford University Press.

4. S.B. Srivastha, “Professional Ethics & Human Values”, SciTech Publications (India) Pvt. Ltd. New Delhi.

5. D.R. Kiran, “Professional Ethics & Human Values”, TATA Mc Graw Hill Education.

6. Saroj Kumar, “Business Law” and Avtar Singh, “Law of Contract”

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.

2. A. N. Tripathi, “Human Values”, New Age Intl. Publishers, New Delhi, 2004.

3. The Story of Stuff (Book), Mohandas Karamchand Gandhi “The Story of My Experiments with Truth”, E. F.Schumacher. “Small is Beautiful”, Slow is Beautiful –Cecile Andrews, J C Kumarappa “Economy of Permanence”, Pandit Sunderlal “Bharat Mein Angreji Raj” and Dharampal, “Rediscovering India

4. G K Kapoor, “Business Law” and Sen & Mitra, “Business & Commercial Laws” and Calvin Frank Allen, “Business law for Engineers”

5. Hilgard, E. R.; Atkinson, R. C. & Atkinson, R.L. (1975). *Introduction to Psychology*. 6th Edition. New Delhi: Oxford and IBH Publishing Co. Pvt. Ltd.

6. Govindarajan, M; Natarajan, G. M. & Senthilkumar, V.S. (2013). *Professional Ethics & Human Values*. Prentice Hall: New Delhi

7. Gogate, S. B. (2011). *Human Values & Professional Ethics*. Vikas Publishing: New Delhi.

8. Charles E Harris Jr., Michael S Pritchard, Michael J Rabins, “Engineering Ethics, Concepts Cases: 4e, Cengage learning, 2015.

9. Caroline Whitbec, “ Ethics in Engineering Practice & Research: 2e, Cambridge University Press 2015.

**III/IV B.TECH (FOUR YEAR COURSE) &
III/VI B.TECH (SIX YEAR DOUBLE DEGREE COURSE)**

(With effect from **2019-2020** admitted batch onwards)

**B.TECH. (CSE) IIIYEAR I-SEMESTER SCHEME OF
INSTRUCTION AND EXAMINATION**

Sub. Ref	Name of the Subject	Periods			Maximum Marks			Credits
		Theory	Tutorial	Lab	Exam	Sessionals	Total	
CSE311	Computer Networks	3	1	—	70	30	100	3
CSE312	Operating Systems	3	1	—	70	30	100	4
CSE313	Formal Language & Automata	3	1	—	70	30	100	3
CSE314	Object Oriented Software	Theory						
		3	1	—	70	30	100	4
CSE315	Operations Research	3	1	—	70	30	100	3
CSE316	Elective - 1	3	1	—	70	30	100	3
CSE317	Data Communications And	—	—	3	50	50	100	1.5
CSE318	Operating Systems Lab	Computer Network Lab						
		—	—	3	50	50	100	1.5
CSE319	Soft Skills Lab	—	—	3	50	50	100	1.5

ELECTIVE - I:

1. Microprocessors
2. Data Communications
3. Principles of Programming Languages

CSE 311 : COMPUTER NETWORKS

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 HoursCredits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives:

1. To make the students understanding of basic requirements of network hardware, software and its architecture.
2. Familiarize the students with layered architecture of the network software and hierarchal nature of the network physical infrastructure.
3. Study of various network interconnecting devices and other associated network hardware.
4. Introduction of advanced networking concepts and wireless and wireless sensor networks.

Course Outcomes:

1. The student must be able to understand the design and estimate the requirements for practical setup of a given network scenario and size.
2. Realize the Operation, maintenance and management of the Internet by mapping the theoretical networking concepts to the real-time network scenarios.
3. Demonstrate the applications of wireless Networks and over view of advanced networking concepts.
4. Identify different networking devices and their usage and functionality

SYLLABUS

1. Introduction to Computer Networks: Introduction, Network Hardware, NetworkSoftware, Reference Models,
2. The Medium Access Control: The Channel Allocation Problem, CSMA Protocols, Collision Free Protocols, The Ethernet, Wireless LANS
3. Network Layer : Network Layer Design Issues, Routing Algorithms-Shortest path routing algorithm, Congestion ControlAlgorithms, Network Layer in the Internet, IP Protocol, IP Address,
4. Transport layer: Transport Service, Elements of Transport Protocols, TCP and UDPProtocols, Network Performance Issues.
5. Application Layer: Over View of DNS, SNMP, Electronic Mail, World Wide Web, Firewalls.
6. Network Devices: Over View of Repeaters, Bridges, Routers, Gateways, MultiprotocolRouters, Hubs, Switches, Modems
7. Overview of Cellular Networks, Ad-hoc Networks, Mobile Ad-hoc Networks, Sensor Networks

Text Books:

1. Computer Networks, Andrews S Tanenbaum,, 5th Edition, Pearson Edu.
2. An Engineering Approach to Computer Networks-S.Keshav, 2nd Edition, Pearson Education.

References:

1. Data Communications and Networking,Behrouz A Forouzan , Tata McGraw-Hill Co Ltd, Second Edition, ISBN: 0-07-049935-7
1. Computer networks, Mayank Dave, CENGAGE.
2. Computer networks, A system Approach, 5thed, Larry L Peterson and Bruce S Davie, Elsevier.
3. Understanding communications and Networks, 3rd Edition, W.A. Shay, Thomson.

CSE312 : OPERATING SYSTEMS

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 Hours Credits: 4
Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course objectives:

1. To understand evolution of Operating System.
2. To understand operating system as a layer of abstraction above physical hardware that facilitates usage convenience and efficient resource management of computer system resources.
3. To learn design and implementation of policies and mechanisms for OS subsystem.
4. To investigate case studies to understand the design philosophies / paradigm for popular multiuser or single user operating system.

Course Outcomes:

1. The student understands OS evolution, its structure and services provided by it.
2. Learn process life cycle, process scheduling objectives, policies and mechanisms, process synchronization, inter process communication, deadlocks and other process subsystem related concepts.
3. Learn memory hierarchy, allocation and deallocation policies and mechanism for main and auxiliary memory, file system design and implementation issues.
4. investigate UNIX/ LINUX and Windows OS platforms w.r.t similarities and differences in design philosophies.

SYLLABUS

1. Introduction to Operating Systems: Over View of Operating Systems, Types of Operating Systems, Operating System Structures, Operating System Services, System Calls, Virtual Machines, Operating System Design and Implementation.
2. Process Management: Process Concepts, Operations on Processes, Cooperating Processes, Threads, Inter Process Communication, Process Scheduling, Scheduling Algorithms, Multiple- Processor Scheduling, Thread Scheduling.
3. Process Synchronization: The Critical Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classical Problems of Synchronization, Critical Regions, Monitors.
4. Deadlocks: System Model, Deadlock Characterization, Methods For Handling Deadlocks, Deadlock Prevention, Avoidance, Deadlock Detection, Recovery from Deadlocks

5. Memory Management: Logical versus Physical Address, Swapping, contiguous memory allocation, paging, structure of the page table, segmentation, Virtual Memory, Demand Paging, Page Replacement, Allocation of Frames, Thrashing, Memory-Mapped files

6. File Systems, Implementation, and Secondary-storage Structure: Concept of a file, Access Methods, Directory Structure, Protection, File System Structure, Allocation Methods, Free Space Management, Directory Management, Device Drivers, overview of Mass-storage structure, Disk structure, disk attachment, disk scheduling, swap-space management.

7. Case study: Overview of LINUX, Windows Operating systems

Text Book:

1. Operating Systems, Abraham Silberschatz, Peter Baer Galvin, and Greg Gagne, John Wiley Publ., Seventh Edition.

1. Operating Systems; A Practical Approach. Rajiv Chopra.

Reference Books:

1. Modern Operating Systems, Andrew S. Tanenbaum, 2nd edition, 1995, PHI.

2. Operating Systems, William Stallings 5th Edition - PHI

3. Operating Systems: A Design-Oriented Approach', Charles Crowley, 'Tata Hill Co., 1998 edition.

CSE 313 : FORMAL LANGUAGES & AUTOMATA THEORY

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 Hours Credits: 3
Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course objectives:

1. To introduce the concepts in automata theory and theory of computation to design grammars and recognizers for different formal languages.
2. To employ finite state machines to solve problems in computing.
3. To introduce finite state machines, context free grammars and Turing Machines and their properties as the basis for the formal expressivity of computer languages for solving linguistic decision problems.
4. To understand the concepts of tractability and decidability, the concepts of NP-completeness and NP-hard problem and also the challenges for Theoretical Computer Science and its contribution to other sciences.

Course outcomes:

1. Ability to think analytically and intuitively for problem solving situations in related areas of theory in computer science

2. Ability to describe the language accepted by an automata or generated by a regular expression or a context-free grammar;

3. Ability to Understand the functioning of Finite-State Machines, Deterministic Finite-State Automata, Nondeterministic Finite-State Automata and Pushdown Automata and Turing Machines.

SYLLABUS

1. Definitions of alphabet, strings, language, grammar, types of grammar, types of machines, generation of languages from grammar, construction of grammar from the given description of languages

2. Definition of finite state machine, Definite state machine, indefinite state machine, representations in mathematical diagram, tabular etc., id of finite state machine's, design of finite state machine from the given description, elimination of λ -transitions, indefinite state machine to definite state machine, optimization of finite state machine

3. Conversion of regular grammar to finite state machine, finite state machine to regular grammar, discussion of pumping lemma, systematic way of construction of finite state machine

4. Definition of regular expression, regular algebra, minimization of regular expressions, closure properties, construction of regular expression from the given description, regular expression to finite state machine, finite state machine to regular expression, construction of regular expression for the given finite state machine- a systematic way using Arden's theorem

5. Definition of push down machine, push down machine, types of push down machine's, push down machine to context free grammar, context free grammar to push down machine, design methodology of various push down machine's, push down machine by empty stack, push down machine by final states, conversion from one type to other type, applications of push down machine's

6. Parsing tree, bottom-up parsing, top-down parsing, types of context free grammar's, left-most and right most derivations, productions, reductions, optimization of context free grammar's, elimination of λ productions, unit productions, normal forms- cnf, gnf

7. Definition of Turing machine, ways of representing Turing machine's- tabular form, diagram, mathematical form, quintuples etc., design of Turing machine, id of Turing machine, types of Turing machine, halting problem, church's thesis, universal Turing machine, Gödel number, definitions of recursive functions- prf, rf, decidability.

NOTE:Theorem proofs are eliminated

Text books:

1. Introduction to automata theory, languages and computation, John.E.H.P croft/ Rajeev Motwani& JD Ullman—pearson education- III edition

2. Theory of computation, K.L.P.Mishra and N.Chandrasekhar, PHI

Reference Books :

1. Theory of computation, formal languages and automata theory, G P SaradhiVarma, B.ThirupathiRao –Sci Tech publications.

CSE 314: OBJECT ORIENTED SOFTWARE ENGINEERING

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods+1Tut/week, Univ. Exam: 3 Hours Credits: 4

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course objectives:

1. To explain the importance of OOSE in Software development.
2. To explain the students the importance of Requirements Engineering.
3. To explain the role of UML and Testing in Software Development.
4. To explain the entire Software Development Process with aid of case studies.

Course Outcomes:

1. Ability to define a problem and perform Requirements Engineering.
 2. Ability to draw UML diagrams for the requirements gathered.
 3. Ability to implement the designed problem in Object Oriented Programming Language and
 4. test whether all the requirements specified have been achieved or not.
1. Introduction to Object Oriented Software Engineering: Nature of the Software, Types of Software, Software Engineering Projects, Software Engineering Activities, Software Quality, Introductionto Object Orientation, Software Process Models-Waterfall Model, Opportunistic Model ,Phased Released Model, Spiral Model, Evolutionary Model, Concurrent EngineeringModel
2. Requirements Engineering: Domain Analysis, Problem Definition and Scope,Requirements Definition, Types of Requirements, Techniques for Gathering and AnalyzingRequirements, Requirement Documents, Reviewing, Managing Change inRequirements.
3. Unified Modeling Language & Use Case Modeling: Introduction to UML, Modeling Concepts,Types ofUMLDiagramswithExamples;User-CenteredDesign,CharacteristicsofUsers,DevelopingUse- Case Models of

Systems, Use-Case Diagram, Use- Case Descriptions, Basics of User Interface Design, Usability Principles, User Interfaces.

4. Class Design and Class Diagrams: Essentials of UML Class Diagrams, Associations and Multiplicity, Other Relationships, Generalization, Instance Diagrams, Advanced Features of Class Diagrams, Interaction and Behavioral Diagrams: Interaction Diagrams, State Diagrams, Activity Diagrams, Component and Deployment Diagrams.

5. Software Design and Architecture: Process of Design, Principles Leading to Good Design, Techniques for Making Good Design Decisions, Good Design Document; Pattern Introduction, Design Patterns: Abstraction-Occurrence Pattern, General Hierarchical Pattern, Play-Role Pattern, Singleton Pattern, Observer Pattern, Delegation Pattern, Adaptor Pattern, Façade Pattern, Immutable Pattern, Read-Only Interface Pattern and The Proxy Pattern; Software Architecture Contents of Architecture Model, Architectural Patterns: Multilayer, Client-Server, Broker, Transaction Processing, Pipe & Filter and MVC Architectural Patterns

6. Software Testing: Overview of Testing, Testing Concepts, Testing Activities, Testing Strategies, Unit Testing, Integration Testing, Function Testing, Structural Testing, Class Based Testing Strategies, Use Case/Scenario Based Testing, Regression Testing, Performance Testing, System Testing, Acceptance Testing, Installation Testing, OOTest Design Issues, Test Case Design, Quality Assurance, Root Cause Analysis, Post-Mortem Analysis.

7. Software Process Management: Introduction to Software Project Management, Rationale Management, Configuration Management, Activities of Software Project Management, Structure of Project Plan, Software Engineering Teams, Software Cost Estimation, Project Scheduling, Tracking and Monitoring.

CASE STUDY:

1. Simple Chat Instant Messaging System
2. GPS Based Automobile Navigation System
3. Waste Management Inspection Tracking System (WMITS)
4. Geographical Information System

Text Books:

1. Object-Oriented Software Engineering Practical software development using UML and Java by Timothy C. Lethbridge & Robert Langanier McGraw-Hill
2. Software Engineering, K.K. Agarwal, New Age Publications 2008
3. Object-Oriented Software Engineering: Using UML, Patterns and Java, Bernd Bruegge and Allen H. Dutoit, 2nd Edition, Pearson Education Asia.

Reference:

1. Software Engineering: A Practitioner's Approach, Roger S. Pressman.
2. A Practical Guide to Testing Object-Oriented Software, John D. McGregor; David A. Sykes, Addison-Wesley Professional.

CSE 315 : OPERATIONS RESEARCH

Common with 6 years integrated B.Tech(CSE)+M.Tech

Instruction: 3 Periods/week, Univ. Exam: 3 Hours Credits: 3
Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives

1. To discuss about basic Operation Research concepts, Formulation of LPP and its solution using graphical method.
2. To discuss about standard form of LPP. solving LPP using various methods.
3. To study the various solutions of transportation problems and assignment problems.
4. To discuss about PERT and CPM charts
5. To discuss about replacement problems, inventory problems and game theory.

Course Outcomes:

1. Ability to solve LPP problems using various methods.
2. Ability to solve transportation and assignment problems using several methods.
3. Analyze the PERT and CPM charts
4. Ability to solve replacement problems and game theory problems.

SYLLABUS

1. Overview of Operations Research, Types of OR Models, Phases of Operations Research—OR Techniques, Introduction to Linear Programming, Formulation of Linear Programming Problem, Graphical Solution; Graphical Sensitivity Analysis,
2. Standard Form of LPP, Basic Feasible Solutions, Unrestricted Variables, Simplex Algorithm, Artificial Variables, Big M Method, Two Phase Simplex Method, Degeneracy, Alternative Optimal, Unbounded Solutions, Infeasible Solutions, Primal And Dual Problems And Their Relations, Dual Simplex Method

3. Transportation Problem as LPP, Initial Solutions, North West Corner Rule, Lowest Cost Method, Vogel's Approximation Method, Optimum Solutions of TPP, Degeneracy in Transportation, Transportation Algorithms,

4. Assignment Problem, Assignment Problem as LPP, Hungarian Method, Travelling Salesman Problem, Solutions of TSP, Sequencing Problems, N-Jobs Two Machine Problems, N-Jobs K Machines Problems, Two-Jobs M-Machine Problems, Crew Scheduling Problems

5. Network Representation of a Project, CPM and PERT, Critical Path Calculations, Time-Cost Optimizations, PERT Analysis and Probability Considerations, Resource Analysis in Network Scheduling.

6. Replacement Problems-Individual And Group Replacement Policy, Reliability & System Failure Problems, Inventory-Factors Effecting Inventory-EOQ, Inventory Problems With and Without Shortages, Inventory Problems With Price Breakups, Multi Item Deterministic Problems. Probabilistic Inventory Problems

7. Game Theory: Two Person Zero Sum Games, Mixed Strategy Games and Their Algorithms.

Text Books:

1. Operations Research, Kanti Swaroop, P.K. Gupta, Man Mohan, Sulthan Chand & Sons Education

2. Publishers Operations Research – An Introduction, Handi A. Taha – Pearson Education.

Reference B:

1. Operations Research Panneer Selvan Prentice Hall of India.

2. Operations Research By S.D. Sharma

3. Introduction To Operations Research, F.S. Hiller, G.J. Liberman, TMH

4. Operations Research, Richard Bronson, Schaum's Series, McGraw Hill

CSE 316 : ELECTIVE-I MICROPROCESSORS

Common with 6 years integrated B.Tech(CSE)+M.Tech

Instruction: 3 Periods/week, Univ. Exam: 3 Hours Credits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives:

1. To discuss the architectures of 8085, 8086 microprocessors, their instruction sets and related ALP programs.

2. To discuss interfacing semiconductor memories, interfacing peripheral to Intel 8086.

3. To study interfacing data converters to 8086 and discuss about micro controller 8051 architecture.

Course Outcomes:

1. Understand the basic architectures of 8085 and 8086 microprocessors.

2. Ability to write ALP programs using instruction sets.

3. Understand the various interfacing concepts and micro controllers.

SYLLABUS

1. Introduction to Microprocessors and Microcomputers: A Brief Architecture and Programming of 8085 Microprocessor.

2. Architecture: Instruction Set and Programming of 8086 Microprocessor

3. Interfacing Semiconductor Memories and I/O Devices: Semiconductor Memories: Classification Internal Organization & Functional Description, Interfacing SRAMs and EPROMs to 8086, Interfacing Characteristics of I/O Devices, I/O Device addressing methods, I/O Device Programming Methods.

4. Interfacing Peripherals to Intel 8086 -1: Parallel I/O Interface-8255, Serial I/O Interface –8251, Timer Interface -8253/8254

5. Interfacing Peripheral to Intel 8086 -2 : Keyboard/ Display Interface-8279, Interrupt Controller Interface – 8259

6. Interfacing Data Converters to 8086: D/A Conversion Methods, A/D Conversion methods, Interfacing DAC, Interfacing ADC.

7. Introduction to Micro controllers: Intel 8051 Architecture and Programming

Text Books:

1. Microprocessor Architecture, Programming, and Applications with the 8085 Ramesh S. Gaonkar, 4th Edition, Penram International, 1999

2. The 80x86 Family, Design, Programming and Interfacing, John E. Uffenbeck, 3rd Edition, Pearson Education Inc., 2002

3. Kenneth J. Ayala, 8051 Microcontroller Architecture, Programming And Applications, 2nd Edition, Penram International Publications, 1999

Reference Books:

1. BARRY B. BREY, The Intel Microprocessors 8086/8088, 80186/80188, 80286, 80386 and 80486, Pentium, Pentium Pro

Processor, Pentium II, Pentium III, Pentium 4, Architecture, Programming and Interfacing, 8th Edition, Pearson Education Inc., 2009

2. Walter A. Tribel and Avtar Singh, The 8088 and 8086 Microprocessors, Programming, interfacing, Software, Hardware, and Applications, 4th Edition, Pearson Education Inc., 2003. Microprocessors and Interfacing, Programming and Hardware, 2nd Edition, Douglass V. Hall, TMH Edition, 1999

3. Sanjay K Bose, Hardware and Software of Personal Computers, New Age International (P) Ltd., 1991

4. Myke Predko, Programming and Customizing the 8051 Microcontroller, TMH, 1999

CSE 316 : ELECTIVE-1 DATA COMMUNICATIONS

Instruction: 3 Periods/week, Univ. Exam: 3 Hours Credits: 3
Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives:

1. To study basics of data communication systems.
2. To study the various types of transmission media.
3. To study the various hardware concepts related to data communications.
4. To discuss about modem and multiplexing techniques.

Course Outcomes:

1. Student will be able to understand basic concepts related to communication systems.
2. Ability to understand different transmission media.
3. Ability to understand concepts related to data communication hardware.
4. Ability to understand basic functionality of modems.

SYLLABUS

1. Introduction to Data Communications: A Communications Model, Data Communications and Data Communications Networking, Protocols and Protocol Architecture, Characteristics of Data Transmission: Concepts and Terminology, Analog and Digital Data Transmission, Transmission Impairments

2. Transmission Media: Guided Transmission Media, Wireless Transmission Data Encoding, Digital Data, Digital Signals, Digital Data, Analog Signals, Analog Data, Digital Signals, Analog Data, Analog Signals

3. Data Communication Interface: Asynchronous and Synchronous Transmission, Line Configurations, Interfacing. Data Link Control Flow

Control, Error Detection, Error Control, High-Level Data Link Control (HDLC), Other Data Link Control Protocols.

4. Data Communications Hardware: Terminals: Introduction, Basic Terminal Components, Enhanced Terminal Components, General-Purpose Terminals, Remote Job Entry Terminals, Transaction Terminals, Clustering of Terminal Devices.

5. Communications Processing Hardware : Introduction, Switching Processors, Multiplex Lines, Multiplexers, Concentrators, Front-End Processors.

6. Modems: Network Attachment and Regulations, Line Conditioning and Leased Lines, Modems and Modem Circuits.

7. Multiplexing: Frequency-Division Multiplexing, Synchronous Time-Division Multiplexing: Characteristics, TDM Link Control, Digital Carrier Systems Statistical Time-Division Multiplexing: Characteristics.

TEXTBOOKS:

1. William Stallings, Data and Computer Communications, 10th Edition, PH/Pearson Edu. Inc., 2014

2. Data Communications and Computer Networks. Brijendra Singh.

3. Mary E.S. Loomis, Data Communications, PHI-N.J., 1983 (Chapter 3, Chapter 5)

4. Paul Bates, Practical Digital and Data Communications, PHI-N.J., 1987 (Chapter 5)

REFERENCE BOOKS:

1. Behrouz A. Forouzan, Data Communications and Networking, 3rd Edition TMH, 2004

2. William A. Shay, Understanding Data Communications & Networks, 2nd Edition Thomson-Brooks/Cole –Vikas Publishing House, 1999

3. Michale A. Miller, Data & Network Communications, Thomson/Delmar –Vikas Pub. House, 2000

CSE 316 : ELECTIVE-I : PRINCIPLES OF PROGRAMMING LANGUAGES

Instruction: 3 Periods/week, Univ. Exam: 3 Hours Credits: 3
Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course objectives:

1. To learn the underlying principles and concepts of programming language.
2. To understand programming language translation process.
3. To expose students to the important paradigms of programming.

4. To understand the concepts of distributed processing and network programming.

Course outcomes:

1. Ability to compare different programming languages.
2. Ability to discuss the significant achievements in programming language history.
3. Ability to assess the programming languages in scientific manner.

SYLLABUS

1. Language Design Issues: Study Programming Languages, History of Programming Languages, Role of Programming Languages, Programming Environments.

2. Impact of Machine Architectures: Operation of a Computer, Virtual Computers and Binding Times; Language Translation Issues: Programming Language Syntax, Stages in Translation, Formal Translation Models, Recursive Descent Parsing; Modeling Language Properties: Formal Properties of Languages, Language Semantics.

3. Elementary Data Types: Properties of Types and Objects, Scalar Data Types, Composite Data Types Encapsulation : Structured Data Types, Abstract Data Types, Encapsulation by Subprograms, Type Definitions. Inheritance: Abstract Data Types Revisited, Inheritance, Polymorphism.

4. Sequence Control: Implement and Explicit Sequence Control, Sequence with Arithmetic Expressions, Sequence Control Between Statements, Sequencing with Non-arithmetic Expressions.

5. Subprogram Control: Subprogram Sequence Control, Attributes of Data Control, Parameter Transmission, Explicit Common Environment.

6. Storage Management: Elements Requiring Storage, Programmer and System – Controlled Storage, Static Storage Management, Heap Storage Management.

7. Distributed Processing: Variations on Subprogram Control, Parallel Programming, Hardware Developments, Software Architecture. Network Programming: Desktop Publishing, The World Wide Web.

Text Book:

1. Programming languages – Design and Implementation by Terrence W. Pratt Marvin V. Zelkowitz. 3rd Edition, Prentice Hall of India.

2. Principles of Programming Languages by Er. Anil Panghal and Ms. Sharda Panghal

Reference Books:

1. Concepts of Programming Languages by Robert L. Sebesta, 4th Edition, Pearson Education.

2. Fundamentals of Programming Languages, Design & Implementation by Seyed H. Roosta. Vikas Publications.

3. Programming Languages by Paradigm and Practice – Doris Appleby Julius J. Vendekopple Tata McGraw Hill Edition.

CSE 317 : DATA COMMUNICATIONS AND COMPUTER NETWORKS LAB

Common with 6 years integrated B.Tech(CSE)+M.Tech

Instruction: 3 Periods/week, Univ. Exam: 3 Hours Credits: 1.5

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

FIRST CYCLE OF EXPERIMENTS

1. PC-to-PC COMMUNICATIONS UNDER DOS WITH NULL MODEM
a) Using Serial Ports and RS-232 C Cable Connection b) Using Parallel Ports and Parallel Cable Connection

2. PC-to-PC COMMUNICATIONS UNDER DOS WITH MODEM and 4-LINE EXCHANGE Using Communication Software: COMIT or XTALK

3. PC-to-PC COMMUNICATIONS UNDER WIN 98's DIRECT CABLE CONNECTION with NULL MODEM
a) Using Serial Ports and RS-232 C Cable Connection b) Using Parallel Ports and Parallel Cable Connection

4. PC-to-PC COMMUNICATIONS UNDER WIN 98's DIAL-UP NETWORKING WITH MODEM and 4-LINE EXCHANGE

5. PC-to-PC COMMUNICATIONS UNDER WIN 98's HYPER TERMINAL WITH MODEM and 4-LINE EXCHANGE

6. LAN WITH BUS TOPOLOGY with a minimum of two systems
i) Windows Peer-to-Peer Network ii) Windows NT Client-Server Network
b) LAN WITH STAR TOPOLOGY with a minimum of two systems

7. a) LAN WITH BUS TOPOLOGY with a minimum of two systems using NOVELL Netware
b) LAN WITH STAR TOPOLOGY with a minimum of two systems using NOVELL Netware

NETWORK PROGRAMMING

1. Socket Programming

a. TCP Sockets

b. UDP Sockets

c. Applications using Sockets

2. Simulation of Sliding Window Protocol

3. Simulation of Routing Protocols

4. RPC

5. Development of applications such as DNS/ HTTP/ E – mail/ Multi – user Chat

Reference Books:

1. Internet and Web Technologies by Raj Kamal, TataMcGraw-Hill
2. Programming the World Wide Web by Robert W. Sebesta, Pearson Education

CSE 318 : OPERATING SYSTEMS LAB

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 HoursCredits: 1.5

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

Course Objectives:

1. To learn about UNIX/LINUX operating system, its intervals.
2. To learn system programming for UNIX/LINUX Operating System.
3. To understand UNIX/LINUX shell and its programming.
4. To understand resource management policies and mechanisms and their performance evaluation.

Course Outcomes:

1. The student practices UNIX commands, Vi editor, shell commands.
2. The student develops skill in writing C programs using system calls for process management, inter process communication and other aspects.
3. The student learns shell programming and develops skill for writing scripts for batch level tasks.
4. The student learns to simulate OS resource management aspects like process scheduling , page replacement and others to evaluate performance.

Module I

1. OS lab familiarization, Home Assignment on Unix commands, Vi editor
2. Simple C programs using command line arguments, system calls, library function calls, make utility
3. C programs using fork system call to create processes and study parent, child process mechanism
4. C programs to create process chaining, spawning
5. C programs to handle errors using errno, perror() function
6. C programs to use pipe system call for inter process communication

Module II

1. Familiarization of Unix shell programming
2. Simple shell programming exercises
3. Shell programming using decision making constructs
4. Shell programming using loop constructs
5. Shell programming for file and directory manipulation

Module III

1. C programs to study process scheduling implementing FCFS, Shortest Job First, and Round Robin algorithms
2. C programs to study page replacement implementing FIFO, Optimal, and LRU page replacement algorithms
3. C programs to study deadlock avoidance and detection
4. C Programs to simulate free space management

References:

1. Unix concepts and applications by Sumitabha Das, TMH Publications.
2. Unix programming by Stevens, Pearson Education.
3. Shell programming by YashwanthKanetkar.
4. Operating SystemConcepts by Silberschatz, and Peter Galvin.

CSE319 : SOFT SKILLS LAB

Common with 6years integrated B.Tech(CSE)+M.Tech)

Instruction: 3Periods/week, Univ. Exam: 3 HoursCredits:1.5

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

1. English LanguageSkills
2. Spoken EnglishSkills
3. Presentation Skills

III/IV B.TECH (FOUR YEAR COURSE) &

III/VI B.TECH (SIX YEAR DOUBLE DEGREE COURSE)

(With effect from 2019-2020 admitted batch onwards)

B.TECH. (CSE) III YEAR II-SEMESTER SCHEME OF INSTRUCTION AND EXAMINATION

Sub. Ref	Name of the Subject	Periods			Maximum Marks			Credits
		Theory	Tutorial	Lab	Exam	Sessionals	Total	
CSE321	Compiler Design	3	1	—	70	30	100	3
CSE322	Web Technologies	3	1	—	70	30	100	3
CSE323	Elective – II	3	1	—	70	30	100	3

CSE324	Elective – III	3	1	—	70	30	100	3
CSE325	Data Warehousing & Data Mining	3	1	—	70	30	100	3
CSE326	Sensor Networks	3	1	0	70	30	100	3
CSE327	Elective - II Lab	—	—	3	50	50	100	1.5
CSE328	Web Technologies Lab	—	—	3	50	50	100	1.5
Total								21

ELECTIVE - II

1. Computer Graphics
2. Embedded Systems
3. Soft Computing

ELECTIVE - III

1. Artificial Intelligence
2. Image Processing
3. Distributed Systems

CSE 321: COMPILER DESIGN

Common with 6 years integrated B.Tech(CSE)+M.Tech

Instruction: 3 Periods/week, Univ. Exam: 3 Hours Credits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course objectives:

1. To explain the basic understanding of grammars and language definition and introducing various phases of designing a compiler.
2. To make the student to understand the concepts underlying the design and implementation of language processors and its mechanisms.
3. To extend the knowledge of parser by parsing LL parser and LR parser.
4. To enrich the knowledge in various phases of compiler and its use, code optimization techniques, loop optimization techniques, machine code generation, and use of symbol table..

Course outcomes:

1. Ability to design & conduct experiments for Intermediate Code Generation in compiler.
2. Ability to learn the new code optimization techniques to improve the performance of a program in terms of speed & space.
3. Ability to acquire the knowledge of modern compiler & its features.

SYLLABUS

1. Introduction: Introduction to Compilers and Language processors, Programming Language basics, Structure & Different Phases of a Compiler, Review of Compiler Structure, Structure of Optimizing Compilation, Compiler construction tools, Boot strapping, Cross compilers.

2. Finite Automata & Lexical Analysis : Introduction to Lexical Analysis, Lexical Analyzers, Approaches to design Lexical Analyzers, Language for specifying lexical analyzers, Introduction to Finite automata, Regular Expressions & Languages, Recognition of Tokens, Transition Diagrams, Implementation of lexical analyzers, Lexical Analyzer Generator LEX.

3. Syntax Analysis : Syntactic Specification of Programming Languages, Context Free Grammars & Languages, Introduction to Parsers. Top-down parsing techniques : Brute force parsing, Recursive Descent Parsing, Predictive Parsing, Bottom-up Parsing: Shift reduce parsing, Operator parsing, LR (k) parsing.

4. Semantic Analysis and Intermediate Code Generation : Semantic Actions, Syntax Directed Translations, Translation on the parse Tree, Implementation of Syntax Directed Translator, Intermediate Codes, Syntax Directed translation to Post fix code, Syntax Trees, Intermediate Code Generation, Three Address Code-Translation of Expressions, Type Checking & Type Conversions.

5. Code Optimization : Principal sources of Code Optimization, Loop Optimization, Basic Blocks & Flow Graphs, DAG Representation of Basic Blocks, Applications of DAG, Local Optimization, Unreachable Code Elimination, Dead Code Elimination, Data Flow Analysis, Data Flow Equations & Computations, Peep-Hole Optimization. Machine Dependent Optimizations, Overview of Informal Compiler Algorithm Notation (ICAN), If Simplification, Loop Simplification, Loop Inversion, Branch Optimization and Prediction

6. Code Generation and Code Scheduling : Issues in Code Generation, Input to Code Generator, Instruction Selection, Register Allocation, Simple Target Machine Model, Program and Instruction Costs, Register allocation & Assignments, Code Generation Algorithm, Code Generators, Optimal Code Generation for Expressions, Code Generation From DAG.

7. Symbol Tables, Run time Environment and Error Handling : Contents of a Symbol Table, Data Structures for Symbol Tables; Run time Environments, Implementation of a simple Stack allocation, Heap Management, Block Structured Languages; Error Detection &

Recovery, Lexical Phase Errors, Syntactic & Semantic Errors, Error Handling Routines.

TextBooks:

1. Principles of Compiler Design by Aho, D. Ullman, Lam and Ravi Sethi, Pearson Education Second Edition
2. Advanced Compiler Design and Implementation, Steven Muchnic, Elsevier Publications.

ReferenceBooks:

1. Compiler Construction by Kenneth. C. Loudon, Vikas Pub. House.
2. Compiler Design, A.A. Pentabekar, Technical Publications
3. Modern Compiler Design, Grune. D., Van Reeuwijk K, Bal H.E, Jacobs C J H, Langendoen K, Springer,

CSE 322 : WEB TECHNOLOGIES

Common with 6 years integrated B.Tech(CSE)+M.Tech

Instruction: 3 Periods/week, Univ. Exam: 3 Hours Credits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives:

On completing this course student will be able to

1. Understand the principles of Web based application development.
2. Design dynamic content in Web Pages using JavaScript.
3. Understanding the concepts of java Servlets, java Server Pages and design applications using them.
4. Understand the concepts of Component development and design applications by establishing connections to Databases

Course Outcomes :

1. Students will be able to construct web based applications and Identify where data structures are appearing in them.
2. Students will be able to connect java programs to different databases.
3. Students will be able to develop EJB programs

SYLLABUS

1. Introduction to HTML , Core Elements , Links and Addressing, Images , Text , Colors and Background, Lists, Tables and Layouts , Frames, Forms , Cascading Style Sheets.

2. Introduction to Java Scripts, Elements of Objects in Java Script, Dynamic HTML with Java Script

3. Document type definition, XML Syntax, XML Schemas, Document Object model, Presenting XML, Using XML Processors

4. Introduction to Servlet, Servlet Life Cycles, Servlet Basics, Tomcat Web Server, Configuring Apache Tomcat, Handling Client Request and Response, Handling Cookies, Session Tracking.

5. Introduction to PHP, Language Basics, Functions, Strings, Arrays.

6. Web Techniques, Data bases, Graphics, PDF, Dates and Times.

7. MYSQL Installation, Accessing MySQL Using PHP, Form Handling, Cookies, Sessions, and Authentication, Tables, Inserting Data into Tables , Selecting Data from a Table, Updating Table , Deleting data from Table, Webpage creation.

Text Books:

1. Web Programming, building internet applications, 2nd Ed., Chris Bates, Wiley Dreamtech

2. Web Technologies; by Uttam K. Roy

3. The complete Reference HTML and DHTML, Thomas A. Powey

Reference Books:

1. Internet , World Wide Web , How to program, Dietel , Nieto, PHI/PEA

2. Web Tehnologies, Godbole, kahate, 2nd Ed., TMH

CSE 323 : ELECTIVE - II : COMPUTER GRAPHICS

Common with 6 years integrated B.Tech(CSE)+M.Tech

Instruction: 3 Periods/week, Univ. Exam: 3 Hours Credits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives:

1. Provides a comprehensive introduction to computer graphics with a foundation in Graphics Applications.
2. A thorough introduction to computer graphics techniques.
3. To give the basics of Geometric Transformations and projections.
4. To introduce three dimensional concepts and object representations with color models and basics of computer animation.

Course Outcomes:

1. The students will understand graphics principles and graphics hardware.
2. The students can demonstrate geometrical transformations.
3. The students can create interactive graphics applications and demonstrate computer graphics animation.

SYLLABUS

1. Introduction: Computer Graphics and their applications: Computer Aided Design, Computer Art, Entertainment, Education and Training, Graphical User Interfaces; Over view of Graphics systems: Video Display Devices, Raster Scan Systems, Random Scan Systems, Graphics Monitors And Workstations, Input Devices, Hard Copy Devices, Interactive Input Methods, Windows and Icons, Virtual Reality Environments, Graphics Software.

2. Output primitives : Points and Lines, , Line and Curve Attributes, Color and Gray scale levels, Antialiasing, Loading the Frame buffer, Line function, Line Drawing Algorithms, Circle Generating Algorithms, Ellipse Generating Algorithms, Pixel Addressing, Area Fill Attributes, Filled Area Primitives, Filled Area Functions, Cell Array, Character Generation, Character Attributes, Bundled Attributes, Curve Functions, Parallel Curve Algorithms.

3. Two Dimensional Transformations: Basic 2D Transformations, Matrix Representations, Homogeneous Coordinates, Composite Transformations, Other Transformations, Transformations between Coordinate Systems, Affine Transformations.

4. Three Dimensional Transformations & Projections: Translation, Rotation, Scaling, Other Transformations, Composite Transformations, 3D Transformation Functions, Modeling and Coordinate Transformations, Need for projections, Parallel & Perspective projections, General Projection Transformations.

5. Viewing Pipeline and Clipping operations : Viewing Pipeline, Viewing Coordinates & Reference frames, Window-to-Viewport Coordinate Transformation, Two Dimensional Viewing Functions, , Three Dimensional Viewing, View Volumes, Clipping and its Operations, Types of clipping operations-Point Clipping, Line Clipping, Polygon Clipping, , Curve Clipping, , Text and Exterior Clipping.

6. Three Dimensional Concepts and Object representations: 3D display methods, 3D Graphics, Polygon Surfaces, Curved Lines and Surfaces, Quadratic Surfaces, Super Quadrics, Blobby Objects, Spline Representations, Cubic Spline methods, Bézier Curves and Surfaces, B-Spline Curves and Surfaces,

7. Color Models and Basics of Computer Animation: Intuitive color concepts, Basics of RGB Color model, YIQ Color Model, CMY & HSV Color models. Design of animation Sequences, Raster Animations, Key Frame systems: Morphing, A Simple program on Animation.

Text Books:

1. Computer Graphics, Donald Hearn & M. Pauline Baker, Pearson Education, New Delhi.

2. Computer Graphics by Dr. Rajiv Chopra.

Reference Books:

1. Procedural Elements for Computer Graphics, David F. Rogers, Tata McGraw Hill Book Company, New Delhi, 2003

2. Computer Graphics: Principles & Practice in C, J.D. Foley, S.K. Van Dam, F.H. John Pearson Education, 2004

3. Computer Graphics using Open GL, Francis S. Hill Jr, Pearson Education, 2004.

4. Computer Vision and Image Processing: A Practical Approach using C++ Tools, S. E. Umbaugh, Prentice Hall, 1998

CSE 323 : ELECTIVE-II EMBEDDED SYSTEMS

Common with 6 years integrated B.Tech(CSE)+M.Tech

Instruction: 3 Periods/week, Univ. Exam: 3 Hours Credits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives:

1. To study the basics of embedded systems and its examples.
2. To study the 8051 Microcontroller architecture and its instruction set.
3. To discuss various software architectures in embedded systems.
4. To discuss Inter Task Communication procedures in RTOS and design issues of RTOS.
5. To study various embedded software development tools and debugging techniques.

Course Outcomes:

1. Student will be able to understand the basic architecture of 8051 microcontroller.
2. ability to write ALP programs using 8051 instruction set.
3. Ability to understand the concepts related to RTOS and its Inter Task Communication methods.
4. Ability to understand various design issues of RTOS.
5. Understand about embedded software development tools.

SYLLABUS

1. Introduction to Embedded Systems: Examples, Typical Hardware, Memory, Microprocessors, Buses; Introduction to 8051 Microcontroller, Architecture, Instruction set, Programming. Interrupts: Interrupt Basics, Shared-Data problem, Interrupt Latency.

2. Software Architectures: Round-Robin Architecture, Round-Robin with Interrupts Architecture, Function-Queue Scheduling Architecture, Real-Time Operating Systems Architecture, Selection of Architecture.

3. Real Time Operating System: Tasks and Task States, Tasks and Data, Semaphores and Shared Data, Semaphore Problems, Semaphore variants.

Inter Task Communication: Message Queues, Mailboxes, Pipes, Timer Functions, Events, Memory Management, Interrupt Routines in RTOS Environment.

4. Design issues of RTOS: Principles, Encapsulation Semaphores and Queues, Hard Real-Time Scheduling Considerations, Saving Memory Space, Saving Power.

5. Embedded Software development Tools: Host and Target Machines, Linker/Locator for Embedded Software, Getting Embedded Software into the Target System.

Embedded Software Debugging Techniques :Testing on your Host Machine, Instruction Set Simulators, Laboratory Tools used for Debugging.

6.Introduction to the Internet of Things: History of IoT, IoT Architecture, M2M – Machine to Machine, Web of Things, IoT protocols, The Layering concepts, IoT Communication Pattern, IoT protocol Architecture.

Text Books:

1. The 8051 Microcontroller Architecture, Programming & Applications, Kenneth J. Ayala, Penram International.

2. Introduction to Embedded Systems by K.V Shibu

3. An Embedded Software Primer, David E. Simon, Pearson Education, 2005.

4. Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, Marina Ruggieri & Homayoun Nikookar, River Publishers Series in Communications.

Reference Book:

1. Embedded Systems: Architecture, Programming and Design, Raj Kamal, Tata McGraw- Hill Education, 2008

CSE 323 : ELECTIVE-II : SOFT COMPUTING

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 Hours Credits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course objectives:

1. To make the student to understand the role of imprecision and uncertainty in real world scenarios.

2. To explain the role of Soft Computing in addressing the imprecision and uncertainty.

3. To explain the principal components of soft computing that include Fuzzy Sets and Fuzzy Logic, Artificial Neural Networks, Genetic Algorithms and Rough Sets.

4. To learn the Design and Implementation of Soft Computing methodologies.

5. To explain the design of hybrid systems which is combination of one or more soft computing methodologies mentioned.

Course outcomes:

1. Ability to represent Uncertainty / imprecision data.

2. Ability to select a suitable method of Soft Computing to solve a particular problem.

3. Ability to build hybrid systems using Soft Computing techniques.

SYLLABUS

1. Soft Computing: Introduction to Fuzzy Computing, Neural Computing, Genetic Algorithms, Associative Memory, Adaptive Resonance Theory, Different Tools and Techniques, Usefulness and Applications.

2. Fuzzy Sets and Fuzzy Logic: Introduction, Fuzzy Sets Versus Crisp Sets, Operations on Fuzzy Sets, Extension Principle, Fuzzy Relations and Relation Equations, Fuzzy Numbers, Linguistic Variables, Fuzzy Logic, Linguistic Hedges, Applications,

3. Interference in fuzzy logic: fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzifications and Defuzzifications, Fuzzy Controller, Fuzzy Controllers, Fuzzy Pattern Recognition, Fuzzy Image Processing, Fuzzy Database.

4. Artificial Neural Network: Introduction, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, re-current networks. Various learning techniques, perception and convergence rule, Auto-associative and hetero-associative memory, Hebb's Learning, Adaline, Perceptron

5. Multilayer Feed Forward Network: Back Propagation Algorithms, Different Issues Regarding Convergence of Multilayer Perceptron, Competitive Learning, Self-Organizing, Feature Maps, Adaptive Resonance Theory, Associative Memories, Applications.

6. Evolutionary and Stochastic Techniques: Genetic Algorithm (GA), Genetic Representations, (Encoding) Initialization and Selection, Different Operators of GA, Analysis of Selection Operations, Hypothesis of Building Blocks, Schema Theorem and Convergence of Genetic Algorithm, Simulated Annealing and Stochastic Models, Boltzmann Machine, Applications.

7. Rough Set: Introduction, Imprecise Categories Approximations and Rough Sets, Reduction of Knowledge, Decision Tables and Applications. Hybrid Systems: Neural-Network-Based Fuzzy Systems, Fuzzy Logic-Based Neural Networks, Genetic Algorithm for Neural Network Design and Learning, Fuzzy Logic and Genetic Algorithm for Optimization, Applications

Text Books:

1. Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications, S. Rajsekaran and G.A. Vijayalakshmi Pai, Prentice Hall of India.

2. Rough Sets, Z. Pawlak, Kluwer Academic Publisher, 1991.

3. Intelligent Hybrid Systems, D. Ruan, Kluwer Academic Publisher, 1997

References:

1. Artificial Intelligence and Intelligent Systems, N.P. Padhy, Oxford University Press.

2. Neural Fuzzy Systems, Chin-Teng Lin & C. S. George Lee, Prentice Hall PTR. Addison-Wesley

3. Learning and Soft Computing, V. Kecman, MIT Press, 2001

4. Fuzzy Sets and Fuzzy Logic, Klir & Yuan, PHI, 1997

CSE 324: ELECTIVE-III ARTIFICIAL INTELLIGENCE

Common with 6 years integrated B.Tech(CSE)+M.Tech

Instruction: 3 Periods/week, Univ. Exam: 3 Hours Credits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives:

1. To learn about AI problem, Production Systems and their characteristics.

2. To understand the importance of search and the corresponding search strategies for solving AI problem.

3. To introduce to Planning, Natural Language Processing and Expert Systems.

Course Outcomes:

1. The Student understands AI problem characteristics, state space approach for solving AI problem, Production System framework.

2. The student learns several optimal search strategies and the use of heuristics.

3. The student learns relational, inferential, inheritable and procedural knowledge and the corresponding knowledge representation approaches.

4. The student is introduced to applying AI problem solving approaches to natural language processing, planning and expert systems.

SYLLABUS

1. Introduction to Artificial Intelligence: Artificial Intelligence, AI Problems, AI Techniques, Defining the Problem as a State Space Search, Problem Characteristics, Production Systems.

2. Search Techniques: Issues in The Design of Search Programs, Un-Informed Search, BFS, DFS; Heuristic Search Techniques: Generate-And-Test, Hill Climbing, Best-First Search, A* Algorithm, Problem Reduction, AO* Algorithm, Constraint Satisfaction, Means-Ends Analysis.

3. Knowledge Representation using Rules: Procedural Vs Declarative Knowledge, Logic programming, Forward Vs Backward Reasoning, Matching Techniques, Partial Matching, RETE Matching Algorithm AI Programming languages: Overview of LISP and PROLOG, Production System in Prolog.

4. Symbolic Logic: Propositional Logic, First Order Predicate Logic: Representing Instance and is-a Relationships, Computable Functions and Predicates, Unification & Resolution, Natural Deduction; Structured Representations of Knowledge: Semantic Nets, Partitioned Semantic Nets, Frames, Conceptual Dependency, Conceptual Graphs, Scripts.

5. Reasoning under Uncertainty: Introduction to Non-Monotonic Reasoning, Truth Maintenance Systems, Logics for Non-Monotonic Reasoning, Statistical Reasoning: Bayes Theorem, Certainty Factors and Rule-Based Systems, Bayesian Probabilistic Inference, Bayesian Networks, Dempster-Shafer Theory, Fuzzy Logic: Crisp Sets, Fuzzy Sets, Fuzzy Logic Control, Fuzzy Inferences & Fuzzy Systems.

6. Natural Language Processing: Steps in The Natural Language Processing, Syntactic Processing and Augmented Transition Nets, Semantic Analysis, NLP Understanding Systems; Planning: Components of a Planning System, Goal Stack Planning, Non-linear Planning using Constraint Posting, Hierarchical Planning, Reactive Systems.

7. Experts Systems: Overview of an Expert System, Architecture of an Expert Systems, Different Types of Expert Systems-Rule Based, Frame Based, Decision Tree based, Case Based, Neural Network based, Black Board Architectures, Knowledge Acquisition and Validation Techniques, Knowledge System Building Tools, Expert System Shells.

Text Books:

1. Artificial Intelligence, Elaine Rich and Kevin Knight, Tata McGraw-Hill Publications

2. Python Programming: A modular approach by Pearson; by Taneja Sheetal (Author), Kumar Naveen.

References:

1. Artificial Intelligence, George F Luger, Pearson Education Publications

2. Artificial Intelligence : A modern Approach, Russell and Norvig, PrintriceHall

3. Introduction To Artificial Intelligence & Expert Systems, Patterson, PHIpublications

CSE 324 : ELECTIVE-III: IMAGE PROCESSING

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 Hours Credits:3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course objectives

1. To explain fundamentals of Image processing concepts.
2. To provide mathematical foundation of image enhancement, image compression and image segmentation.
3. To explain the students about Morphology and its applications in image processing.
4. To explain various methods and techniques for image transformation.

Course outcomes

1. Ability to develop algorithms for fundamental concepts in Image processing.
2. Ability to perform image enhancement , image compression and image segmentation using various methods.
3. Ability to implement Image transformation techniques

SYLLABUS

1. Fundamentals of Image Processing: Image Acquisition, Image Model, Sampling, Quantization, Relationship Between Pixels, Distance Measures,Connectivity, Image Geometry, Photographic Film. Histogram: Definition, DecisionOfContrastBasing On Histogram, Operations Basingon Histograms Like Image Stretching, Image Sliding, Image Classification. Definition and Algorithm of Histogram Equalization.

2. Image Enhancementin Spatial Domain: Arithmetic and Logical Operations, Pixelor Point Operations,Size Operations;Smoothing Filters-Mean, Median, Mode Filters–Comparative Study.

3. Edgeenhancement inspatial domain: Edgeenhancement filters, Directorial Filters, Sobel,Laplacian, Robert, KIRSCH Homogeneity & DIFffilters, PREWITTFilter, Contrast based edge enhancement techniques, Comparative study, Lowpassfilters, Highpassfilters, Sharpening filters, Comparative study, Color fundamentals and colormodel

4. ImageCompression:RunLengthEncoding,modifiedrunlengthencoding,ContourCoding,HuffmanCode,CompressionDu etoChangein Domain,Compression DuetoQuantizationCompressionatthe Time of Image Transmission. Brief Discussion on:- Image CompressionStandards.

5. Image Segmentation: Definition of segmentation, Characteristics of Segmentation, Detection of Discontinuities,Thres holding. Pixel Based SegmentationMethod. Region Based Segmentation Methods, Segmentation by Pixel Aggregation, Segmentation by Sub Region Aggregation, HistogramBasedSegmentation, Spilt and Merge Technique, Segmentation of moving objects.

6. Morphology:Dilation,Erosion,Opening,Closing,Hit-And-MissTransform,Thinning,Thickening,Skeletons , Pruning Extensions to Gray – ScaleImages Application of Morphology inI.P

7. Image Transforms : A Detail Discussion On Fourier Transform, DFT,FFT, Properties of Fouriertrans form, WALSH Trans Form,WFT, HADAMARD Transform, DCT Image Enhanc ementinFrequencyDomain: DesignofLowPass,HighPass, EDGE Enhanc ement,Smoothing Filtersin FrequencyDomain. Butter WorthFilter, Homomorphic FiltersinFrequency DomainAdvantagesof Filters in Frequency Domain, Comparative Study of Filters in Frequency, Domain and Spatial Domain.

TextBooks:

1. DigitalImage Processing, Rafael C.Gonzalez And Richard E.Woods, Addison Wesley
2. Digital Image Processing, S. Jayaraman, S. Esakkirajan&T. VeeraKumar,TMH

ReferenceBooks:

1. Fundamentals Of Electronic Image Processing By Arthyr – R – Weeks,Jr.(PHI)
2. ImageProcessing, Analysis, And Machine Vision By Milan Sonka Vaclan Halavac Roger Boyle, Vikas Publishing House.
3. Fundamentals of Digital Image Processing, Chris Solomon, Tobi Breckon,Wiley-Blackwell

CSE 324 : ELECTIVE- III : DISTRIBUTED SYSTEMS

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 HoursCredits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives:

This course provides an introduction to the fundamentals of distributed computer systems, assuming the availability of facilities for data transmission.

Course Outcomes:

By the end of the course, students should be able to build distributed systems that:

1. Scale as the number of entities in the system increase
2. Can sustain failures and recover from them
3. Work with distributed, fault tolerant file systems
4. Can handle and process large data volumes
5. Are secure and handle certain classes of distributed denial of service attacks
6. Are Loosely coupled, transactional and eventually stable

SYLLABUS

1. Introduction to Distributed Systems, What is a Distributed System?, Hard ware concepts, Software concepts, Design issues.
2. Communication in Distributed Systems, Lay red Protocols, ATM networks, The Client – server model, Remote Procedure call, Group communication.
3. Synchronization in Distributed System, Clock Synchronization, Mutual Exclusion, Election algorithms, Atomic transactions, Deadlocks in Distributed Systems.
4. Process and processors in Distributed System threads, System Models, Processors allocation, Scheduling in Distributed System, Fault tolerance, Real time Distributed System.
5. Distributed File Systems, Distributed File System Design, Distributed File System implementation, Trends in Distributed File System.
6. Distributed Shared Memory, Introduction, What is Shared memory?, Consistency models, Page based Distributed Shared memory, Shared – variable Distributed Shared memory, Object based Distributed Shared Memory.

Text Books:

1. Distributed Operating Systems, Andrew S. Tanenbanm
2. Advanced Concepts in Operating Systems, Makes Singhal and NiranjanG.Shivaratna

CSE 325 : DATA WARE HOUSING & DATA MINING

Common with 6years integrated B.Tech(CSE)+M.Tech and B.Tech(IT)
Instruction: 3Periods/week, Univ. Exam: 3 HoursCredits: 3

Internal: 30 Marks
Marks

University Exam: 70 Marks

Total: 100

Course Objectives:

1. To understand the evolution of data warehousing and data mining systems
2. To understand extracting, cleaning and transformation of data into a warehouse.
3. To learn the principles of statistics, information theory, machine learning and other areas AI and implementation of data mining techniques.
4. To understand pattern mining using classification and clustering methods.

Course Outcomes:

1. The student understands the differences between OLTP and OLAP.
2. The student learns how data cube technology supports summarization and querying high dimensional data.
3. The student is introduced to similarity, distance, information gain and other performance and error metrics used for evaluation of mining results.
4. The student is introduced to various approaches to association rule mining , supervised and unsupervised learning and the corresponding classification and clustering approaches involving decision trees, Bayesian approaches, model based and agglomerative approaches.

SYLLABUS

1. Introduction to Data Mining: Importance of Data Ware housing and Data Mining, Kinds of Patterns,Technologies,Applications, Major Issues in Data Mining,Data Objects and Attributes Types, Statistical Descriptions of Data, Estimating Data Similarityand Dissimilarity
2. Data exploration and pre-processing: Data Visualization, Quality data, Data Cleaning, Data Integration, Data Reduction, Data Transformation, Discretization and Concept Hierarchy Generation.
3. Data Warehouse and OLAP Technology: Basic Concepts of Data warehouse, Data Modelingusing CubesandOLAP,DWH Designandusage, ImplementationusingDataCubesandOLAPs,Data Generalization withAOI.
4. Data Cube Technology: Preliminary Concepts of Data Cube Computation, Data CubeComputationMethods:Multi-way Array A ggregation for Full Cube, BUC, Star-cubing, Pre-computing shell fragments for High dimensional OLAP
5. Mining Frequent Patterns Based on Associations and Correlations: Basic Concepts, Frequent Itemset Mining Methods: Apriori Algorithm,

Association Rule Generation, Improvements to A Priori, FP- Growth Approach, Pattern Evaluation Methods

6. Classification & Prediction: Basic Concepts, Decision Tree Induction, Bayes Classification, Rule- Based Classification, Model Evaluation and Selection, Techniques to Improve Classification Accuracy, Classification by Back Propagation, K-nearest neighbor classifier.

7. Cluster Analysis: Basic Concepts and issues in clustering, Types of Data in Cluster Analysis, Partitioning Methods, Hierarchical Methods, DBSCAN, Grid Based Methods, Evaluation of Clustering Solutions

Text Books:

1. Data Mining- Concepts and Techniques by Jiawei Han, Micheline Kamber and Jian Pei—Morgan Kaufmann publishers —3rd edition

2. Data Mining Techniques, A.K.Pujari, University Press

References:

1. Data mining concepts by Tan, Steinbach, and Vipin Kumar - Pearson Education publishers

CSE 326 : SENSORNET WORKS

Common with 6 years integrated B.Tech(CSE)+M.Tech

Instruction: 3 Periods/week, Univ. Exam: 3 Hours Credits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

1. Introduction: The vision of Ambient Intelligence, Application examples, Types of applications, Challenges for Wireless Sensor Networks (WSNs), Sensor networks vs Enabling Technologies for WSNs, Single node architecture: Hardware components, Energy consumption of sensor nodes, Operating systems and execution environments

2. Network architecture: Sensor network scenarios, Optimization goals and figures of merit, Design principles for WSNs

3. Physical layer and transceiver design considerations in WSNs: MAC Protocols: Fundamentals of (wireless) MAC protocols, Low duty cycle protocols and wakeup concepts, Contention-based protocols, Schedule-based protocols, The IEEE 802.15.4 MAC protocol, IEEE 802.11

4. Link layer protocols: Fundamentals: tasks and requirements, Error control, Framing, Link management

5. Naming and addressing: Fundamentals, Address and name management in wireless sensor networks, Assignment of MAC addresses, Content-based and geographic addressing

6. Routing protocols: The many faces of forwarding and routing, Energy-efficient unicast, Broadcast and multicast, Geographic routing.

7. Data-centric and content-based networking : Introduction, Data-centric routing, Data aggregation, Data-centric storage

TEXT BOOK:

1. Protocols and Architectures for Wireless Sensor Networks, Holger Karl, Andreas Willig., John Wiley & Sons Ltd, 2005

2. Network Management Fundamentals, Alexander Clemm CISCIPress 2007

CSE 327 : ELECTIVE-II LAB: COMPUTER GRAPHICS LAB

Common with 6 years integrated B.Tech(CSE)+M.Tech

Instruction: 3 Periods + 0 Tut/week, Univ. Exam: 3 Hours Credits: 1.5

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

Course Objectives:

5. Provides a comprehensive introduction to computer graphics with a foundation in Graphics Applications.

6. A thorough introduction to computer graphics techniques.

7. To give the basics of Geometric Transformations and projections.

8. To introduce three dimensional concepts and object representations with color models and basics of computer animation.

Course Outcomes:

4. The students will understand graphics principles and graphics hardware.

5. The students can demonstrate geometrical transformations.

6. The students can create interactive graphics applications and demonstrate computer graphics animation.

A. Digital Differential Analyzer Algorithm

B. Bresenham's Line Drawing Algorithm

C. Midpoint Circle Generation Algorithm

D. Ellipse Generation Algorithm

E. Creating various types of texts and fonts

F. Creating two dimensional objects

G. Two Dimensional Transformations

H. Coloring the Pictures

I. Three Dimensional Transformations

J. Curve Generation

K. Simple Animations using transformations

L. Key Frame Animation

CSE 327 : ELECTIVE-II LAB: EMBEDDED SYSTEMS LAB

Common with 6 years integrated B.Tech(CSE)+M.Tech

Instruction: 3 Periods +0Tut/week, Univ. Exam: 3Hours Credits: 1.5
Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

PART- I:

1. Simple Assembly Program for Addition | Subtraction | Multiplication | Division
2. Operating Modes, System Calls and Interrupts, Loops, Branches
3. Write an Assembly programs to configure and control General Purpose Input/Output (GPIO) port pins.
4. Write an Assembly programs to read digital values from external peripherals and execute them with the Target board.
5. Program for reading and writing of a file
6. Program to demonstrate Time delay program using built in Timer / Counter feature on IDE environment
7. Program to demonstrates a simple interrupt handler and setting up a timer
8. Program demonstrates setting up interrupt handlers. Press button to generate an interrupt and trace program flow with debug terminal.
9. Program to Interface 8 Bit LED and Switch Interface
10. Program to implement Buzzer Interface on IDE environment
11. Program to Displaying a message in a 2 line x 16 Characters LCD display and verify the result in debug terminal.
12. Program to demonstrate I2C Interface on IDE environment
13. Program to demonstrate I2C Interface – Serial EEPROM
14. Demonstration of Serial communication. Transmission from Kit and reception from PC using
15. Serial Port on IDE environment use debug terminal to trace the program.
16. Generation of PWM Signal
17. Program to demonstrate SD-MMC Card Interface.

PART- II:

Write the following programs to understand the use of RTOS with ARM Processor on IDE Environment using ARM Tool chain and Library:

1. Create an application that creates two tasks that wait on a timer whilst the main task loops.
2. Write an application that creates a task which is scheduled when a button is pressed, which illustrates the use of an event set between an ISR and a task
3. Write an application that Demonstrates the interruptible ISRs (Requires timer to have higher priority than external interrupt button)
4. a). Write an application to Test message queues and memory blocks.

b). Write an application to Test byte queues

5. Write an application that creates two tasks of the same priority and sets the time slice period to illustrate time slicing. Interfacing Programs:

6. Write an application that creates a two task to Blinking two different LEDs at different timings

7. Write an application that creates a two task displaying two different messages in LCD display in two lines.

8. Sending messages to mailbox by one task and reading the message from mailbox by another task.

9. Sending message to PC through serial port by three different tasks on priority Basis.

10. Basic Audio Processing on IDE environment.

CSE 327 : ELECTIVE –II LAB: SOFT COMPUTING LAB

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3 Periods +0Tut/week, Univ. Exam: 3Hours Credits: 1.5
Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

Course Objectives:

1. This course introduces soft computing techniques that are different from conventional AI techniques.
2. This course also provides necessary mathematical background for understanding and implementing soft computing Techniques, such as neural networks, fuzzy systems, and genetic algorithms.

Course Outcomes:

1. Understand importance of soft computing.
2. Understand different soft computing techniques like Genetic Algorithms, Fuzzy Logic, Neural Networks and their combination.
3. Implement algorithms based on soft computing.
4. Apply soft computing techniques to solve engineering or real life problems.

Exercises:

Experiment 1: Write a program in MATLAB to plot various membership functions.

Experiment 2: Use Fuzzy toolbox to model tip value that is given after a dinner which can be-not good, satisfying, good and delightful and service which is poor, average or good and the tip value will range from Rs. 10 to 100.

Experiment 3: Implement FIS Editor.

Experiment 4: Generate AND, NOT function using McCulloch-Pitts neural net by MATLAB program.

Experiment 5: Generate XOR function using McCulloch-Pitts neural net by MATLAB program.

Experiment 6: Write a MATLAB program for Perceptron net for an AND function with bipolar inputs and targets.

Experiment 7: Write a MATLAB program for Hebb Net to classify two dimensional input patterns in bipolar with their given targets

Experiment 8: Write a program of Perceptron Training Algorithm

Experiment 9: Write a program to implement Hebb's rule

Experiment 10: Write a program of Back Propagation Algorithm.

CSE328 : WEB TECHNOLOGIES LAB

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 Hours Credits:1.5

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

Each student should develop two projects out of this list using JSP, JDBC, J2EE

1. Design Airlines Ticket Reservation System
2. Design ONLINE Banking system.
3. Design Library Information system
4. Design Gram Panchayat Information system for House tax, water tax, wealth tax, Library tax collection, phone bill, Electricity bill collection.
5. Design student information system portal which maintain attendance, marks etc.
6. Design online examination system.

IV/IV B.TECH (FOUR YEAR COURSE) &

IV/VI B.TECH (SIX YEAR DOUBLE DEGREE COURSE)

(With effect from 2019-2020 admitted batch onwards)

B.TECH. (CSE) IV YEAR I-SEMESTER SCHEME OF INSTRUCTION AND EXAMINATION

Sub. Ref	Name of the Subject	Periods			Maximum Marks			Credits
		Theory	Tutorial	Lab	Exam	Sessionals	Total	
CSE411	Elective – IV	3	1	—	70	30	100	3
CSE412	Elective – V	3	1	—	70	30	100	3
CSE413	GPS Applications	3	1	—	70	30	100	3

CSE414	Computational Biology	3	1	—	70	30	100	3
CSE415	Entrepreneurship	3	1	—	50	50	100	3
CSE416	Cryptography & Network Security	3	1	—	50	50	100	3
CSE417	Elective – IV Lab	—	—	3	50	50	100	1.5
CSE418	Elective – V Lab	—	—	3	50	50	100	1.5
Total								21.0

ELECTIVE -IV

1. Big Data Analytics
2. Machine Learning
3. R Programming

ELECTIVE - V

1. Cyber security & Digital Forensics
2. IOT
3. Cloud Computing

CSE 411 : ELECTIVE-IV BIGDATA ANALYTICS

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 Hours Credits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives:

- To introduce Big Data and the Data analytics lifecycle to address business challenges that leverage big data.
- To understand the importance of mining data streams and social network graphs.
- To introduce big data analytics technology and tools including MapReduce and Hadoop.

Expected Course Outcome:

- Reframe a business challenge as an analytics challenge.
 - Apply appropriate analytic techniques and tools to analyze big data.
 - Create models and identify insights that can lead to actionable results.
 - Effectively participate in big data and other analytics projects.
 - Use tools such as MapReduce / Hadoop.
1. Big Data Concepts and Environment: Big Data Overview-Big Data Challenges and Opportunities- Data analytics lifecycle overview – Phases of Data Analytics: Discovery, Data preparation, Model planning, Model building.

2. Overview of Hadoop and HDFS: Introduction to Hadoop - The Distributed File System: HDFS, GPFS – The Design of HDFS – HDFS-Concepts-Blocks, Name Nodes and Data Nodes; Components of Hadoop-Hadoop Cluster Architecture-Batch Processing- Serialization - Hadoop ecosystem of tools-NoSQL .

3. Map Reduce: MapReduce Basics - Functional Programming Roots - Mappers and Reducers - The Execution Framework -MapReduce Algorithm Design –Shuffling, Grouping, Sorting- Custom Partitioners and Combiners- MapReduce Formats and Features.

4. Data Stream Mining: The Stream Data Model: A Data-Stream-Management System, Examples of Stream Sources, Stream Queries, Issues in Stream Processing. Sampling Data in a Stream, Filtering Streams (The Bloom Filter), Counting Distinct Elements in a Stream, Counting Ones in a Window, Decaying Windows.

5. Big Data Clustering: Overview of clustering techniques, Hierarchical Clustering, Partitioning Methods, CURE algorithm, Clustering stream

6. Mining Social Network Graphs: Link Analysis: Page Rank- Efficient computation of Page Rank- Topic Sensitive Page Rank- Link Spam- Hubs and Authorities. Mining Social Network Graphs: Web Advertising: Online and Offline Algorithms; Social Network Graphs: Clustering of Social Network Graphs- Direct Discovery of Communities- Partitioning of Graphs- Finding overlapping communities- Simrank Counting Triangles- Neighborhood properties of Graphs.

Text Book:

1. RadhaShankarmani, M Vijayalakshmi, "Big Data Analytics", 2nd Edition, Wiley

Reference Books:

1. AnandRajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, 2014.

2. Data Warehousing in the Age of Big Data, Krish Krishnan Elsevier Inc, 2013

CSE 411 : ELECTIVE-IV MACHINE LEARNING

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 HoursCredits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

1. Introduction to Machine Learning, Applications of Machine learning, Supervisory Learning: Learning classes from examples, Vapnik-Charvonenkis (VC) Dimension, Probably Approximately Correct(PAC) Learning, noise, learning multiple classes, regression, model selection and generalization, dimensions of supervised machine learning algorithms

2. Bayesian Decision Theory: Classification, losses and risks, discriminant functions, utility theory, value of information, Bayesian networks, Influence diagrams, Association rules, Parametric Methods: Maximum likelihood estimation, evaluating an estimator with bias and variance, Bayes' estimator, parametric classification, regression, tuning model complexity: bias vs variance dilemma, model selection procedures

3. Multivariate methods: Multivariate data, parameter estimation, missing value imputation, univariate normal distribution and classification, discrete features, regression, Dimensionality Reduction: Subset selection, PCA, Factor Analysis, multi-dimensional scaling, LDA

4. Clustering: Mixture densities, K-means clustering, Expectation Maximization algorithm, mixtures of Latent Variable Models, Supervised learning after clustering, Hierarchical clustering, choosing number of clusters

5. Non-parametric methods: Non-parametric methods density estimation, generalisation to multivariate data, nonparametric classification, condensed nearest neighbors, non-parametric regression: smoothing models, choosing smoothing parameters

6. Decision trees and Linear Discrimination: Univariate classification and regression trees, rule extraction from trees, Multivariate trees, Generalizing linear model, two class and multi-class geometry of linear discriminant, pairwise separation, gradient descent, logistic discrimination for binary and multi-class problems, Support vector machines, optimal separating hyperplane, kernel functions for non-separable spaces, SVM for regression.

7. Hidden Markov Models: Discrete Markov processes, Hidden Markov Models, Three basic problems of HMM, Evaluation problem, finding the state sequence, Learning model parameters, continuous observations, Model selection in HMM Assessing and comparing classification Algorithms: Cross-validation and resampling methods, measuring error, interval estimation, hypothesis testing, assessing performance of a classifier, comparing two classification algorithms, comparing multiple classification algorithms based on variance

Text Book:

1. Introduction to Machine Learning by EthemAlpaydin, Prentice-Hall of India, 2006

2. Machine Learning by SaikatDutt and Subramanian Chandramouli

Reference books:

1. Machine Learning, Tom Mitchell , McGraw Hill, 1997

2. Pattern Classification, Richard O. Duda, Peter E. Hart and David G. Stork, John Wiley & Sons Inc., 2001

CSE 411 : ELECTIVE-IV : R PROGRAMMING

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3 Periods +0Tut/week, Univ. Exam: 3Hours Credits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

COURSE OBJECTIVS:

After taking the course, students will be able to

- * Use R for statistical programming, computation, graphics, and modeling,
- * Write functions and use R in an efficient way,
- * Fit some basic types of statistical models
- * Use R in their own research,
- * Be able to expand their knowledge of R on their own.

COURSE OUTCOMES:

At the end of this course, students will be able to:

- * List motivation for learning a programming language
- * Access online resources for R and import new function packages into the R workspace
- * Import, review, manipulate and summarize data-sets in R
- * Explore data-sets to create testable hypotheses and identify appropriate statistical tests
- * Perform appropriate statistical tests using R Create and edit visualizations

UNIT-I: Introduction, How to run R, R Sessions and Functions, Basic Math, Variables, Data Types, Vectors, Conclusion, Advanced Data Structures, Data Frames, Lists, Matrices, Arrays, Classes.

UNIT-II: R Programming Structures, Control Statements, Loops, - Looping Over Nonvector Sets, - If-Else, Arithmetic and Boolean Operators and values, Default Values for Argument, Return Values, Deciding Whether to explicitly call return- Returning Complex Objects, Functions are Objective, No Pointers in R, Recursion, A Quicksort Implementation-Extended Example: A Binary Search Tree.

UNIT-III: Doing Math and Simulation in R, Math Function, Extended Example Calculating Probability- Cumulative Sums and Products-Minima and Maxima- Calculus, Functions For Statistical Distribution, Sorting, Linear Algebra Operation on Vectors and Matrices, Extended Example: Vector cross Product- Extended Example: Finding Stationary Distribution of Markov Chains, Set Operation, Input /out put, Accessing the Keyboard and Monitor, Reading and writer Files,

UNIT-IV: Graphics, Creating Graphs, The Workhorse of R Base Graphics, the plot() Function – Customizing Graphs, Saving Graphs to Files.

UNIT-V: Probability Distributions, Normal Distribution- Binomial Distribution- Poisson Distributions Other Distribution, Basic Statistics, Correlation and Covariance, T-Tests,-ANOVA.

UNIT-VI: Linear Models, Simple Linear Regression, -Multiple Regression Generalized Linear Models, Logistic Regression, - Poisson Regression- other Generalized Linear Models-Survival Analysis, Nonlinear Models, Splines- Decision- Random Forests,

TEXT BOOKS:

- 1) The Art of R Programming, A K Verma, Cengage Learning.
- 2) R for Everyone, Lander, Pearson
- 3) The Art of R Programming, Norman Matloff, No starch Press.

REFERENCE BOOKS:

- 1) R Cookbook, Paul Teetor, Oreilly.
- 2) R in Action, Rob Kabacoff, Manning

CSE 412 : ELECTIVE-V : CYBER SECURITY & DIGITAL FORENSICS

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 Hours Credits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

1. Introduction to Information Security Fundamentals and Best Practices: Protecting Your Computer and its Contents, Securing Computer Networks—Basics of Networking, Compromised Computers, Secure Communications and Information Security Best Practices, Privacy Guidelines, Safe Internet Usage.

2. Ethics in Cyber Security & Cyber Law: Privacy, Intellectual Property, Professional Ethics, Freedom of Speech, Fair User and Ethical Hacking, Trademarks, Internet Fraud, Electronic Evidence, Cybercrimes.

3. Penetration Testing: Overview of the web from a penetration testers perspective, Exploring the various servers and clients, Discussion of the various web architectures, Discussion of the different types of vulnerabilities, Defining a web application test scope and process, Defining types of penetration testing.

4. Web Application Security: Common Issues in Web Apps, What is XSS, SQL injection, CSRF, Password Vulnerabilities, SSL, CAPTCHA, Session Hijacking, Local and Remote File Inclusion, Audit Trails, Web Server Issues.

5. Forensics & Network Assurance: Forensic Technologies, Digital Evidence Collection, Evidentiary Reporting, Layered Defense, Surveillance and Reconnaissance, Outsider Thread Protection

6. Information Risk Management: Asset Evaluation and Business Impact Analysis, Risk Identification, Risk Quantification, Risk Response Development and Control, Security Policy, Compliance, and Business Continuity. Forensic investigation using Access Data FTK, En-Case

7. Cyber Incident Analysis and Response: Incident Preparation, Incident Detection and Analysis. Containment, Eradication, and Recovery. Proactive and Post-Incident Cyber Services, CIA triangle

Text Books:

1. The Official CHFI Study Guide for Computer Hacking Forensic Investigator by Dave Kleiman
2. CISSP Study Guide, 6th Edition by James M. Stewart
3. www.nist.gov/
4. Title: Cyber Forensics by Dejei & S. Murugan, OXFORD university Press

CSE 412 : ELECTIVE-V-INTERNET OF THINGS

Common with 6 years integrated B.Tech(CSE)+M.Tech

Instruction: 3 Periods/week, Univ. Exam: 3 Hours Credits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

1) Introduction to the internet of things. IoT Architecture: History of IoT, M2M –Machine to Machine, Web of Things, IoT protocols The Architecture The Layering concepts, IoT Communication Pattern, IoT protocol Architecture, The 6LoWPAN

2) prototyping connected objects. Open-source prototyping platforms, Basics of IoT Networking (IoT components and Gateways)

3) Integrating internet services. XML and JSON. HTTP APIs for accessing popular Internet services (Facebook, Twitter, and others). Practical activities. IoT Application Development: Application Protocols MQTT, REST/HTTP, CoAP, MySQL, RPL,

4) Overview of IoT supported Hardware platforms such as: Raspberry pi, ARM Cortex Processors, Arduino and Intel Galileo boards

5) Ubiquitous computing, applications of IoT, Virtualization of network resources and physical devices in IoT.

6) Internet of Things Standardisation M2M Service Layer Standardisation OGC Sensor Web for IoT

TEXT BOOK:

Internet Of Things: Converging Technologies For Smart Environments And Integrated Ecosystems, Marina Ruggieri H, River Publishers Series In Communications

CSE 412 : ELECTIVE-V : CLOUD COMPUTING

Common with 6 years integrated B.Tech(CSE)+M.Tech

Instruction: 3 Periods/week, Univ. Exam: 3 Hours Credits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives:

1. To import fundamental concepts in the area of cloud computing.
2. To understand the concept of Virtualization and cloud data storage.
3. To learn cloud Application Development and cloud Governance.
4. To gain competence in Map Reduce and Hadoop Overview.

Course Outcomes:

1. Identify the architecture and infrastructure of cloud computing.
2. Develop applications for cloud computing.
3. Design and Implement a novel cloud computing application.

SYLLABUS

1. Introduction to cloud computing: Cloud computing components, Infrastructure services, storage applications, database services – introduction to SaaS, PaaS, IaaS, IDaaS, data storage in cloud

2. Virtualization: enabling technologies, types of virtualization, server virtualization, desktop virtualization, memory virtualization, application and storage virtualization-tools and products available for virtualization

3. SAAS and PAAS: Getting started with SaaS, SaaS solutions, SOA, PaaS and benefits.

4. IaaS and Cloud data storage: understanding IaaS, improving performance for load balancing, server types within IaaS, utilizing cloud based NAS devices, cloud based data storage, and backup services, cloud based block storage and database services

5. Cloud Application development: Client server distributed architecture for cloud designing cloud based solutions, coding cloud based applications, traditional Apps vs cloud Apps, client side programming, server side programming overview-fundamental treatment of web application frameworks.

6. Cloud Governance and economics: Securing the cloud, disaster recovery and business continuity in the cloud, Managing the cloud, migrating

to the cloud, governing and evaluating the clouds business impact and economics,

7. Inside Cloud: Introduction to MapReduce and Hadoop-over view of big data and its impact on cloud

Text Books:

1. Cloud Computing: SaaS, PaaS, IaaS, Virtualization, Business Models, Mobile, Security and More, Kris Jamsa, Jones & Bartlett Publishers, Paper back edition, 2013

2. Hadoop Map Reduce cookbook, Srinath Perera and Thilina Gunarathne, Packt publishing

References:

1. Cloud Computing: A Practical Approach, Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, Tata McGraw Hill Edition

CSE413 : GPS APPLICATIONS

Common with 6 years integrated B.Tech(CSE)+M.Tech

Instruction: 3 Periods/week, Univ. Exam: 3 Hours Credits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

UNIT-1: Development of NAVSTAR GPS. GPS Satellite configuration- Space segment, Control segment, User segment.

UNIT-2: GPS working principle, basic equations for finding user position, user position determination with least squares estimator.

UNIT-3: Other Global Satellite Constellations, GLONASS, GALILEO, Comparison of 3 GNSS (GPS, GALILEO, GLONASS) in terms of constellation and services provided.

UNIT-4: GPS Signal generation, Pseudorandom noise (PRN) code, C/A code, P code, Navigation data, Signal structure of GPS, signal power.

UNIT-5: Coordinate Systems: Geoid, Ellipsoid, Coordinate Systems, Geodetic and Geo centric coordinate systems, ECEF coordinates, world geodetic 1984 system, Conversion between Cartesian and geodetic coordinate frame.

UNIT-6: GPS Error sources, ionospheric effects on GPS signals and its mitigation methods.

UNIT-7: Satellite based augmentation system-need for GPS augmentation, GPS Aided GEO Augmented System (GAGAN).

Textbook:

1. G S RAO, Global Navigation Satellite Systems, McGraw-Hill Publications, New Delhi, 2010

2. Pratap Mishra, Global positioning system: signals, measurements, and performance, Ganga-Jamuna Press, 2006.

Reference Books:

1. Scott Gleason and Demoz Gebre-Egziabher, GNSS Applications and Methods, Artech House, 685 Canton Street, Norwood, MA 02062, 2009.

2. James Ba – Yen Tsui, 'Fundamentals of GPS receivers – A software approach', John Wiley & Sons (2001).

3. B. Hoffmann-Wellenhof, GPS theory and practice, 5th Edition, Springer 2001.

CSE 414 : COMPUTATIONAL BIOLOGY

Common with 6 years integrated B.Tech(CSE)+M.Tech

Instruction: 3 Periods/week, Univ. Exam: 3 Hours Credits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

1. Introduction: Definitions, Sequencing, Biological sequence/structure, Genome Projects, Pattern recognition and prediction, Folding problem, Sequence Analysis, Homology and Analogy, EMBnet, NCBI.

2. Protein Information Resources: Biological databases, Primary sequence databases, Protein Sequence databases, Secondary databases, Protein pattern databases, and Structure classification databases.

3. DNA Sequence analysis: DNA sequence databases, Importance of DNA analysis, Gene structure and DNA sequences, Features of DNA sequence analysis, EST (Expressed Sequence Tag) searches, Gene hunting, Profile of a cell, EST analysis, Effects of EST data on DNA databases.

4. Pair wise alignment techniques: Database searching, Alphabets and complexity, Algorithm and programs, Comparing two sequences, subsequences, Identity and similarity, The Dotplot, Local and global similarity, different alignment techniques, Dynamic Programming, Pair wise database searching.

5. Multiple sequence alignment: Definition and Goal, The consensus, computational complexity, Manual methods, Simultaneous methods, Progressive methods, Databases of Multiple alignments and searching

6. Secondary database: Searching Importance and need of secondary database searches, secondary database structure and building a sequence search protocol

7. Analysis packages: Comprehensive packages, packages specializing in DNA analysis, Probability and Statistics: Introduction, The beginnings of modern probability theory, Chance and Risk, Degrees of certainty. Bayesian Logic.

Text Books:

1. Introduction to Bioinformatics, by T K Attwood & D J Parry-Smith
Addison WesleyLongman

2. Bioinformatics- A Beginner s Guide by Jean-Michel Claveriw,
CerdricNotredame, WILEY dreamleach India Pvt. Ltd Reference Books: 1.
Introduction to Bioinformatics by M.Lesk OXFORD publishers (Indian
Edition)

CSE415: ENTERPRENUERSHIP

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 HoursCredits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100
Marks

Unit-I : Basic Concepts of Management: Management: Definition,
Nature and Importance ; Functions of the Management; Levels of
Management; F.W Taylor's Scientific Management; Henry Fayol's Principles
of Management;

Unit-II: Forms of Business Organizations: Introduction, Types of
Business organizations: Private Sector- Individual Ownership , Partnership,
Joint stock companies and Co-Operative organizations; Public sector-
Departmental Organizations, Public Corporations and Government
Companies; The Joint sector Management.

Unit-III : Production and operations Management: Plant location-
Factors to be considered in the selection of Plant location; Break - even
analysis- Significance and managerial applications; Importance of
Production Planning and Control and its Functions; Human Resource
Management and Functions of Human Resource Manager (in brief);
Functions of Marketing; Methods of Raising Finance.

Unit-IV : Entrepreneurship : Definition, Characteristics and Skills ,
Types of Entrepreneurs, Entrepreneur vs. Professional Managers, , Growth
of Entrepreneurs, Nature and Importance of Entrepreneurs, Women
Entrepreneurs, Problems of Entrepreneurship.

Unit-V : Entrepreneurial Development and Project Management:
Institutions in aid of Entrepreneurship Development, Idea generation:
Sources and Techniques;, Stages in Project formulation ; Steps for starting
a small enterprise - Incentives for Small Scale Industries by Government.

Text Books:

(1)Sharma,S.C, and Banga, T.R., Industrial Organization &
Engineering Economics, Khanna Publishers, Delhi, 2000.

(2) Vasant Desai The Dynamics of Entrepreneurial Development and
Management (Planning for future Sustainable growth),Himalayan Publishing
House, 2018.

Reference Books:

(1) Aryasri , A.R., Management Science, McGraw Hill Education (India
Private Limited , New Delhi 2014.

CSE 416 : CRYPTOGRAPHY & NETWORK SECURITY

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 HoursCredits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100
Marks

Course Objectives:

1. Introduction of the issues in network security- its need and importance, taxonomy and terminology.
2. Discussion of various cryptographic techniques.
3. Exploration of different types of security threats and remedies.
4. Understanding of Internet security protocols and standards

Course Outcomes:

1. Realize the need and importance of network and data security in the Internet and in the distributed environments.
2. Identify the different types of network security issues and their remedies.
3. Application various cryptographic tools and techniques in different contexts and as per need of security levels.
4. Implementation of some Internet security protocols and standards

SYLLABUS

1 Overview: Computer Security Concepts, Threats, Attacks, and Assets, Security Functional Requirements, A Security Architecture for Open Systems, Computer Security Trends, Computer Security Strategy. Cryptographic Tools: Confidentiality with Symmetric Encryption, Message Authentication and Hash Functions, Public-Key Encryption, Digital Signatures and Key Management, Random and Pseudorandom Numbers, Practical Application: Encryption of Stored Data. User Authentication: Means of Authentication, Password-Based Authentication, Token-Based Authentication, Biometric Authentication, Remote User Authentication, Security Issues for User Authentication, Practical Application: An Iris Biometric System, Case Study: Security Problems for ATM Systems.

2 Access Control: Access Control Principles, Subjects, Objects, and AccessRights, Discretionary Access Control, Example: UNIX File Access Control, Role-BasedAccess Control, Case Study: RBAC System for a Bank. Database Security: The Need forDatabase Security, Database Management Systems, Relational Databases, DatabaseAccess Control, Inference, Statistical Databases, Database Encryption, CloudSecurity.

3 Malicious Software: Types of Malicious Software (Malware), Propagation—Infected Content—Viruses, Propagation—Vulnerability Exploit—Worms,Propagation—Social Engineering—SPAM E-mail, Trojans, Payload—System Corruption,Payload—Attack Agent—Zombie, Bots, Payload—Information Theft—Key loggers, Phishing,Spyware, Payload—Stealth—Backdoors, Root kits,Countermeasures. Denial-of-Service Attacks: Denial-of-Service Attacks, Flooding Attacks,Distributed Denial-of-Service Attacks, Application-Based Bandwidth Attacks, Reflector andAmplifier Attacks, Defenses Against Denial-of-Service Attacks, Responding to aDenial-of-Service Attack.

4 Intrusion Detection: Intruders, Intrusion Detection, Host-Based IntrusionDetection, Distributed Host-Based Intrusion Detection, Network-Based IntrusionDetection, Distributed Adaptive Intrusion Detection, Intrusion Detection ExchangeFormat, Honeypots, Example System: Snort. Firewalls and Intrusion Prevention Systems:The Need for Firewalls, Firewall Characteristics,Types of Firewalls,FirewallBasing,Firewall Location and Configurations, Intrusion Prevention Systems, Example: Unified Threat Management Products.

5 Buffer Overflow: Stack Overflows, Defending Against Buffer Overflows, Other Formsof Overflow Attacks, Software Security: Software Security Issues, Handling ProgramInput, Writing Safe Program Code, Interacting with the Operating System and OtherPrograms, Handling Program Output. Operating System Security: Introduction to OperatingSystem Security, System Security Planning, Operating Systems Hardening, ApplicationSecurity, Security Maintenance, Linux/Unix Security, Windows Security, VirtualizationSecurity.

6 Symmetric Encryption and Message Confidentiality: Symmetric EncryptionPrinciples, Data Encryption Standard, Advanced Encryption Standard, Stream Ciphers andRC4, Cipher Block Modes of Operation, Location of Symmetric Encryption Devices,Key Distribution. Public-Key Cryptography and Message Authentication: SecureHash Function, HMAC, The RSA Public-Key Encryption Algorithm, Diffie-Hellman andOtherAsymmetricAlgorithms.

7 Internet Security Protocols and Standards: Secure E-mail and S/MIME, DomainKeys IdentifiedMail, Secure Socket Layer (SSL) and Transport Layer Security(TLS),HTTPS, IPv4 and IPv6 Security. Internet Authentication Applications: Kerberos, X.509,Public-Key Infrastructure,

Federated Identity Management. Wireless Network Security:Wireless Security Overview, IEEE 802.11 Wireless LAN Overview, IEEE 802.11i WirelessLAN Security.

TextBook:

1. Computer Security - Principles and Practices (Except the Chapters 13, 14, 15, 16, 17,18, 19), 2ndEdition by William Stallings, Pearson Education,Inc.

ReferenceBooks:

1. Cryptography and Network Security by William Stallings, Pearson Education Asia,New Delhi.

2. Network Security Essentials Applications and Standards, byWilliam Stallings,Pearson Education Asia, New Delhi.

CSE 417 : ELECTIVE-IV LAB BIG DATA ANALYTICS LAB

Common with 6years integrated B.Tech(CSE)+M.Tech and B.Tech(IT)

Instruction: 3 Periods +0Tut/week, Univ. Exam: 3Hours Credits: 1.5

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

Getting Hadoop Up and Running in a cluster:

1. Setting up Hadoop on standalonemachine.
2. Wordcount Map Reduce program using standaloneHadoop.
3. Adding the combiner step to the Wordcount Map Reduceprogram.
4. Setting upHDFS.
5. Using HDFS monitoringUI
6. HDFS basic command-line fileoperations.
7. Setting Hadoop in a distributed clusterenvironment.
8. Running the WordCount program in a distributed clusterenvironment.

9. Using Map Reduce monitoringUI

Hadoop Map Reduce Applications:

10. Choosing appropriate Hadoop datatypes.
11. Implementing a custom Hadoop Writable datatype.
12. Implementing a custom Hadoopkeytype.
13. Emitting data of different value types from amapper.
14. Choosing a suitable Hadoop Input Format for your input dataformat.
15. Formatting the results of Map Reduce Computation – using HadoopOutputFormats.

Analytics

16. Simple analytics using MapReduce.

17. Performing Group-By using MapReduce.
18. Calculating frequency distributions and sorting using MapReduce.
19. Plotting the Hadoop results using GNUplot.
20. Calculating histograms using MapReduce.
21. Calculating scatter plots using MapReduce.
22. Parsing a Complex dataset with Hadoop.
23. Joining two datasets using MapReduce.

Text Book:

Hadoop Map Reduce Cookbook, Srinath Perera & Thilina Gunarathne, 2013, PACKT PUBLISHING.

CSE 417 : ELECTIVE-IV LAB MACHINE LEARNING LAB

Common with 6 years integrated B.Tech(CSE)+M.Tech and B.Tech(IT)

Instruction: 3 Periods + 0 Tut/week, Univ. Exam: 3 Hours Credits: 1.5

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

Course objectives:

This course will enable students to

1. Make use of Data sets in implementing the machine learning algorithms.
2. Implement the machine learning concepts and algorithms in any suitable language of choice.

Course outcomes:

The students should be able to:

1. Understand the implementation procedures for the machine learning algorithms.
2. Design Java/Python programs for various Learning algorithms.
3. Apply appropriate data sets to the Machine Learning algorithms.
4. Identify and apply Machine Learning algorithms to solve real world problems.

Description (If any):

1. The programs can be implemented in either JAVA or Python.
2. For Problems 1 to 6 and 10, programs are to be developed without using the built-in classes or APIs of Java/Python.
3. Data sets can be taken from standard repositories (<https://archive.ics.uci.edu/ml/datasets.html>) or constructed by the students.

Lab Experiments:

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.

2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.

3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

4. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.

5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.

6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.

7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.

8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.

9. Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.

10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

CSE 417 : ELECTIVE-IV LAB : R- PROGRAMMING LAB

Common with 6 years integrated B.Tech(CSE)+M.Tech and B.Tech(IT)

Instruction: 3 Periods + 0 Tut/week, Univ. Exam: 3 Hours Credits: 1.5

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

1. Implement the Following

- a. To create a data frame df1 to contain 10 observations and 3 variables, column 1 with letters, column 2 with random numbers and column 3 with first 10 natural numbers.

- b. Create df3 by merging df1 by column1 with another data frame df2 containing 20 observations and 2 variables column4 with letters, column5 with sequence of 20 real numbers from 0 to 1 in equalsteps
- c. Find the dimensionality of data framedf3.
- d. Rename observations whose column1 value is 'D' from data framedf3
2. Implement the following
 - a. Create h1 to contain 1000 random numbers, distributed in normal distribution and plot the histogram withcolors.
 - b. Create a data frame to contain randomly drawn samples of 25 cards from 52 distinct cards with replacements. Use 'table' function to find the 'duplicated' and tabulate the list of cards and their frequency of occurrence in thesample.
3. Write R Program using 'apply' group of functions to create and apply normalization function on each of the numeric variables/columns of iris dataset to transform theminto
 - a. 0 to 1 range with min-maxnormalization.
 - b. a value around 0 with z-scorenormalization.
4. Create a data frame with 10 observations and 3 variables and add new rows and columns to it using 'rbind' and 'cbind'function.
5. Create a function to discretize a numeric variable into 3 quantiles and label them as low, medium, and high. Apply it on each attribute of iris dataset to create a new data frame. 'discrete_iris' with Categorical variables and the classlabel.
6. Write R program to find the approximate value of δ (pi) by simulation using a large number of uniformly distributed data points with their coordinates in the range of [-1,1] and find the ratio of number of points within the circle of radius 1, to total number of data points. Observe the improvement in accuracy of result with the increased number of data pointsdistributed.
7. Write R programs to find the probability of a variable to have a given value in different distributions like Uniform, Normal, Poisson and Binomial using 'pnorm', 'ppois', and the other suchfunctions.
8. Apply 'ddply' for data summarization of iris dataset based on 'species' and get the same summarization using'sqldf'
9. After attaching data set 'mtcars' to access its variables, use R statements to visualize the relationship between the variables of'mtcars':
 - a. using scatter plots withcolors.
 - b. boxplots showing the spread of the variable 'mpg' for different values of'cyl'.
 - c. Find correlations between all pairs of variables.

10. Write R program to implement linear and multiple regression on 'mtcars' dataset to estimate the value of 'mpg' variable, with best R^2 and plot the original values in 'green' and predicted values in'red'.

11. Write R program to create new variables in low dimensional spaceusing

- a. PCAand
- b. SVD and use them for predicting the values of 'mpg'variable.

12. Write R Programs to apply k-mean clustering on 'iris' data set and get the summary statistics. Implement a mini-project to process a collection of text documents / tweets and apply tokenization, stopwords removal and stemming to represent the collection as a document – term matrix reflecting the term frequencies. Cluster the documents using a simple clustering algorithm and estimate the purity of the clusteringsolution.

CSE418 : ELECTIVE-V LAB : CYBER SECURITY LAB

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3 Periods/week Credits:1.5

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

Module-1: The students will be exposed to different types of attack scenarios and hacking tools with respect to security.Open source tools will be used for the implementation of the lab experiments

Module-II : The students will be exposed to different case studiesof cyber-attacksand using open source Cyber Forensic tools they will examine the case.

CSE 418 : ELECTIVE-V LAB: INTERNET OF THINGS LAB

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3PeriodsUniv. Exam: 3 Hours Credits: 1.5

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

LIST OF EXPERIMENTS:

1. Study Of Various Network Protocols Used In IoT.
2. Application OfWifi In IoT Systems.
3. Application Of 6lowpan In IoT Systems.
4. Application Of Bluetooth In IoT Systems.
5. Application Of 802.15.4 Zigbee. In IoT Systems.
6. Design A Simple IoT System Comprising Sensors, Wireless Network Connection, Data Analytics

CSE418 : ELECTIVE-V LAB : CLOUD COMPUTING LAB

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3 Periods/week Credits:1.5

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

Use Eucalyptus or Open Nebula or equivalent to set up the cloud and demonstrate.

1. Find procedure to run the virtual machine of different configuration. Check how many virtual machines can be utilized at particular time.
2. Find procedure to attach virtual block to the virtual machine and check whether it holds the data even after the release of the virtual machine.
3. Install a C compiler in the virtual machine and execute a sample program.
4. Show the virtual machine migration based on the certain condition from one node to the other.
5. Find procedure to install storage controller and interact with it.

IV/IV B.TECH (FOUR YEAR COURSE) &

IV/VI B.TECH (SIX YEAR DOUBLE DEGREE COURSE)

(With effect from 2019-2020 admitted batch onwards)

B.TECH. (CSE) IV YEAR II-SEMESTER SCHEME OF INSTRUCTION AND EXAMINATION

Sub. Ref	Name of the Subject	Periods			Maximum Marks		Credits
		Theory	Tutorial	Lab	Exam	Sessionals	
CSE421	—	—	—	—	50	50	100 14.5

TEGUIDELINES for doing the Project Work:

1. Candidates can do their thesis work within the department or in any industry/research organization for one full semester i.e. in the 4th year 2nd semester of their study. In case of project done in an industry/research organization, one advisor (Guide) should be from the department and one advisor (Co-Guide) should be from the industry/research organization.

2. Students should work in teams of 3 to 4 members and submit the thesis on the project work done by them.

Format for Preparation of Project Thesis For B. Tech (CSE):

1. Arrangement Of Contents:

The sequence in which the project report material should be arranged and bound should be as follows:

1. Cover Page & TitlePage
2. Bonafide Certificate
3. Abstract
4. Table of Contents

5. List of Tables
6. List of Figures
7. List of Symbols, Abbreviations and Nomenclature
8. Chapters
9. Appendices
10. References

Appendix "S" Item No.37

B.Tech. (Chemical Engineering)

Effective from 2021-22 Batch

Group - A

(For the branches of Civil Engg., Chemical Engg., Biotechnology, Computer Science Engg and Information Technology)

B.Tech. Ist Year - I Semester

Course Credits	Category code	Course Title	Hours per			Internal week	External week	Total Marks	
			L	T	P			Marks	Marks
CH-1101	BS	Mathematics – I	3	0	0	30	70	100	3
CH-1102	BS	Chemistry	3	0	0	30	70	100	3
CH-1103	HSS	English	3	0	0	30	70	100	3
CH-1104	ES	CPNM	3	0	3	30	70	100	3
CH-1105	ES	Basic Electrical Engineering	3	0	0	30	70	100	3
CH-1106	HSS	English Language Lab	0	0	2	50	50	100	1.5
CH-1107	BS	Chemistry Lab	0	0	3	50	50	100	1.5
CH-1108	ES	CPNM Lab	0	0	3	50	50	100	1.5
Total Credits									19.5

B.Tech. Ist Year - II Semester

Course Credits	Category code	Course Title	Hours per			Internal week	External week	Total Marks	
			L	T	P			Marks	Marks
CH-1101	BS	Mathematics – I	3	0	0	30	70	100	3
CH-1201	BS	Mathematics – II	3	0	0	30	70	100	3
CH-1202	BS	Physics	3	0	0	30	70	100	3
CH-1203	ES	Engineering Graphics	1	0	4	30	70	100	3

CH-1204	ES	Material Science & Engineering	3	0	0	30	70	100	3
CH-1205	ES	Mechanical Engineering	3	0	0	30	70	100	3
CH-1206	ES	Workshop Lab	0	0	3	50	50	100	1.5
CH-1207	BS	Physics Lab	0	0	3	50	50	100	1.5
CH-1208	ES	General Engineering Lab. (Mechanical Engineering/ Electrical Engineering)	0	0	3	50	50	100	1.5
Total Credits									19.5

B.Tech. IInd Year - I Semester

Course Credits Marks	Category code	Course Title	Hours per week	Internal	External	Total Marks			
			L	T	P				
CH-2101	BS	Maths-III	3	0	0	30	70	100	3
CH-2102	ES	Solid Mechanics	3	0	0	30	70	100	3
CH-2103	HSS	Managerial Economics	3	0	0	30	70	100	3
CH-2104	PC	Organic Chemistry	3	0	0	30	70	100	3
CH-2105	PC	Particle and Fluid Particle Processing	3	0	0	30	70	100	3
CH-2106	PC	Organic Chemistry lab	0	0	3	50	50	100	1.5
CH-2107	PC	Particle and Fluid Particle Processing lab	0	0	3	50	50	100	1.5
CH-2108	SC	MATLAB (software training)	1	0	2	50	50	100	2
CH-2109	MC	Environmental Science	0	0	0	-	100	100	0
Total Credits									20

B.Tech. IInd Year - II Semester

Course Credits Marks	Category code	Course Title	Hours per week	Internal	External	Total Marks	
			L T P				
CH-2201	BS	Maths-IV	3	0	0	30	70 100 3
CH-2202	PC	Material and Energy Balances	3	0	0	30	70 100 3
CH-2203	PC	Heat Transfer	3	0	0	30	70 100 3
CH-2204	PC	Fluid Mechanics	3	0	0	30	70 100 3
CH-2205	HSS	Industrial Management & Entrepreneurship	3	0	0	30	70 100 3
CH-2206	PC	Heat Transfer lab	0	0	3	50	50 100 1.5
CH-2207	PC	Fluid Mechanics lab	0	0	3	50	50 100 1.5
CH-2208	SC	ASPEN PLUS (Process design)	1	0	2	50	50 100 2

CH-2209	MC	Professional Ethics and Human Values	0	0	0	-	100	100	0
CH-2210	MC	NCC/NSS	3 Hours per week.						
Total Credits									20

Summer Internship (Community Service)

B.Tech. IIIrd Year - I Semester

Course Credits Marks	Category code	Course Title	Hours per week	Internal	External	Total Marks	Marks
			L	T	P		
CH-3101	PC	Chemical Engineering Thermodynamics	3	0	0	30	70 100 3
CH-3102	PC	Mass Transfer-I	3	0	0	30	70 100 3
CH-3103	PC	Chemical Reaction Engineering - I	3	0	0	30	70 100 3
CH-3104	OE	Open Elective- I	2	0	2	30	70 100 3
CH-3105	PC	Core Elective -I	3	0	0	30	70 100 3
CH-3106	PC	Mass Transfer-I lab	0	0	3	50	50 100 1.5
CH-3107	PC	Chemical Technology lab	0	0	3	50	50 100 1.5
CH-3108	SC	Seminar/ Minor project	1	0	2	50	50 100 2
CH-3109	MC	Indian Constitution	2	0	0	0	100 100 0
CH-3110	MC	Summer internship 2 months (Mandatory after second year) to be evaluated during V semester-	-	-	100	0	100 100 2
Total Credits							22

Core Elective-I (CH 3105)

- A. General Chemical Technology
- B. Ceramic Raw Materials
- C. Fuel Cell Technology
- D. Polymer Technology

Open Elective-I (CH 3104)

Corrosion Engineering

B.Tech III Year - II Semester

Course Credits Marks	Category code	Course Title	Hours per week	Internal	External	Total Marks	
			L T P				

CH-3201	PC	Mass transfer-II	3	1	0	30	70	100	3
CH-3202	PC	Chemical Reaction Engineering-II	3	0	0	30	70	100	3
CH-3203	PC	Process Instrumentation and Control	3	0	0	30	70	100	3
CH-3204	PC	Core elective- II	3	0	0	30	70	100	3
CH-3205	OE	Open Elective – II	2	0	2	30	70	100	3
CH-3206	PC	Mass transfer –II lab	0	0	3	50	50	100	1.5
CH-3207	PC	Chemical Reaction Engineering lab	0	0	3	50	50	100	1.5
CH-3208	PC	Process Instrumentation and Control lab	0	0	3	50	50	100	1.5
CH-3209	SC	Intellectual Property Rights	3	0	0	30	70	100	2
CH-3210	MC	Essence of Indian Traditional Knowledge	2	0	0	-	100	100	0
Total Credits									21.5

SUMMER INTERNSHIP (2 MONTHS)

Core Elective-II: (CH 3204)

- Process Modeling and Simulation
- Petroleum Refinery Engineering
- White Ware and Heavy Clayware
- Computational Fluid Dynamics
- Multi Component Separation Processes
- Chemical Engineering Mathematics
- Fertilizer Technology

Open Elective-II (CH 3205)

- Nano Science & Technology
- Industrial Safety and Management
- Environmental Pollution Control Engineering

B.Tech. IV Year - I Semester

Course	Category	Course Title	Hours per	Internal	External	Total	
Credits	code			Mark	Mark	Mark	
Marks			L T P				
CH-4101	PC	Transport Phenomena	3	1	0	30	70 100 3
CH-4102	PC	Process Engineering Economics	3	0	0	30	70 100 3
CH-4103	PC	Chemical Process Equipment Design	3	0	0	30	70 100 3

CH-4104	PC	Core Elective -III	3	0	0	30	70	100	3
CH-4105	OE	MOOCS	3	0	0	30	70	100	3
CH-4106	OE	MOOCS	2	0	2	30	70	100	3
CH-4107	PC	Chemical Process Equipment Design Lab	0	0	3	50	50	100	1.5
CH-4108	SC	Sustainable Process Engineering	3	0	0	30	70	100	2
CH-4109	MC	Summer internship 2 months (Mandatory after third year) to be evaluated during VII semester	-	-	-	100	-	100	2
Total Credits									23.5

Core Elective-III (CH 4104)

- Computer Aided Design
- Industrial Pollution Control Engineering
- Process Optimization
- Reservoir Engineering
- Fuels, Refractories and Furnaces
- Biochemical Engineering
- Paper Technology

Open Elective-III (CH 4105) & Open elective –IV (CH 4106) are MOOCS courses.

(To be specified/approved by BOS)

B.Tech IV Year - II Semester

Course	Category	Course Title	Internal	External	Total	Credits
		Marks	Marks	Marks		
CH-4201	Major Project	Project work	50	50	100	14
(6 Months Internship in industry) Total credits						14

MINOR REQUIREMENTS IN CHEMICAL ENGINEERING

Total Credit requirement : 20

Student must have acquired a minimum of 8 SGPA up to the end of 2nd semester without backlogs. In case after declaration 3rd semester results if student fails to score required minimum of 8 SGPA his/her registration for Minor programme stands canceled and he/she shall continue with regular programme. Of the 20 additional credits to be acquired, 16 Credits shall be earned by selecting courses one from each of the following pools and 4 credits through MOOCS with two courses of minimum 8 weeks duration.

Subject	L-T-P	Credit

POOL 1			
Fluid Mechanics (CH-2204)	3-1-0	4	
Heat Transfer (CH-2203)	3-1-0	4	
Material and Energy Balances (CH-2202)	3-1-0	4	
POOL 2			
General Chemical Technology (CH-3105)	3-1-0	4	
Mass Transfer-I (CH 3102)	3-1-0	4	
Chemical Engg. Thermodynamics (CH-3101)	3-1-0	4	
Material Science and Engineering (CH-1204)	4-0-0	4	
POOL 3			
Chemical Reaction Engineering-I (CH-3103)	3-1-0	4	
Process Instrumentation and Control (CH-3203)	3-1-0	4	
Process Engineering Economics (CH-4102)	3-1-0	4	
POOL 4			
Industrial Pollution Control Engineering (CH-4104B)	4-0-0	4	
Process Optimization (CH-4104C)	4-0-0	4	
Particle and Fluid Processing (CH-2105)	4-0-0	4	

B.Tech. (Honors) in Chemical Engineering

(Total Credits: 180)

20 additional credits are to be acquired for Honors.

Student must have acquired a minimum of 8 SGPA up to the end of 2nd semester without backlogs. In case after declaration 3rd semester results if student fails to score required minimum of 8 SGPA his/her registration for Honors programme stands canceled and he/she shall continue with regular programme.

Of the 20 additional credits to be acquired, 16 credits shall be earned by undergoing specified courses listed below with four courses each carrying 4 credits. **The remaining 4 credits must be acquired through MOOCS, which shall be domain specific, each with 2 credits and with minimum duration of 12 weeks as recommended by board of studies**

The courses that are offered for B.Tech. (Hons) in Chemical Engineering are:

Fluid Mechanics (CH-2204) 3-1-0 4			
Subject		L-T-P	Credit
POOL 1			
CHH-1001	Process Modeling and Simulation	3-1-0	4
CHH-1002	Advanced Mass Transfer	3-1-0	4
CHH-1003	Pollution Control	3-1-0	4
CHH-1004	Corrosion Engineering	3-1-0	4
CHH-1005	Petroleum Refinery Engineering	3-1-0	4
CHH-1006	Energy Engineering	3-1-0	4
CHH-1007	Transport Phenomena-II	3-1-0	4
CHH-1008	Chemical Reaction Engineering-III	3-1-0	4
CHH-1009	Advanced Process Control	3-1-0	4
CHH-1010	Analytical Techniques	4-0-0	4

CH-1101: MATHEMATICS-I

Course Objectives:

- To transmit the knowledge of Partial differentiation.
- To know of getting maxima and minima of function of two variables and finding errors and approximations.
- To evaluate double and triple integrals, volumes of solids and area of curved surfaces.
- To expand a periodical function as Fourier series and half-range Fourier series.

Course Outcomes:

At the end of the course, the student will be able to

- Find the partial derivatives of functions of two or more variables.
- Evaluate maxima and minima, errors and approximations.
- Evaluate double and triple integrals, volumes of solids and area of curved surfaces.
- To expand a periodical function as Fourier series and half-range Fourier series.
- Have a fundamental understanding of Fourier series and be able to give Fourier expansions of a given function.

SYLLABUS

(Partial Differentiation)

Introduction - Functions of two or more variables - Partial derivatives - Homogeneous functions – Euler's theorem - Total derivative - Change of variables – Jacobins. Mean value Theorems (without proofs)

(Applications of Partial Differentiation)

Geometrical interpretation -Tangent plane and Normal to a surface - Taylor's theorem for functions of two variables - Errors and approximations - Total differential. Maxima and Minima of functions of two variables - Lagrange's method of undetermined multipliers - Differentiation under the integral Sign - Leibnitz's rule.

(Multiple Integrals)

Introduction - Double Integrals - Change of Order of Integration - Double Integrals in Polar Coordinates - Triple Integrals - Change of Variables.

(Multiple Integrals-Applications)

Area enclosed by plane curves - Volumes of solids - Area of a curved surface - Calculation of Mass - Center of gravity - Moment of inertia - product of inertia – principal axes- Beta Function - Gamma Function - Relation between Beta and Gamma Functions. Error Function or Probability Integral.

(Fourier Series)

Introduction - Euler's Formulae - Conditions for a Fourier Expansion - Functions having points of discontinuity - Change of Interval - Odd and Even Functions - Expansions of Odd or Even Periodic Functions, Half-Range Series - Parseval's Formula. Practical Harmonic analysis.

TEXT BOOK :

Scope and Treatment as in "Higher Engineering Mathematics", by Dr. B.S. Grewal, 43rd Edition, Khanna publishers.

REFERENCE BOOKS:

1. Graduate Engineering Mathematics by V B Kumar Vatti., I.K.International publishing house Pvt. Ltd.
2. Advanced Engineering Mathematics by Erwin Kreyszig.
3. A text book of Engineering Mathematics, by N.P. Bali and Dr. Manish Goyal, Lakshmi Publications.
4. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.
5. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.
6. Higher Engineering Mathematics by Dr. M.K.Venkataraman.

CH-1102 : CHEMISTRY

Course Objectives:

- To apply the basic knowledge of Chemistry to the Engineering Discipline.

- To develop knowledge about water and its treatment for industrial and potable purposes.

- To develop understanding in the areas of Polymers, Mechanism of Corrosion of Metals and Corrosion Control Methods, Fuels, Lubricants and Nanomaterials for of conducting polymers, bio-degradable polymers and fiber reinforced plastics and apply the knowledge for solving existing challenges faced in various engineering and societal areas.

Course outcomes :

At the end of the course, the student will be able to

- This course applies the basic concepts and principles studied in Chemistry to Engineering.

- It provides an application of chemistry to different branches of Engg.

- The students will be able acquire knowledge in the areas of Water Chemistry, Polymers, Corrosion, Fuels and Lubricants and nanomaterials and suggest innovative solutions for existing challenges in these areas.

SYLLABUS

Water Chemistry :

Sources of Water – Impurities and their influence of living systems – WHO Limits – Hardness and its Determination – Boiler Troubles and their removal – Water Softening Methods – Lime-Soda, Zeolite and Ion Exchange - Municipal Water Treatment-Break Point Chlorination – Desalination of Sea Water – Reverse Osmosis Method, Electro-dialysis.

Polymers and Plastics :

Polymers: Definition – Types of Polymerization (Addition & Condensation) – Mechanisms of Addition Polymerization – Radical and Ionic – Thermodynamics of Polymerization Process. Plastics: Thermosetting and Thermoplastics – Effect of Polymer Structure on Properties of Cellulose Derivatives – Vinyl Resins – Nylon (6,6), Reinforced Plastics – Conducting Polymers.

Corrosion :

Corrosion: Origin and Theory – Types of Corrosion: Chemical and Electrochemical; Pitting, Inter granular, Waterline, Stress – Galvanic Series – Factors Effecting Corrosion.

Corrosion Controlling Methods: Protective Coatings: Metallic Coatings, Electroplating and Electroless Plating – Chemical conversion Coatings – Phosphate, Chromate, Anodized, Organic Coatings – Paints and Special Paints.

Fuels and Lubricants :

Solid Fuels: Wood and Coal, Ranking of Coal – Analysis (Proximate and Ultimate) Coke Manufacture – Otto Hoffmann's Process – Applications; Liquid Fuels: Petroleum Refining – Motor Fuels – Petrol and Diesel Oil – Knocking – Octane number – Cetane Number; Gaseous Fuels: Biogas, LPG and CNG – Characteristics – Applications; Rocket Fuels: Propellants – Classification – Characteristics.

Lubricants: Classification – Mechanism – Properties of Lubricating Oils – Selection of Lubricants for Engineering Applications.

Nanomaterials :

Nanomaterials, Properties and application of fullerenes, fullerols, Carbon nanotubes and nanowires. Synthesis - Top-down and Bottom-up approaches - Nanocomposites - Nanoelectronics- Applications of nanomaterials in catalysis, telecommunication and medicine.

TEXT BOOKS:

1. Engineering Chemistry – PC Jain and M. Jain – Dhanpath Rai and Sons, New Delhi.
2. A Text book of Engineering Chemistry – S. S. Dara – S. Chand & Co. New Delhi.

REFERENCE BOOKS:

1. Engineering Chemistry – B. K. Sharma – Krishna Prakashan – Meerut.
2. Introduction to Nanoscience - S. M. Lindsay - Oxford University Press
3. Engineering Chemistry - B. L. Tembe, Kamaluddin and M. S. Krishnan, (NPTEL).

CH-1103 : ENGLISH

Course Objectives:

- To make students understand the explicit and implicit meanings of a text/topic;
- To give exposure to new words and phrases, and aid to use them in different contexts;
- To apply relevant writing formats to draft essays, letters, emails and presentations; and
- To adapt oneself to a given situation and develop a functional approach to finding solutions: adaptability and problem solving.

Course Outcomes:

At the end of the course, the student will be able to

- Students will be able to analyse a given text and discover the various aspects related to language and literature;
- Learn the various language structures, parts of speech and figures of speech;
- Develop one's reading and writing abilities for enhanced communication; and
- Learn to apply the topics in real-life situations for creative and critical use.

SYLLABUS

On the conduct of life: William Hazlitt

Life skills: Values and Ethics

If: Rudyard Kipling

The Brook: Alfred Tennyson

Life skills: Self-Improvement

How I Became a Public Speaker: George Bernard Shaw

The Death Trap: Saki

Life skills: Time Management

On saving Time: Seneca

Chindu Yellama

Life skills: Innovation

Muhammad Yunus

Politics and the English Language: George Orwell

Life skills: Motivation

Dancer with a White Parasol: Ranjana Dave.

Grammar:

Prepositions – Articles – Noun-Pronoun Agreement, Subject-Verb Agreement – Misplaced Modifiers – Clichés, Redundancies.

Vocabulary:

Introduction to Word Formation – Root Words from other Languages – Prefixes and Suffixes – Synonyms, Antonyms – Common Abbreviations

Writing:

Clauses and Sentences – Punctuation – Principles of Good Writing – Essay Writing – Writing a Summary

Writing: Essay Writing

Life skills: Innovation

Muhammad Yunus.

TEXTBOOK:

1. *Language and Life: A Skills Approach* Board of Editors, Orient Blackswan Publishers, India. 2018.

REFERENCEBOOKS :

1. *Practical English Usage*, Michael Swan. OUP. 1995.
2. *Remedial English Grammar*, F.T. Wood. Macmillan.2007
3. *On Writing Well*, William Zinsser. Harper Resource Book. 2001
4. *Study Writing*, Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
5. *Communication Skills*, Sanjay Kumar and PushpLata. Oxford University Press. 2011.
6. *Exercises in Spoken English*, Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

CH-1104 : CPNM

Course Objectives:

- The course is designed to provide complete knowledge of C language.
- To provide students with understanding of code organization and functional hierarchical decomposition with using complex data types.
- To provide knowledge to the Students to develop logics which will help them to create programs, applications in C.
- This course aims to identify tasks in which the numerical techniques learned are applicable and apply them to write programs, and hence use computers effectively to solve the task.
- This course provides the fundamental knowledge which is useful in understanding the other programming languages.

Course Outcomes:

At the end of the course, the student will be able to

- Identify basic elements of C programming structures like data types, expressions, control statements, various simple functions and Apply them in problem solving.
- Apply various operations on derived data types like arrays and strings in problem solving.
- Design and Implement of modular Programming and memory management using Functions, pointers.
- Apply Structure, Unions and File handling techniques to Design and Solve different engineering programs with minimal complexity.

- Apply Numerical methods to **Solve** the complex Engineering problems.

SYLLABUS

Introduction to C: Basic structure of C program, Constants, Variables and data types, Operators and Expressions, Arithmetic Precedence and associativity, Type Conversions. Managing Input and Output Operations Formatted Input, Formatted Output.

Decision Making, Branching, Looping, Arrays & Strings: Decision making with if statement, Simple if statement, The if...else statement, Nesting of if...else statement, the else..if ladder, switch statement, the (?:) operator, the GOTO statement., The while statement, the do statement, The for statement, Jumps in Loops ,One, Two-dimensional Arrays, Character Arrays. Declaration and initialization of Strings, reading and writing of strings, String handling functions, Table of strings.

Functions: Definition of Functions, Return Values and their Types, Function Calls, Function Declaration, Category of Functions: No Arguments and no Return Values, Arguments but no Return Values, Arguments with Return Values, No Argument but Returns a Value, Functions that Return Multiple Values. Nesting of functions, recursion, passing arrays to functions, passing strings to functions, the scope, visibility and lifetime of variables.

Pointers: Accessing the address of a variable, declaring pointer variables, initializing of pointer variables, accessing variables using pointers, chain of pointers, pointer expressions, pointers and arrays, pointers and character strings, array of pointers, pointers as function arguments, functions returning pointers, pointers to functions, pointers to structures-Program Applications

Structure and Unions: Defining a structure, declaring structure variables, accessing structure members, structure initialization, copying and comparing structure variables, arrays of structures, arrays within structures, structures within structures, structures and functions and unions, size of structures and bit-fields- Program applications.

File handling: Defining and opening a file, closing a file, Input/ Output operations on files, Error handling during I/O operations, random access to files and Command Line Arguments- Program Applications

Numerical Methods: Solutions of Algebraic and Transcendental Equations, Bisection Method, Newton Raphson Method. Newton's forward and backward Interpolation, Lagrange's Interpolation in unequal intervals. Numerical Integration: Trapezoidal rule, Simpson's 1/3 rules. Solutions of Ordinary First Order Differential Equations: Euler's Method, Modified Euler's Method and Runge-Kutta Method.

TEXT BOOKS:

1. Programming in ANSI C, E Balagurusamy, 6th Edition. McGraw Hill Education (India) Private Limited.
2. Introduction to Numerical Methods, SS Sastry, Prentice Hall.

REFERENCE BOOKS:

1. Let Us C, Yashwant Kanetkar, BPB Publications, 5th Edition.
2. Computer Science, A structured programming approach using C, B.A. Forouzan and R.F. Gilberg, "3rd Edition, Thomson, 2007.
3. The C-Programming Language' B.W. Kernighan, Dennis M. Ritchie, PHI.
4. Scientific Programming: C-Language, Algorithms and Models in Science, Luciano M. Barone (Author), Enzo Marinari (Author), Giovanni Organtini, World Scientific.

CH-1105 : BASIC ELECTRICAL ENGINEERING

Course Objectives:

- An understanding of basic EE abstractions depends on analysis and design of electric and magnetic circuits and its elements.
- To provide the students with knowledge of fundamental laws in electrical engineering
- To develop the ability of the students to analyze electrical and magnetic circuits using the basic laws of electrical engineering
- To expose the students to the concepts of various types of electrical machines and application of electrical machines.
- To inculcate the understanding about the AC fundamentals
- To prepare the students to have a basic knowledge of transformers
- To acknowledge about three phase induction motor and its operating principle
- To know about the fundamentals of synchronous motors and its working principle

Course Outcomes:

At the end of the course, the student will be able to

- Predict the behavior of any electrical and magnetic circuits.
- State and explain the basic laws of electromagnetic induction.
- Understand Constructional details, principle of operation, types of Electrical Machines performance Characteristics, speed control methods and its applications
- Ability to conduct experiments on Ac Machines to find its characteristics.
- Calculate performance characteristics of transformer like regulation and efficiency

- Formulate and then analyze the working of synchronous motors
- Solve simple problems on synchronous motors.

SYLLABUS

Magnetic circuits: Definitions of magnetic circuit, reluctance, magnetomotive force (mmf), magnetic flux, simple problems on magnetic circuits, hysteresis loss (chapter 8, page nos. 155-175),

Electromagnetic induction: Faraday's laws of electromagnetic induction, induced E.M.F., dynamically induced E.M.F, statistically induced EMF, self inductance, mutual inductance (Chapter 9, page nos. 176-190),

D.C. generators: D.C generator principle, construction of D.C generator, E.M.F equation of D.C generator, types of D.C generators, armature reaction, losses in D.C generator, efficiency, characteristics of D.C generators, applications of D.C generators (chapter 10, 11, pages 208-238),

D.C. motors: D.C motor principle, working of D.C motors, significance of back, E.M.F, torque equation of D.C motors, types of D.C motors, characteristics of D.C motors, speed control methods of D.C motors, applications of D.C motor, testing of D.C machines, losses and efficiency, direct load test and Swinburne's test (Chapter 12, 13, page Nos. 239-269).

A.C. circuits: Introduction to steady state analysis of A.C circuits, single and balanced 3 phase circuits (chapter 16, page nos. 323-348).

Transformers: Transformer principle, EMF-equation of transformer, transformer on load, equivalent circuit of transformer, voltage regulation of transformer, losses in a transformer, calculation of efficiency and regulation by open circuit and short circuit tests (Chapter 20, page Nos. 423-455).

Three phase inductance motor: Induction motor working principle, construction of 3-phase induction motor, principle of operation, types of 3-phase induction motor, torque equation of induction motor, slip-torque characteristics, starting torque, torque under running condition, maximum torque equation, power stages of induction motor, efficiency calculation of induction motor by direct loading (Chapter 21, page nos. 463-489).

Alternator: Alternator working principle, EMF equation of alternator, voltage regulation by Synchronised impedance method (Chapter 23, page nos. 505-515).

Synchronous motor: Synchronous motor principle of operation, construction, methods of starting of synchronous motor, (Chapter- 24, page nos. 516-526).

TEXT BOOK:

1. 'Elements of Electrical Engineering & Electronics' by V.K. Mehta, S.Chand & Co.

REFERENCE BOOK:

1. 'A first course in Electrical Engineering' by Kothari.

CH-1106 : ENGLISH LANGUAGE LAB

Course Objectives:

- To make students recognize the sounds of English through Audio-Visual aids;
- To help students build their confidence and help them to overcome their inhibitions and self-consciousness while speaking in English;
- To familiarize the students with stress and intonation and enable them to speak English effectively; and
- To give learners exposure to and practice in speaking in both formal and informal contexts.

Course Outcomes:

At the end of the course, the student will be able to

- Recognize of English sound patterns and the fluency in their speech will be enhanced;
- Study the communicative items in the laboratory will help students become successful in the competitive world;
- Participate in group activities like roleplays, group discussions and debates; and
- Express themselves fluently and accurately in social as well professional context.

SYLLABUS

Introduction to Phonetics: The Sounds of English (Speech sound – vowels and consonants) - Stress and Intonation - Accent and Rhythm.

Listening Skills: Listening for gist and specific information - listening for Note taking, summarizing and for opinions - Listening to the speeches of eminent personalities.

Speaking Skills: Self-introduction - Conversation Skills (Introducing and taking leave) - Giving and asking for information - Role Play - Just A Minute (JAM) session - Telephone etiquette.

Reading and Writing skills: Reading Comprehension – Précis Writing - E-Mail writing - Punctuation.

Presentation skills: Verbal and non-verbal communication - Body Language - Making a Presentation.

REFERENCE BOOKS:

1. Ashraf Rizvi. *Effective Technical Communication*. Tata McGraw Hill Education Private Limited, New Delhi.
2. *Speak Well*. Orient Blackswan Publishers, Hyderabad.
3. Allan Pease. *Body Language*. Manjul Publishing House, New Delhi.

CH-1107 : CHEMISTRY LAB

Course Objectives:

- To develop the fine skills of quantitative determination of various chemical components through titrimetric analysis
- To prepare and use ionexchange/ zeolite columns for the removal of hardness of water
- To develop the skill of organic synthesis through the preparation of a polymer/ drug

Course Outcomes:

At the end of the course, the student will be able to

- Determine the amount of various chemical species in solutions by titrations and conduct the quantitative determinations with accuracy
- Develop novel materials to be used as zeolite and prepare columns for removal of hardness of water
- Produce a polymer or a drug

SYLLABUS

1. Determination of Sodium Hydroxide with HCl (Na_2CO_3 Primary Standard)
2. Determination of Alkalinity (Carbonate and Hydroxide) of water sample
3. Determination of Fe(II)/Mohr's Salt by Permanganometry
4. Determination of Oxalic Acid by Permanganometry
5. Determination of Chromium (VI) by Mohr's Salt Solution
6. Determination of Zinc by EDTA method
7. Determination of Hardness of Water sample by EDTA method
8. Determination of Chlorine in water by Iodometric Titration
9. Ionexchange/ Zeolite column for removal of hardness of water
10. Synthesis of Polymer/ drug

REFERENCE BOOKS:

1. Vogel's Quantitative Chemical Analysis – V – Edition – Longman.
2. Experiments in Applied Chemistry (For Engineering Students) – Sinita Rattan – S. K.Kataria& Sons, New Delhi.

CH-1108 : CPNM LAB

Course Objectives:

- To impart writing skill of C programming to the students and solving problems.

- To write and execute programs in C to solve problems such as Modularize the problems into small modules and then convert them into programs.,
- To write and execute programs in C to solve problems such as arrays, files, strings, structures and different numerical methods.
- This reference has been prepared for the beginners to help them understand the basic to advanced concepts related to Objective-C Programming languages.

Course Outcomes:

At the end of the course, the student will be able to

- Understand various computer components, Installation of software. C programming development environment, compiling, debugging, and linking and executing a program using the development environment.
- Analyzing the complexity of problems, Modularize the problems into small modules and then convert them into programs.
- Construct programs that demonstrate effective use of C features including arrays, strings, structures, pointers and files.
- Apply and practice logical ability to solve the real world problems.
- Apply Numerical methods to Solve the complex Engineering problems.

SYLLABUS

1. Write a program to read x, y coordinates of 3 points and then calculate the area of a triangle formed by them and print the coordinates of the three points and the area of the triangle. What will be the output from your program if the three given points are in a straight line?
2. Write a program, which generates 100 random integers in the range of 1 to 100. Store them in an array and then print the arrays. Write 3 versions of the program using different loop constructs. (e.g. for, while, and do while).
3. Write a set of string manipulation functions e.g. for getting a sub-string from a given position, Copying one string to another, Reversing a string, adding one string to another.
4. Write a program which determines the largest and the smallest number that can be stored in different data types like short, int, long, float, and double. What happens when you add 1 to the largest possible integer number that can be stored?
5. Write a program, which generates 100 random real numbers in the range of 10.0 to 20.0, and sort them in descending order.

6. Write a function for transposing a square matrix in place (in place means that you are not allowed to have full temporary matrix).

7. First use an editor to create a file with some integer numbers. Now write a program, which reads these numbers and determines their mean and standard deviation.

8. Given two points on the surface of the sphere, write a program to determine the smallest arc length between them.

9. Implement bisection method to find the square root of a given number to a given accuracy.

10. Implement Newton Raphson method to det. a root of polynomial equation.

11. Given table of x and corresponding f(x) values, Write a program which will determine f(x) value at an intermediate x value by using Lagrange's interpolation/

12. Write a function which will invert a matrix.

13. Implement Simpson's rule for numerical integration.

14. Write a program to solve a set of linear algebraic equations.

CH-1201 : MATHEMATICS – II

Course Objectives:

- The way of obtaining rank, eigen values and eigen vectors of a matrix.
- To know the importance of Cayley-Hamilton theorem and getting canonical form from a given quadratic form.
- To solve the system of equations by using direct and indirect methods.
- To solve first order and higher order differential equations by various methods.
- To obtain the Laplace transforms and inverse Laplace transforms for a given functions and their applications.

Course Outcomes:

At the end of the course, the student will be able to

- Find rank, eigen values and eigen vectors of a matrix and understand the importance of Cayley-Hamilton theorem.
- Reduce quadratic form to canonical forms and solving linear systems by direct and indirect methods.
- Demonstrate solutions to first order differential equations by various methods and solve basic applications problems related to electrical circuits, orthogonal trajectories and Newton's law of cooling

- Discriminate among the structure and procedure of solving higher order differential equations with constant and variable coefficients.
- Understand Laplace transforms and its properties and finding the solution of ordinary differential equations.

SYLLABUS

(Linear Algebra)

Rank of a matrix- Echelon form, Normal Form - Solution of Linear System of Equations - Consistency of Linear System of Equations - Direct & Indirect Methods: Gauss elimination method, LU Factorization method, Gauss Seidal Method. Complex Matrices: Hermitian, Skew-Hermitian and Unitary Matrices and their Properties.

(Eigen Values and Eigen Vectors)

Eigen Values and Eigen Vectors of a Matrix - Cayley-Hamilton theorem - Inverse and Powers of a Matrix using Cayley-Hamilton's theorem and its applications. Diagonalization of a Matrix - Quadratic Forms - Reduction of Quadratic Form to Canonical Form - Nature of a Quadratic Form.

(Ordinary Differential Equations of First Order and its Applications)

Formation of ordinary differential equations (ODEs) - Solution of an ordinary differential equation - Equations of the first order and first degree - Linear differential equation - Bernoulli's equation - Exact differential equations - Equations reducible to exact equations - Orthogonal Trajectories - Simple Electric (LR & CR) Circuits - Newton's Law of Cooling - Law of Natural growth and decay.

(Differential Equations of Higher Order)

Solutions of Linear Ordinary Differential Equations with Constant Coefficients - Rules for finding the complimentary function - Rules for finding the particular integral - Method of variation of parameters - Cauchy's linear equation - Legendre's linear equation - Simultaneous linear differential equations.

(Laplace Transforms)

Introduction - Existence Conditions - Transforms of Elementary Functions - Properties of Laplace Transforms - Transforms of Derivatives - Transforms of Integrals - Multiplication by t^n - Division by t - Evaluation of integrals by Laplace Transforms - Inverse Laplace Transform - Applications of Laplace Transforms to Ordinary Differential Equations - Simultaneous Linear Differential Equations with Constant Coefficients - Second Shifting Theorem - Laplace Transforms of Unit Step Function, Unit Impulse Function and Laplace Transforms of Periodic Functions.

TEXT BOOK:

1. Scope and Treatment as in "Higher Engineering Mathematics", by Dr. B.S. Grewal, 43rd edition, Khanna publishers.

REFERENCE BOOKS:

1. Graduate Engineering Mathematics by V B Kumar Vatti., I.K. International publishing house Pvt. Ltd.
2. Advanced Engineering Mathematics by Erwin Kreyszig.
3. A text book of Engineering Mathematics, by N.P. Bali and Dr. Manish Goyal. Lakshmi Publications.
4. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.
5. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.

CH-1202 : PHYSICS

Course Objectives:

- To impart knowledge in basic concept of physics of Thermodynamics relevant to engineering applications.
- To grasp the concepts of physics for electromagnetism and its application to engineering. Learn production of Ultrasonics and their applications in engineering.
- To Develop understanding of interference, diffraction and polarization: connect it to a few engineering applications.
- To Learn basics of lasers and optical fibers and their use in some applications.
- To Understand concepts and principles in quantum mechanics and Nanopahse Materials. Relate them to some applications.

Course Outcomes:

At the end of the course, the student will be able to

- Understand the fundamentals of Thermodynamics and Laws of thermodynamics. Understand the working of Carnot cycle and concept of entropy.
- Gain Knowledge on the basic concepts of electric and magnetic fields. Understand the concept of the nature of magnetic materials. Gain knowledge on electromagnetic induction and its applications.
- Understand the Theory of Superposition of waves. Understand the formation of Newton's rings and the working of Michelson's interferometer. Remember the basics of diffraction, Evaluate the path difference. Analysis of Fraunhofer Diffraction due to a single slit.

- Understand the interaction of matter with radiation, Characteristics of Lasers, Principle, working schemes of Laser and Principle of Optical Fiber. Realize their role in optical fiber communication.

- Understand the intuitive ideas of the Quantum physics and understand dual nature of matter. Compute Eigen values, Eigen functions, momentum of Atomic and subatomic particles using Time independent one Dimensional Schrodinger's wave equation. Understand the fundamentals and synthesis processes of Nanophase materials.

SYLLABUS

THERMODYNAMICS :

Introduction, Heat and Work, First law of thermodynamics and applications, Reversible and Irreversible process, Carnot cycle and Efficiency, Second law of thermodynamics, Carnot's Theorem, Entropy, Second law in terms of entropy, Entropy and disorder, Third law of thermodynamics (statement only).

ELECTROMAGNETISM

Concept of electric flux, Gauss's law - some applications, Magnetic field - Magnetic force on current, torque on current loop, The Biot-Savart's Law, B near a long wire, B for a circular Current loop, Ampere's law, B for a solenoid, Hall effect, Faraday's law of induction, Lenz's law, Induced magnetic fields, Displacement current, Maxwell's equations (no derivation), Magnetic materials: Classification of magnetic materials and properties.

Ultrasonics :Introduction, Production of Ultrasonics – Piezoelectric and Magnetostriction methods, acoustic grating, applications of ultrasonics

OPTICS

Interference: Principles of superposition – Young's Experiment – Coherence - Interference in thin films (reflected light), Newton's Rings, Michelson Interferometer and its applications.

Diffraction: Introduction, Differences between interference and diffraction, Fresnel and Fraunhofer diffraction, Fraunhofer diffraction at a single slit (Qualitative and quantitative treatment).

Polarisation: Polarisation by reflection, refraction and double refraction in uniaxial crystals, Nicol prism, Quarter and Half wave plate, circular and elliptical polarization.

LASERS and FIBRE OPTICS

Introduction, characteristics of a laser beam, spontaneous and stimulated emission of radiation, population inversion, Ruby laser, He-Ne laser, Semiconductor laser, applications of lasers.

Introduction to optical fibers, principle of propagation of light in optical fibers, Acceptance Angle and cone of a fibre, Numerical aperture, Modes of propagations, classification of fibers, Fibre optics in communications, Application of optical fibers.

MODERN PHYSICS

Introduction, De Broglie concept of matter waves, Heisenberg uncertainty principle, Schrodinger time independent wave equation, application to a particle in a box. Free electron theory of metals, Kronig - Penney model (qualitative treatment), Origin of energy band formation in solids, Classification of materials into conductors, semi conductors and insulators.

Nanophase Materials

Introduction, properties, Top-down and bottom up approaches, Synthesis - Ball milling, Chemical vapour deposition method, sol-gel methods, Applications of nano materials.

TEXT BOOKS :

1. Physics by David Halliday and Robert Resnick – Part I and Part II - Wiley.
2. A textbook of Engineering Physics, Dr. M. N. Avadhanulu, Dr. P.G. Kshirsagar - S. Chand
3. Engineering Physics by R.K. Gaur and S.L. Gupta –Dhanpat Rai

REFERENCE BOOKS:

1. Modern Engineering Physics by A.S. Vadudeva
2. University Physics by Young and Freedman

CH-1203 : ENGINEERING GRAPHICS

Course Objectives:

- Understand the basics of Engineering Graphics and BIS conventions.
- Develop the graphical skills for communication of concepts, ideas and design of engineering products through technical drawings
- Demonstrate and practice the various profiles/curves used in engineering practice through standard procedures.
- Demonstrate and practice the orthographic projections of points, lines, planes, solids and section of solids
- Demonstrate and practice the development of surfaces of simple solids
- Familiarize the basic concept of isometric views clearly.

Course Outcomes:

At the end of the course, the student will be able to

- Develop simple engineering drawings by considering BIS standards.
- Able to draw different engineering curves with standard Procedures
- Comprehend the basics of orthographic projections and deduce orthographic projections of points, lines, planes and solids at different orientations in real life environment.
- Visualize clearly the sections of solids.
- Apply the concepts of development of surfaces while designing/analyzing any product.
- Recognize the significance of isometric drawing to relate 2D environment with 3D environment.

SYLLABUS

Introduction: Lines, Lettering and Dimensioning, Geometrical Constructions, and Scales.

Curves: Conic sections: General construction of ellipse, parabola and hyperbola. Construction of involutes of circle and polygons only. Normal and tangent to curves.

Projections of Points: Principal or Reference Planes, Projections of a point situated in any one of the four quadrants.

Projections of Straight Lines: Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane.

Projections of Straight Line Inclined to Both the Reference Planes: Projections of Planes: Projection of Perpendicular planes: Perpendicular to both reference planes, perpendicular to one reference plane and parallel to other reference plane and perpendicular to one reference plane and inclined to other reference plane. Projection of Oblique planes. Introduction to Auxiliary Planes.

Projections of Solids: Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to other and axes inclined to both the reference planes.

Sections of Solids: Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids (Prism, Pyramid, Cylinder and Cone) in simple position only.

Development of Surfaces: Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.

Isometric Views: Isometric projection, Isometric scale and Isometric view. Isometric view of Prisms, Pyramids, cylinder, cone, and their combinations.

TEXT BOOK:

1. Elementary Engineering Drawing by N.D.Bhatt, Charotar Publishing House.

REFERENCE BOOK:

1. Engineering Graphics by K.L. Narayana and P. Kannaiah, Tata McGraw Hill.

CH-1204 : MATERIALS SCIENCE & ENGINEERING

Course Objectives:

Materials science and engineering is an important subject to every engineer to understand about the materials' behavior in different environments. Main objectives of the study are as follows:

- To understand the structure of atoms
- To learn something about the crystalline nature of the materials
- To know about the influence of atoms controlling the properties of materials
- To know the equivalency of the materials for replacement
- To learn to prepare alloys, composites for conventional materials
- To find the relation between arrangement and thermodynamic properties of materials

Course Outcomes:

The student will be able to

- Analyze the behavior of crystalline materials w.r.t their atomic arrangement.
- Understand the imperfections in crystalline materials
- Assess the mechanical behavior of the materials
- Explain phase transformations of alloys
- Elaborate the corrosion properties of materials

SYLLABUS

An introduction to materials, classification of engineering materials, brief review of atomic structure, calculation of energy of electron of Bohr's atomic model, Bonds in materials – classification, properties of ionic, covalent and metallic solids, variation in bonding character and properties. Crystal Geometry and crystal structure – solids- crystalline solids and amorphous solids (non-crystalline), differences between crystalline and non-crystalline materials. Ideal crystal, space Lattice, unit cell, primitive cell, non-

primitive cell, lattice co-ordinates, Bravais lattices for crystal systems, crystal systems and their properties, symmetry and elements of symmetry, Atomic packing fraction and packing efficiency (SC, BCC, FCC, Diamond cubic and HCP structures), c/a ratio for HCP structure. Miller indices for directions and linear density calculation, planes in crystals and their representation, planar density calculation, coordination number. Determination of crystal Structure by X-ray diffraction method – Debye method, numerical problems for different cubic structures (SC, BCC and FCC).

Fundamentals of thermodynamics – stability and meta-stability of materials, internal energy (E), enthalpy (H), Gibbs free Energy (G), and thermal entropy and configurational entropy (S). solid solutions-types, crystal imperfections – classification, point defects- classification and estimation of point defects in the crystals; Imperfections (dislocations) – classification (edge and screw); Burger circuits and Burgers Vector, planar defects, volume defects, dislocation reactions, role of dislocations in determining crystal properties; surface defects - types

Mechanical Properties: Stress –types of stresses; Strain-types of strain; true stress and true strain, engineering stress and engineering strain of the materials, relation between engineering strain and true strain, relation between engineering stress and true stress; Hooke's Law; Poisson's Ratio, stress-strain diagram and its uses; different moduli of elasticity – Young's modulus, shear modulus, and bulk modulus; relation between different moduli of elasticity, strain vs stress relationship diagrams for different materials (metals, non-metals, rubbers and plastics and polymers); elastic deformation and plastic deformation and their differences. Critical Resolved shear stress (CRSS). Fracture – types, ductile fracture and its mechanism, brittle fracture and its mechanism (Griffith's criteria), fatigue factors affecting the fatigue, creep and creep failure mechanisms, creep resistance materials. Composite materials – classification, advantages of composite materials over conventional materials, Limitations of composite materials, factors affecting the performance of fibrous composites, factors affecting the performance of matrix in composites,

Phase- time scale for phase changes, Phase diagrams- phase rule, single component systems, Binary phase changes, the lever rule and numerical problems, advantages of phase diagrams, advantages of alloying of metals on the properties of steels, Iron-iron carbide ($\text{Fe-Fe}_3\text{C}$) phase diagram, limitations of plain carbon steels, types of steels used in chemical industries,

Corrosion and prevention: Principles and mechanism of corrosion, types of corrosion cells: composition cell, concentration cell, stress cells, Different forms of corrosion, prevention and control of corrosion: proper selection of materials, proper design and fabrication procedure, application of protective coatings.

TEXT BOOKS:

1. 'Materials Science & Engineering' by V.Raghavan, Prentice Hall of India Ltd, New Delhi
2. 'Elements of Materials Science & Engineering', 5th Edition, Lawrence H.VanVlack, Addison-Wiley Publishing Company

REFERENCE BOOKS:

1. 'Science of Engineering Materials', Vols.1-3, by Manas Chanda, McMillan Company of India, Delhi
2. Principles of Materials Science & Engineering', William F.Smith, McGraw-Hill Publishing Co.
3. 'Essentials of Materials Science' by A.G. Guy.
4. A textbook of Engineering physics, by Dr.M.N.Abadhanulu and Dr.P.G.Kshirsagar; S.Chand and company pvt Ltd. Chapters 26 and 27.
5. An introduction to corrosion science and engineering By Herbert Uhlig and R. Winston Revie, Published by John Wiley and sons, New York.
6. Corrosion Engineering by Mars.G.Fontana, McGraw-Hill, publication

CH-1205 : MECHANICAL ENGINEERING

Course Objectives:

- ♣ To be aware of the basics in Thermodynamics
- ♣ To get knowledge on applications of steam tables
- ♣ To understand the principles and applications of IC engines, compressors and turbines
- ♣ To comprehend the principles of belts, chain drives and gears

Course Outcomes:

- At the end of the course, the student will be able to
- To Know the thermodynamic laws and various processes
 - To make out the applications of steam in boilers and turbines
 - To derive the various performance parameters related to IC engines and of air compressors
 - To arrive basic needs of working of belts, chain drives and gears

SYLLABUS

Thermodynamics: Definitions, systems, classification of thermodynamic systems, cycles and zeroth law of thermodynamics, first law of thermodynamics, closed system, flow processes, open systems with steady flow process, applications of steady flow energy equation to engineering systems.

Second law of thermodynamics: Carnot cycle, inequality of Clausius-reversible Carnot cycle, entropy, relation between heat and entropy, general expression for entropy change, entropy change of a perfect gas during various thermodynamic processes, air standard cycles, Otto, diesel, dual combustion cycles,

Properties of steam and use of steam tables: Boilers, classification steam boilers, simple vertical, Cochran, locomotive boiler, Babcock and Wilcox boiler, steam generation, Rankine cycle.

Impulse and reaction turbine: Classification of steam turbines, velocity diagram and power produced in impulse turbine, performance of steam turbines, reduction of rotor speed,

IC engines: Classification-main composition of IC engines, carburettor, fuel pump injector, cooling systems for IC engines, working of 2-stroke and 4-stroke petrol and diesel engines, power and efficiency of IC engines.

Reciprocating air-compressors: Single stage, work done during cycle, effect of clearance, two stage compressors, condition for minimum work, effect of inter-cooling, efficiency.

Drives: Belts, expression for the ratios of tension on the slack and tight side, power transmitted – V-belts, chain drives, gears – spur, helical, bevel gear, trains simple and compound.

TEXT BOOKS:

1. A Text Book of Thermal Engineering by R.S.Khurmi and J.K.Gupta
2. 'Theory of Machines' by R.S.Khurmi

REFERENCE BOOKS:

1. 'Engineering Thermodynamics' by P.K.Nag
2. 'Engineering Thermodynamics' by J.B.Jones and R.E.Dugar
3. 'Engineering Thermodynamics' by R.K.Rajput
4. 'Theory of Machines' by Balani.

CH-1206 : WORKSHOP LAB

Course Objectives:

- Get hands on experience with the working skills in Carpentry trade.
- Know how to work with Sheet Metal tools.
- Get familiar with the working skills of Metal Fitting operations.
- Get hands on experience with house hold electrical wiring.

Course Outcomes:

At the end of the course, the student will be able to

- Can be able to work with Wood Materials in real time applications.
- Can be able to build various parts with Sheet Metal in day-to-day life.

- Can be able to apply Metal Fitting skills in various applications.
- Can be able to apply this knowledge to basic house electrical wiring and repairs.

SYLLABUS

Carpentry: Any three jobs from – Half lap joint, Mortise and Tenon joint, Half – lap Dovetail joint, Corner Dovetail joint, Central Bridle joint.

Sheet Metal: Any three jobs from – Square tray, Taper tray(sides), Funnel, Elbow pipe joint.

Fitting: Any three jobs from – Square, Hexagon, Rectangular fit, Circular fit and Triangular fit.

House wiring: Any three jobs from – Tube light wiring, Ceiling fan wiring, Stair-case wiring, Corridor wiring.

REFERENCE BOOKS:

1. Elements of workshop technology, Vol.1 by S. K. and H. K. Choudary.
2. Work shop Manual / P.Kannaiah/ K.L.Narayana/ SciTech Publishers.
3. Engineering Practices Lab Manual, Jeyapoovan, Saravana Pandian, 4/e Vikas.

CH-1207 : PHYSICS LAB

Course Objectives:

- To enable the students to acquire skill, technique and utilization of the Instruments
- Draw the relevance between the theoretical knowledge and to imply it in a practical manner with respect to analyze various electronic circuits and its components.
- To impart the practical knowledge in basic concepts of Wave optics, Lasers and Fiber optics.
- To familiarize the handling of basic physical apparatus like Vernier callipers, screw gauge, spectrometers, travelling microscope, laser device, optical fibre, etc.

Course Outcomes:

At the end of the course, the student will be able to

- Design and conduct experiments as well as to analyze and interpret
- Apply experimental skills to determine the physical quantities related to Heat, Electromagnetism and Optics
- Draw the relevance between theoretical knowledge and the means to imply it in a practical manner by performing various relative experiments.

SYLLABUS

1. Determination of Radius of Curvature of a given Convex Lens By forming Newton's Rings.
2. Determination of Wavelength of Spectral Lines in the Mercury Spectrum by Normal Incidence method.
3. Study the Intensity Variation of the Magnetic Field along axis of Current Carrying Circular Coil.
4. Determination of Cauchy's Constants of a Given Material of the Prism using Spectrometer.
5. Determination of Refractive Index of Ordinary ray m_o and Extraordinary ray m_e .
6. Determination of Thickness Given Paper Strip by Wedge Method.
7. Calibration of Low Range Voltmeter.
8. Calibration of Low Range Ammeter.
9. Determination of Magnetic Moment and Horizontal Component of Earth's Magnetic Field.
10. Lees Method - Coefficient of thermal Conductivity of a Bad Conductor.
11. Carey Foster's Bridge – Verification of laws of Resistance and Determination Of Specific Resistance.
12. Melde's Apparatus – Frequency of electrically maintained Tuning Fork.
13. Photoelectric cell-Characteristics.
14. Planks Constants.
15. Laser- Diffraction.

CH-1208 : GENERAL ENGINEERING LABORATORY

MECHANICAL ENGINEERING LABORATORY

Course Objectives:

- To be aware of the viscosity, flash point of oil samples and calorific value of a gas
- To get knowledge on calibration of pressure gauge, flywheel and torsional pendulum
- To understand the principles and applications of Air compressors and IC engines

Course Outcomes:

At the end of the course, the student will be able to

- To determine the viscosity, flash point and calorific value of fluids
- To make out the applications of pressure gauge, flywheel and torsional pendulum
- To derive performance parameters related to IC engines and efficiencies of air compressor

Experiments

1. Find the viscosity of the given sample of oil using Redwood viscometer-1
2. Find the viscosity of the given sample of oil using Redwood viscometer-II
3. Find the flash point of the given sample of oil using Abel's flash point tester
4. To calibrate pressure gauge using standard pressure and standard weights
5. Draw the valve timing diagram of a 4-stroke diesel engine and port timing diagram of a 2-stroke petrol engine
6. Perform load test at full load, half load, $\frac{1}{4}$ th load on a 4-stroke Ruston engine and draw the performance curves
7. Find the volumetric efficiency, isothermal efficiency of the given compressor
8. To determine the moment of inertia of a fly-wheel and shaft experimentally and compare the values with the calculated values
9. To determine experimentally the calorific value of a gaseous fuel by using Junkers gas calorimeter
10. To determine the modulus of rigidity of the material of the wire by torsional oscillators

ELECTRICAL ENGINEERING LABORATORY

Course Objectives

This course provides

- Insight of fundamental laws in electrical engineering.
- Deals with the constructional and operational details of DC and AC machines.
- Analyze electrical and magnetic circuits using basic laws of electrical engineering

Course Outcomes

After the completion of the course, the student should be able to

- Understand the basic laws of electrical and magnetic circuits.
- Analyze the characteristics of DC generator and motors.
- Design of equivalent circuit of transformer.
- Apply the basic knowledge to solve problems on synchronous machines.

Experiments

1. Study and calibration of ammeter
2. Study and calibration of voltmeter
3. Study and calibration of wattmeter
4. Study and calibration of energy meter
5. Measurement of low resistance (armature)
6. Measurement of medium resistance (field)
7. Measurement of insulation resistance
8. Measurement of filament resistance
9. Verification of KCL and KVC
10. Superposition theorem.
11. Parameters of a choke coil
12. OC and SC tests on transformer
13. Load test D.C. shunt machine
14. OC test on DC, separately excited machine
15. Swinburne's test
16. 3-phase induction motor (No load and rotor block tests)
17. Alternator regulation by Syn. impedance method

CH-2101 : MATHEMATICS-III

Course Objectives:

The objectives, in particular are to learn about:

- Differentiation of vector functions of real variables, curves in space, differential operators, the concept of gradient, divergence and curl and their potential applications.
- The concepts of Line-, Surface and Volume integrals and transformation theorems such as Green's theorem in the plane, Stoke's theorem, Gauss Divergence theorem and their applications.
- Formation of Partial Differential Equations and solution of first order first degree linear, non-linear Partial Differential Equations, Homogeneous

and Non homogeneous linear partial differential equations with constant coefficients.

- The method of separation of variables and how to use it to find the solution of one dimensional wave (string equation), one-and two-dimensional Heat flow equations, Laplace's equation in Cartesian and polar coordinates.
- The concept of integral transforms, namely, Fourier transforms, Fourier Sine, Cosine and related inverse transforms, and their applications in solving several Physical and Engineering problems.

Course Outcomes:

At the end of the course, the students would be able to:

- Understand differential operations and the concepts of Gradient, Divergence and Curl and their applications.
- Apply the concepts of Line integrals, Surface Integrals, Volume Integrals and their potential applications: work done by a force field, circulation and Flux etc. Also, find out the relation between Line, Surface and Volume integrals: Green's theorem in the plane, Stoke's and Divergence theorems.
- Understand the formation of partial differential equations and the solving Linear and Non linear first order partial differential equations. Also, how to find the solution of Linear Partial Differential Equations with constant coefficients by finding the complementary function and particular integrals.
- Apply the method of separation of variables to solve the important governing equations of one dimensional wave equation, One and Two dimensional heat flow equations, Laplace's equations in Cartesian and polar coordinates.
- Apply the knowledge of Fourier transform techniques in solving several Initial and Boundary value problems of Engineering, such as problems in Conduction of heat / Thermodynamics, Hydraulics transverse vibrations of a string, oscillations of an elastic beam, bending of beams, electrical circuits, free and forced vibrations of a membrane and transmission lines , etc.

SYLLABUS

(Vector Calculus-Differentiation)

Differentiation of vectors, curves in space, velocity and acceleration, relative velocity and relative acceleration, scalar and vector point functions, vector operator ∇ applied to scalar point functions- gradient, ∇ applied to vector point functions- divergence and curl. Physical interpretation of gradient, divergence and curl (i.e., $\nabla \cdot \mathbf{F}$), Irrotational and Solenoidal fields, the relations obtained after ∇ applied twice to point functions, ∇ applied to products of two functions.

(Vector Integration)

Integration of vectors, line integral, circulation, work done, surface integral-flux, Green's theorem in the plane, Stoke's theorem, volume integral, Gauss Divergence theorem. (All theorems without proofs).

Introduction of orthogonal curvilinear coordinates, cylindrical and spherical polar coordinates

(Partial Differential Equations)

Formation of partial differential equations, solutions of partial differential equations- equations solvable by direct integration, linear equations of first order: Lagrange's Linear equation, non-linear equations of first order, Charpit's method. Homogeneous linear equations with constant coefficients- rules for finding the complementary function, rules for finding the particular integral (working procedure), non-homogeneous linear equations.

(Applications of Partial Differential Equations)

Method of separation of variables, One dimensional wave equation- vibrations of a stretched string, one dimensional Heat flow equation, Two dimensional heat flow in steady state - solution of Laplace's equation in Cartesian and polar coordinates (two dimensional).

(Integral Transforms (Fourier Transform))

Introduction, definition, Fourier integral, Sine and Cosine integrals, Complex form of Fourier integral, Fourier transform, Fourier Sine and Cosine transforms, Finite Fourier Sine and Cosine transforms, properties of Fourier transforms.

Convolution theorem for Fourier transforms, Parseval's identity for Fourier transforms, Fourier transforms of the derivatives of a function, simple applications to Boundary value problems.

TEXT BOOK:

1. Scope and treatment as in "Higher Engineering Mathematics", by Dr. B.S.Grewal, **43rd Edition**, Khanna Publishers.

REFERENCE BOOKS:

1. Graduate Engineering Mathematics by V B Kumar Vatti, I.K.International publications
2. Advanced Engineering Mathematics by Erwin Kreyszig.
3. A text book of Engineering Mathematics by N.P. Bali and Dr. Manish Goyal, Lakshmi Publications.
4. Mathematical Methods of Science & Engineering aided with MATLAB by Kanti B.Dutta, Cengage Learning India Pvt. Ltd.
5. Higher Engineering Mathematics by B. V. Ramana, Tata McGraw Hill Company.

6. Advanced Engineering Mathematics by H.K.Dass. S.Chand Company.

CH-2102 : SOLID MECHANICS

Course Objectives:

- To impart knowledge about the behaviour of elastic bodies subjected to different types of external forces.
- To impart skills of analysing the statically determinate beams subjected to different types of loads for shear force, bending moment and their corresponding stress distribution.
- To develop skills to analyse shafts, springs and shells for determining the critical stress distribution

Course Outcomes:

- At the end of the course the students will be able to
- Analyse different bodies subjected to different types of loads like axial forces, transverse loads and torsional moment.
- Analyse the statically determinate beams subjected to loads.
- Analyse shafts, springs and shells.

SYLLABUS

Axial loads: Simple stress and strain, Hook's law, load extension diagram for mild steel, stress in compound assemblies, thermal stresses,

Transverse loads: Shear force and bending moment diagrams for a) cantilevers, b) simply supported beams and c) over-hanging beams due to concentrated loads and U D L s only,

Theory of simple bending: Relation between i) f and y , ii) M and I , iii) E and R , distribution of shear stress in common shapes of cross-section,

Principal stresses and principal planes, maximum shear stress and its plane, Mohar's circle of stress,

Torsion of solid and hollow circular shafts, transmission of horse power, design of flange coupling, closed coil helical spring i) under axial load and ii) under axial twist, riveted joints, design of lap joints,

Stress in thin cylindrical shells and spherical shells, stress in thick cylinders, compound cylinders, pressure due to shrink-fitting.

TEXT BOOK:

1. 'Strength of Materials' by Ramamrutham

REFERENCE BOOK:

1. 'Elements of Strength of Materials' by S.P.Timoshenko and D.H.Young, East West Press, New Delhi.

CH-2103 : MANAGERIAL ECONOMICS

Course Objectives:

1. To bring about an awareness about the nature of Managerial Economics and its linkages with other disciplines.
2. To understand the Micro and Macro Environment of Business.
3. To familiarise the prospective engineers with the concepts and tools of Managerial Economics with an objective to understand the real world of business.

Course Outcomes:

Managerial Economics will help the prospective engineers, who are likely to occupy managerial positions in future to understand the various economic activities in business and industry for an effective and efficient running of the organisations.

SYLLABUS

Significance of Economics and Managerial Economics:

Economics: Definitions of Economics- Wealth, Welfare and Scarcity definition Classification of Economics- Micro and Macro Economics.

Managerial Economics: Definition, Nature and Scope of Managerial Economics, Differences between Economics and Managerial Economics, Main areas of Managerial Economics, Managerial Economics with other disciplines.

Demand Analysis :Demand - Definition, Meaning, Nature and types of demand, Demand function, Law of demand - Assumptions and limitations. Exceptional demand curve.

Elasticity of demand - Definition, Measurement of elasticity, Types of Elasticity (Price, Income, Cross and Advertisement), Practical importance of Price elasticity of demand, Role of income elasticity in business decisions, Factors governing Price Elasticity of demand.

Demand Forecasting - Need for Demand forecasting, Factors governing demand forecasting, Methods of demand forecasting: Survey methods- Experts' opinion survey method and consumers Survey methods.

Utility Analysis: Utility- Meaning, Types of Economic Utilities, Cardinal and Ordinal Utility, Total Utility, Marginal Utility, The law of Diminishing Marginal Utility and its Limitations

Theory of Production and Cost analysis: Production - Meaning, Production function and its assumptions, use of production function in decision making; Law of Variable Proportions: three stages of the law.

Cost analysis - Nature of cost, Classification of costs - Fixed vs. Variable costs, Marginal cost, Controllable vs. Non - Controllable costs, Opportunity cost, Incremental vs. Sunk costs, Explicit vs. Implicit costs,

Replacement costs, Historical costs, Urgent vs. Postponable costs, Escapable vs. unavoidable costs, Economies and Diseconomies of scale.

Market Structures : Definition of Market, Classification of markets; Salient features or conditions of different markets - Perfect Competition, Monopoly, Duopoly , Oligopoly, Importance of kinked demand curve ;Monopolistic Competition.

Pricing Analysis : Pricing - Significance: Different Pricing methods- Cost plus pricing, Target pricing, Marginal cost pricing, Going -rate pricing, Average cost pricing, Peak load pricing , Pricing of joint Products, Pricing over the life cycle of a Product, Skimming pricing Penetration pricing, Mark-up and Mark- down pricing of retailers.

Business cycles, Inflation and Deflation: Business cycles - Definition , Characteristics , Phases, Causes and Consequences; Measures to solve problems arising from Business cycles Inflation -Meaning, Types, Demand-pull and Cost push inflation, Effects of Inflation, Anti- inflationary measures. Deflation- Meaning, Effects of Deflation, Control of Deflation, Choice between Inflation and Deflation.

TEXT BOOKS:

1. Sankaran,S., Managerial Economics, Marghan Publications, 2015, Chennai.
2. Aryasri, A.R., Managerial Economics and Financial Analysis, MC Graw Hill Education, New Delhi,2015.

CH-2104 : ORGANIC CHEMISTRY

Course Objectives:

The student will be able to:

- appreciate the nature and scope of organic chemistry.
- apply key concepts from general chemistry including electronegativity, bonding (ionic and covalent), hybridization of atomic orbitals, and molecular orbital theory to organic systems.
- draw skeletal structures for organic compounds.
- apply acid-base concepts to organic systems; predict ordering of acid or base strength.
- Name alkanes, alkenes, polyenes, alkynes, alkyl halides, aromatic compounds, carbonyl compounds, amines and their various derivatives using systematic (IUPAC) nomenclature.
- draw reaction mechanisms for some key reactions.
- recognize stereochemistry and be able to apply the Cahn-Ingold-Prelog system to designation of stereochemistry (E/Z or R/S).

- learn many of the reactions of alkanes, alkenes, polyenes, alkynes, aromatic, carbonyl, and amine compounds, and close related species. Be able to predict reactions involving these functional groups.

- be able to solve problems employing spectroscopic methods including mass spectrometry, infrared and NMR spectroscopy

- understand the basic chemical and structural features of biomolecules, including lipids, carbohydrates, amino acids and proteins, and nucleic acids

Course Outcomes:

At the end of the course, the student will be able to

- Determine the molecular formula for organic compounds
- Differentiate the structure and properties of biomolecules, polymers and heterocyclic compounds
- Identify the role of chemical engineer in modern drug discovery programs
- Separate the racemic mixtures using resolution methods
- Elucidate the structure of organic compounds (small molecules) using spectroscopic methods.

SYLLABUS

Numerical problems: Determination of percentage composition of carbon, hydrogen and nitrogen, molecular weight determination by depression in freezing point and elevation of boiling point methods, molecular weight of acids by silver salt method; molecular weight of bases by chloroplatinate method, determination of molecular formula of a compound, problems relating to reactions of carboxylic acids, functional derivatives of acids, carbonyl compounds, alcohols, amines, phenols, diazonium salts applications, alkenes and their laboratory tests,

Nomenclature of alkanes, alkenes, alkynes, dienes, cyclic aliphatic hydrocarbons, structure of benzene, nomenclature of benzene derivatives, arenas, industrial preparation of ethylene, acetylene; sp , sp^2 and sp^3 hybridization; preparation and chemical reactions; conformational analysis of ethane, propane and butane, Wurtz reaction, Diels-Alder reaction, aromaticity/Morkovinkov rule, Clemmensen and Wulf-Kishner reduction,

Electro-philic and nucleophilic aromatic substitution: Orientation in disubstituted benzenes, mechanism of nitration, halogenation, sulphonation, Friedel-Craft's alkylation and acylation reactions, nomenclature of alkyl halides, preparation and chemical reactions, mechanisms of SN_1 , SN_2 , E_1 , E_2 reactions, nomenclature of aryl halides, preparation and chemical reactions: low reactivity of vinyl and aryl halides, Sandmeyer reaction.

Nomenclature of alcohols; industrial preparation of ethyl alcohol, preparation and chemical reactions, Lucas test, nomenclature of mono, dicarboxylic acids, industrial preparation of formic, acetic, benzoic, phthalic, salicylic acids, preparation and chemical reactions, mechanism of HVZ reaction and Claisen condensation, nomenclature of functional derivatives of acids, preparation and chemical reactions, mechanism of Hoffmann bromamide reaction, acid and base catalyzed hydrolysis of ester, nomenclature of ethers and epoxides, industrial preparation of ether and ethylene oxide, preparation and chemical reactions; Williamson's synthesis.

Nomenclature of aldehydes and ketenes: Industrial preparation of formaldehyde, acetaldehyde, benzaldehyde, salicylaldehyde, acetone; preparation and chemical reactions; mechanisms of Cannizzaro, Aldol, Reformatsky and Wittig reactions, reactions without mechanisms -Perkin, Cope, Knoevenagel and Pinacol-Pinacolone reactions, difference between aldehyde and ketone, nomenclature of phenols, industrial preparation of phenol, preparation and chemical reactions, mechanisms of Fries rearrangement, Kobe reaction, Reimer-Tiemann reaction, classification of carbohydrates, structure of glucose and fructose, reactions of glucose and fructose, Ruff degradation, Wohls degradation, filiani-Fisher synthesis, glucose into fructose, fructose into glucose, glucose to vitamin-C, mechanism of Osazone formation.

Nomenclature of amines, industrial preparation of aniline, preparation and chemical reactions - exhaustive methylation, mechanism of Hoffmann elimination, benzedene rearrangement without mechanism, Hinsberg test, differentiation test using nitrous acid, preparation of diazonium salts and synthetic application, preparation of sulphanilamide, sulphaguanidine, sulphamerazine, sulphapyridine (sulpha drugs), mode of action of sulpha drugs.

Preparation of soaps and detergents: Mode of action of soaps, differences between soaps and detergents; preparation of malonic, acetoacetic ester and their synthetic applications, preparation of Grignard reagents and their synthetic applications, preparation of polyethylene, polystyrene, teflon, PVC, polyvinyl cyanide, rubber-vulcanisation, styrene-butadiene rubber, polychloroprene, bakelite, nylon-6 and nylon 6-6, plexiglas, terylene, Ziegler-Natta polymerization, definition of thermoplastics and thermosetting plastics,

Isomerism: Structural and optical isomerism, geometrical isomerism, E Z configuration, sequence rules, R & S configuration, racemic mixture and their separation, asymmetric synthesis - Fischer projection formula, definitions of axial and equatorial bonds, 1-3- diaxial interaction, enantiomers, diastereomers, mesomers, isomerism in cyclic compounds, chair, boat and twisted boat structures (1-methylcyclohexane, 1, 2-cyclohexane diol), sSynthetic applications of - Zn/Hg, $Na-NH_3$, $LiAlH_4$, $NaBH_4$, diborane and zinc

dust, soda lime, OsO_4 , hydroxylamine, acetic anhydride, benzoylchloride and PCl_5 .

REFERENCE BOOKS:

1. 'Text Book of Organic Chemistry' by Morrison & Boyd
2. 'Text Book of Organic Chemistry' by Bahl&Tuli
3. 'Text Book of Organic Chemistry' by M.K.Jain
4. 'Text Book of Organic Chemistry' by I.L.Finar (Vols.1&2 as reference books)

CH-2105 : PARTICLE & FLUID PARTICLE PROCESSING

Course Objectives:

Mechanical Operations is one of the core subjects for chemical engineers, where student can learn some of the unit operations necessary for process industry. Main objectives of the inclusion of this subject are:

- To make the students exposed to different geometrical sizes of raw materials used in the industries, area of calculation of the particles w.r.t their sizes
- To get familiarity with the different laws of grinding
- To do the power consumption calculations
- To learn different separation process on their physical properties
- To differentiate between the process such as mixing and agitation
- To know the movement of particles in different liquids (viscous)

Course Outcomes:

At the end of the course, student will be able to

- Select suitable size reduction equipment based on performance and power requirement.
- Analyze particle size distribution of solids
- Evaluate solid-fluid separation equipment
- Determine the power required for agitation, blending and mixing
- Select conveyers for the transportation of materials in the industry

SYLLABUS

Characteristics of solid particles – shape, size, differential and cumulative screen analysis, specific surface area, particle population, different mean diameters for a mixture of particles, Principles of comminution - Laws of crushing, description and working of size reduction equipment - jaw, gyratory and roll crushers, hammer mills, revolving mills, attrition mills, fluid energy mill, cutting machines, open and closed circuit grinding, wet and dry grinding, grindability index,

Size separation, screening, industrial screens - grizzly, gyratory and vibratory screens, revolving screens, trammels, capacity and effectiveness of screens, magnetic separation, electrostatic separation, froth flotation,

Filtration - description and working of filtration equipment, plate and frame filter press, shell and leaf filters, rotary drum filter, filter aid, centrifugal filtration, top suspended batch centrifuge, theory of filtration, washing of cakes, Motion of particles through fluids- drag, free and hindered settling, settling velocities, classification, sink and float methods, differential setting methods - jigging and tabling, cyclone separators,

Batch sedimentation, thickeners, flocculation, centrifugal sedimentation, gravity and centrifugal decanters, Agitation of liquids, power consumption in agitated vessels, scale up of agitation equipment, mixing equipment for mixing of solids and pastes, mixers for dry powders, mixing index, Conveying, types of conveyors – mechanical, belt, chain and screw conveyors, elevators, pneumatic conveyors, size enlargement - need and applications.

TEXT BOOK:

1. 'Unit Operations of Chemical Engineering' by W.L. McCabe, J.C. Smith and P.Harriot, McGraw- Hill Book Company

REFERENCE BOOKS:

1. 'Chemical Engineering -Vol.2' by J.H.Coulson and J.F.Richardson, Pergaman press and ELBS
2. 'Chemical Engineer's Hand Book' by R.H.Perry {ed}, McGraw-Hill Book Co.
3. 'Unit Operations' by Brown et al., Asian Publishing House
4. 'Introduction to Chemical Engineering' by Badger and Banchero, McGraw-Hill Book Company.

CH-2106 : ORGANIC CHEMISTRY LABORATORY

Course Objectives:

The student will learn to analyze the organic compounds. The students will be exposed to the preparation of various organic chemicals in this laboratory.

Course Outcomes:

At the end of the course, the student will be able to

- Analyze and identify the given organic compound.
- Prepare organic compounds like aspirin, benzanilide, m-dinitrobenzene, benzoic acid, phthalimide, methyl orange, parabenzoquinone and nerolin
- Identify extra elements

List of Experiments:

1. Preparation of aspirin
2. Preparation of benzanilide
3. Preparation of m-dinitrobenzene
4. Preparation of benzoic acid
5. Preparation of phthalimide
6. Preparation of methyl orange
7. Preparation of parabenzoquinone
8. Preparation of nerolin
9. Detection of extra elements
10. Analysis of compound -1
11. Analysis of compound -2
12. Analysis of compound -3
13. Analysis of compound -4
14. Analysis of compound -5
15. Analysis of compound -6

**CH-2107 : PARTICLE & FLUID PARTICLE PROCESSING
LABORATORY**

Course Objectives:

Solid processing is an essential component in process industries. In the present day, when the world is facing the challenge of dealing with depleting mineral resources, this subject assumes high importance to the students of chemical engineering. The student is introduced to the concepts of sampling, processing of solid raw materials. The student also gets hands on training on operating various machines used for processing of solids.

Course Outcomes:

At the end of the course, the student will be able to

- Select suitable methods for size reduction of minerals or other intermediates
- Analyze particle size distribution of solids
- Evaluate suitable mechanical separations of powders, solid-liquid and solid-gas mixtures.

List of Experiments:

1. To take a representative sample from a bulk by two methods, viz. Riffle and cone & quartering and to find out the average size (volume-surface mean diameter) of the samples
2. To determine the grindability index {GI} of coal by hard groove machine

3. To determine the time of grinding in a ball mill for producing a product with 80% passing a given screen

4. To verify the laws of crushing using any size reduction equipment like crushing rolls, ball mill or vibrating mill and to find out the work Index {WI} of the material

5. To compare open circuit and closed circuit grinding by means of a ball mill

6. To determine the optimum time of sieving for a given sample of material

7. To find the effectiveness of hand screening of a given sample by a given screen

8. To find the screen effectiveness of a trommel

9. To separate a mixture of coal into two fractions using sink and float method

10. To separate a mixture of coal into two fractions using froth flotation technique

11. To find the size analysis of a given fine sample using beaker decantation method

12. To separate a mixture of particles by jigging

13. To concentrate a given material by means of tabling

14. To obtain batch sedimentation data and to calculate the minimum thickener area under given conditions

15. To determine the specific cake resistance and filter medium resistance of a slurry in plate and frame filter press.

CH-2108 : MATLAB

Course Objectives:

The student will learn to apply the knowledge of *MATLAB* for solving Chemical Engineering problems.

Course Outcomes:

At the end of the course, the student will be able to

- Apply Matlab to create and print arrays and execute function files
- Solve linear equations using Matlab
- Determine the curve fit equation for the given data
- Draw 2D plots and 3D plots for the given data.

SYLLABUS

Introduction, Tutorial lessons: MATLAB session, working with arrays of numbers, creating and printing simple data, saving and executing a script file, creating and executing function files, working with files and directories.

Interactive computation - Matrices and vectors, matrix and array operations, creating and using inline functions, using built in functions and online help, saving and loading data, plotting simple graphs.

Script files, function files, language specific features, advanced data objects.

Applications - linear algebra, curve fitting and interpolation, data analysis and statistics, numerical integration, ordinary differential equations, nonlinear algebraic equations.

Basic 2D plots, using subplot to layout multiple graphs. 3-D plots, symbolic Math tool box: two useful tools in symbolic Math tool box, using symbolic Math tool box.

TEXT BOOK:

1. 'Getting started with MATLAB: A quick introduction for scientists and engineers' by Rudra Pratap, Oxford University press.

CH -2109 : ENVIRONMENTAL SCIENCE

Course Objectives:

The aim of this course is to make the students better understand the changes in the environment and be given a greater voice and planning conservation through an interdisciplinary environmental science curriculum that is design to enhance scientific enquiry and to strengthen competence.

Course Outcomes:

At the end of the course, the student will be able to

- Understand various types of pollution regulations and their scientific bases.
- Apply knowledge for the protection and improvement of the environment.
- Recognize the major concepts in environmental science and demonstrating in-depth of the environment

SYLLABUS

Introduction: Definition, scope and importance, measuring and defining environmental development – indicators,

Ecosystems: Introduction, types, characteristic features, structure and functions of ecosystems – forest, grassland, desert, aquatic (lakes, rivers and estuaries).

Environmental and natural resources management: Land resources-land as a resource, common property resources, land degradation, soil erosion and desertification, effects of modern agriculture, fertilizer-pesticide problems,

Forest resources- use and over-exploitation, mining and dams –their effects on forest and tribal people,

Water resources – use and over utilization of surface and ground water, floods, droughts, water logging and salinity, dams-benefits and costs, conflicts over water,

Energy resources- Energy needs, renewable and non-renewable energy sources, use of alternate energy sources, impact of energy use on environment,

Bio-diversity and its conservation: Value of bio-diversity- consumptive and productive use, social, ethical, aesthetic and option values, bio-geographical classification of India - India as a mega diversity nation, threats to biodiversity, hot spots, habitat loss, poaching of wild life, loss of species, seeds etc., conservation of biodiversity - in-situ and ex-situ conservation,

Environmental pollution- local and global issues: Causes, effects and control measures of air pollution, indoor air pollution, water pollution, soil pollution, marine pollution, noise pollution, solid waste management, composting, vermiculture, urban and industrial wastes, recycling and re-use, nature of thermal pollution and nuclear hazards, global warming, acid rain , ozone depletion,

Environmental problems in India: Drinking water, sanitation and public health, effects of activities on the quality of environment, urbanization, transportation, industrialization, green revolution, water scarcity and ground water depletion, controversies on major dams – resettlement and rehabilitation of people: problems and concerns, rain water harvesting, cloud seeding and watershed management,

Economy and environment: The economy and environment interaction, economics of development, preservation and conservation, sustainability: theory and practice, limits to growth, equitable use of resources for sustainable lifestyles, environmental impact assessment, Social issues and the environment: Population growth and environment, environmental education, environment movements, environment versus development,

Institutions and governance: Regulation by Government, monitoring and enforcement of environmental regulation, environmental Acts, water (prevention and control of pollution) act, air (prevention and control of pollution) act, environment .protection act, wild life protection act, forest conservation act, coastal zone regulations, institutions and policies relating to India, environmental governance,

International conventions: Stockholm conference-1972, Earth summit-1992, World commission for environmental development (WCED),

Case studies: Chipko movement, Narmada bachao andolan, Silent valley project, Madhura refinery and Taj mahal, Industrialization of

Pattancheru, Nuclear reactor at Nagarjuna sagar, Tehri dam, Ralegaon siddhi (Anna Hazare), Kolleru lake-aquaculture, Fluorosis in Andhra Pradesh,

Field work: Visit to a local area to document and mapping environmental assets –river/forest/grass land / hill/ mountain, study of local environment-common plants, insects, birds, study of simple ecosystems – pond, river hill, slopes etc, visits to industries- water treatment plants, effluent treatment plants.

TEXT BOOK:

1. Environmental Studies by Anubha Kaushik & C.P. Kaushik, Second Edition, New Age International (P) Limited.

CH-2201: MATHEMATICS-IV

Course Objectives:

The student should be able to learn the concepts:

- Function of complex variables, differentiation and integration of complex functions. Evaluation of complex integration using Cauchy's theorem and Cauchy's integral formula.
- Conformal mappings, Expansion of complex functions as Taylor's and Laurent's series. Evaluation of some real definite integrals using Cauchy's Residue Theorem.
- -transforms, inverse -transforms and applications of these transforms to solve the difference equations.
- Correlation, Regression and some discrete and continuous distributions.
- Sampling, Testing of hypothesis for large samples and small samples.

Course Outcomes:

At the end of the course, the student will be able to:

- Understand the concepts of function of complex variables, differentiation and integration of complex functions. Evaluation of complex integration using Cauchy's theorem and Cauchy's integral formula.
- know about conformal mappings, Expansion of complex functions in terms of Taylor's and Laurent's series. Evaluation of some real definite integrals using Cauchy's Residue Theorem.
- Understand the concept of difference equations and their formation, solution. Evaluate of -transforms, inverse -transforms and applications of these transforms to solve difference equations.
- Apply the concepts of Correlation, Regression and some discrete and continuous distributions.

- Understand the Sampling theory: Sampling, Testing of hypothesis for large and small samples.

SYLLABUS

(Functions of Complex Variables)

Introduction-Limit and continuity of $f(z)$ - Derivative of $f(z)$, Cauchy-Reimann Equations, Analytic Functions, Harmonic functions, Orthogonal systems, Applications to flow problems, Geometrical representation of $f(z)$. Integration of complex functions, Cauchy's theorem, Cauchy's integral formula and their applications.

(Conformal Mappings and Contour Integration)

Introduction to Conformal transformation, Bilinear transformation, Series of complex terms -Taylor's and Laurent's series (without proofs), Zero's and Singularities of analytic functions.

Residues and Calculations of residues, Cauchy's Residue Theorem, Evaluation of real definite integrals: Integration around unit circle, semi circle.

(Difference Equations & Z-transforms)

Introduction - Formation of difference equations - Linear difference equations - Rules for finding complementary function - Rules for finding particular integral - simultaneous difference equations with constant coefficients - Applications to deflection of a loaded string.

Introduction to Z-Transforms - Some standard Z-transforms - Linear Property - Damping Rule - Shifting U_n to the right and to the left-multiplication by z -Two basic theorems - Some useful Z-transforms - Inverse Z-transformation - Convolution theorem - Convergence of Z-transform - Two sided Z-transform - Evaluation of inverse Z-transform - Application to Difference equations.

(Correlation, Regression and Distributions)

Introduction - correlation - coefficient of correlation -Lines of regression.

Introduction to Discrete and Continuous Random Variables - Distributions: binomial distribution, Poisson distribution, exponential distribution, normal distribution.

(Sampling Theory)

Introduction - Testing of hypothesis - Level of significance - Confidence limits - Test of significance of large samples - comparison of large samples- Test of significance for means of two large samples. Student t-distribution - Significance test of sample mean - Significance test of difference between sample means - Chi square test - Goodness of fit - F-distribution.

TEXT BOOK:

1. Scope and treatment as in "Higher Engineering Mathematics", by Dr.B.S.Grewal, 43rd Edition, Khanna Publications.

REFERENCE BOOKS:

1. Graduate Engineering Mathematics by V B Kumar Vatti, I.K.International publications
2. Advanced Engineering Mathematics by Erwin Kreyszig.
3. A text book of Engineering Mathematics by N.P. Bali and Dr.Manish Goyal; Lakshmi publications.
4. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.
5. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.
6. Engineering Mathematics series by Chandrica Prasad.

CH-2202 : MATERIAL & ENERGY BALANCES

Course Objectives:

To give intensive quantitative training in the practical applications of the principles of physical chemistry to the solution of complicated industrial problems and in methods of predicting missing physicochemical data from generalized principles.

Course Outcomes:

At the end of the course, the student will be able to

- Convert physico-chemical quantities from one system of units to another
- Identify basis and degrees of freedom
- Perform material and energy balances on single units without and with chemical reactions
- Solve the material and energy balance problems on multi-unit processes with recycle, purge and bypass
- Analyze the ideal and real behavior of gases, vapors and liquids

SYLLABUS

Stoichiometry and composition relationships- the gram-mole and pound-mole, limiting reactant, excess reactant, degree of completion, basis of calculation, weight percent, volume percent and mole percent, density and specific gravity- Baume and API gravity scales,

Behavior of ideal gases- application of the ideal-gas law, Dalton and Amagat laws to gaseous mixtures, composition of gases on dry basis and on wet basis,

Vapor pressures- Effect of temperature on vapor pressure, Antoine equation, reference substance vapor pressure plots, vapor pressure of immiscible liquids, ideal solutions and Raoult's law, non-volatile solutes,

Humidity - Percentage saturation, relative saturation or relative humidity, dew point, vaporization, condensation, wet and dry bulb temperatures, adiabatic vaporization and adiabatic saturation temperature, Material balances- Tie substance, yield, conversion, processes involving chemical reactions, material balance- calculations involving drying, dissolution, and crystallization, processes involving recycle, bypass and purge, Heat capacities of gases and gaseous mixtures- effect of temperature on heat capacity of gas, mean heat capacity of gas, Kopp's rule, latent heats, heat of fusion, heat of vaporization, Trouton's rule, Kistyakowsky equation for non-polar liquids, estimation of latent heat of vaporization using Classius-Clayperon equation, enthalpy of humid air and humid heat capacity, Standard heat of reaction - Standard heat of formation, laws of thermochemistry, standard heat of combustion, calculation of heat of formation from heats of combustion, calculation standard heat of reaction from heats of formation and from heats of combustion, standard integral heat of solution, effect of temperature on heat of reaction, Kirchoff's equation, adiabatic and non-adiabatic reactions, theoretical and actual flame temperatures.

TEXT BOOK:

1. 'Chemical Process Principles, Part-I - Material and Energy balances' by Olaf A Hougen, K.M. Watson and R.A.Ragatz, CBS Publishers and Distributors (1995)

REFERENCE BOOKS:

1. 'Basic principles and Calculations in Chemical Engineering' by David M. Himmelblau, Prentice Hall of India Pvt Ltd, 1995
2. 'Stoichiometry' by B.I. Bhatt and S.M. Vora, 3rd Edition, Tata McGraw Hill Publishing Company Limited, New Delhi (1996)
3. 'Stoichiometry for Chemical Engineers' by Williams and Johnson, McGraw Hill Publishers.

CH-2203 : HEAT TRANSFER

Courses Objectives:

- To study the fundamental concepts of heat transfer viz., conduction, convection, radiation
- To use these fundamentals in typical engineering applications (Heat exchanger and Evaporator, boiling and condensation.) and current research.

Course Outcomes:

At the end of the course, the student will be able to

- Analyze problems involving steady state heat conduction in simple geometries
- Develop equations for different types of convection and solve for heat transfer rate by convection in flow through pipes and flow over a flat plate
- Design of shell and tube heat exchangers using LMTD and effectiveness method
- Estimate the rate of radiation heat transfer with and without participating medium and ability to identify the roll of radiation shields
- Estimate steam economy, capacity of single and multiple effect evaporators
- Understand the concepts of boiling and condensation

SYLLABUS

Nature of heat flow: Conduction, convection, natural and forced convection, radiation.

Heat transfer by conduction : Basic laws of conduction, thermal conductivity; Steady-state conduction – compound resistances in series, heat flow through a cylinder; Unsteady-state conduction – one dimensional heat flow with constant surface temperature, heat flow with variable surface temperature, semi-infinite solid;

Heat transfer by convection: Principles of heat flow in fluids – Typical heat exchange equipment, countercurrent and parallel flows, energy balances, heat flux and heat transfer coefficients, overall heat transfer coefficients, integration over total surface, LMTD, individual heat transfer coefficients.

Heat transfer to fluids without phase change : boundary layers, laminar flow heat transfer, correction for heating and cooling, heat transfer in turbulent flow, estimation of wall temperature, cross-sections other than circular, analogy between transfer of momentum and heat, heat transfer to liquid metals, heating and cooling of fluids outside tubes, natural convection.

Heat transfer to fluids with phase change: heat transfer from condensing vapors, heat transfer to boiling liquids.

Radiation heat transfer: Fundamental facts concerning radiation, emission of radiation, absorption of radiation by opaque solids, radiation between surfaces, radiation to semitransparent materials, combined heat transfer by conduction-convection-radiation.

Heat-exchange equipment: General design of heat exchange equipment, shell and tube heat exchangers, plate-type exchangers, extended surface equipment, heat pipes, scraped-surface exchangers, condensers and vaporizers, heat transfer in agitated vessels, heat transfer in packed beds.

Evaporation: Evaporation, types of evaporators, performance of tubular evaporators, multiple-effect evaporators, methods of feeding, vapor compression.

TEXT BOOK:

1. Unit Operations of Chemical Engineering, 7th Ed. by W. L. McCabe, J. C. Smith and P. Harriot, McGraw Hill International Edition, Singapore (2005).

REFERENCE BOOK:

1. Process Heat Transfer, by D. Q. Kern, Tata McGraw Hill, New Delhi.

CH-2204 : FLUID MECHANICS

Course Objectives:

To provide

- Knowledge on pressure distribution in static fluids.
- Knowledge on rheological behavior of fluids, types of fluid flow, boundary layers and basic equations of fluid flow.
- Knowledge of incompressible & compressible fluid flow in pipes
- Knowledge on fluid flowing past solid surfaces
- Knowledge on pipes, fittings, transportation and metering devices.

Course Outcomes:

At the end of the course, the student will be able to

- Derive dimensionless groups by using dimensional analysis.
- Solve problems related to manometers and decanters using the principles of fluid statics.
- Determine the pipe size / flow rate / power requirements under laminar and turbulent flow conditions.
- Solve problems involving motion of particles in fluid, fluid–solid operations in packed beds and fluidized beds.
- Select machinery and measuring devices for fluid flow.

SYLLABUS

Dimensional Analysis: Units and Dimensions, Dimensional Homogeneity, Dimensional Analysis, Buckingham π theorem, Geometric similarity, kinematic similarity, and dynamic similarity.

Fluid statics and applications: Nature of fluids, Hydrostatic Equilibrium, Applications of fluid statics – Manometers, continuous gravity decanter and centrifugal decanter.

Fluid Flow phenomena: Laminar flow, shear rate, shear stress. Rheological properties of fluids – Newtonian fluids, Non Newtonian fluids,

time dependent flow, viscoelastic fluids. Viscosity, Reynolds number, Turbulence - nature of turbulence, deviating velocities, intensity and scale of turbulence, Reynolds stresses and eddy viscosity. Boundary layers - boundary layer formation over flat plate, flow in boundary layers, laminar and turbulent flow in boundary layers, boundary layer formation in straight tubes, boundary layer separation and wake formation.

Basic Equations of Fluid Flow: Continuity equation (Mass Balance in a flowing fluid), equation of motion (Differential Momentum Balance), Navier - Stokes equations, Euler's equation, Couette flow, Macroscopic Momentum Balance, layer flow with free surface, Bernoulli equation (Energy equation), corrections for effect of solid boundaries and pump work.

Incompressible flow in pipes and channels : Shear Stress and skin friction in pipes, Relation with skin friction and wall shear, Friction factor, relations between skin friction parameters, equivalent diameter, laminar flow in pipes and channels, velocity distribution, average velocity, Kinetic energy correction factor and momentum correction factor for laminar flow, Hagen-Poiseuille equation, laminar flow of non-Newtonian liquids, laminar flow in annulus. Turbulent flow in pipes and channels, Velocity distribution for turbulent flow, universal velocity distribution equations, its limitations, flow quantities for turbulent flow in smooth round pipes, Reynolds number-friction factor law for smooth tubes, effect of roughness, friction factor chart, drag reduction, friction from changes in velocity or direction – sudden expansion, sudden contraction, pipe fittings, friction losses in Bernoulli equation, velocity heads, separation of boundary layer in diverging channel, minimizing losses.

Flow in compressible fluids: Definitions and basic equations, processes of compressible flow, isentropic flow through nozzles, Adiabatic friction flow, Isothermal friction flow

Flow past immersed objects: Drag and drag coefficients, flow through bed of solids, Motion of particles through fluids - mechanics of particle motion, equation for one-dimensional motion of particles through fluid, terminal velocity, criterion for settling, free and hindered settling. Fluidization – conditions, minimum fluidization velocity, types of fluidizations and its applications.

Transportation and Metering of Fluids: Pipes, fittings, valves. Positive displacement Pumps – reciprocating, rotary and peristaltic pumps. Centrifugal pumps - theory, construction, performance, single and multistage pumps. Fans, Blowers and Compressors. Vacuum pumps – jet ejectors.

Metering of fluids: Full bore meters – Venturi meter, Orifice meter, Rotameters, Vortex-Shedding meters, Magnetic meters and Coriolis meters. Insertion meters – Pitot Tube, Thermal meters, notches and weirs.

TEXT BOOK:

1. "Unit Operations of Chemical Engineering" Seventh Edition, by W.L. McCabe, J C Smith and P Harriot, Mc Graw Hill

REFERENCE BOOKS:

1. "Chemical Engineering" Volume I by Coulson J.M. and Richardson J.F, Elsevier

"Fluid Mechanics" 2nd edition by Noel de Nevers, Mc Graw Hill

CH-2205: INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP

Course Objectives:

1. To familiarise the students with the concepts of Management.
2. To relate the concepts of Management with Industrial Organisations.
3. To explain the factors affecting productivity and how productivity can be increased with effective utilization of inputs in an industrial undertaking.
4. To set forth a basic framework for understanding Entrepreneurship.

Course Outcomes:

An engineer with his/her fundamental knowledge of Industrial Management, will be in position to take appropriate decisions in the corporate environment. The concepts of Entrepreneurship acts as a motivating factor to launch new enterprises and translate one's dream into reality.

SYLLABUS

Basic Concepts of Management:

Management :- Definition, Nature and Importance ; Functions of the Management; Levels of Management; F.W Taylor's Scientific Management; Henry Fayol's Principles of Management; Forms of Business Organizations: Introduction, Types of Business organizations:

Private Sector- Individual Ownership , Partnership, Joint stock companies and Co-Operative organizations; Public sector- Departmental Organizations, Public Corporations and Government Companies; The Joint sector Management.

Production and operations Management: Plant location- Factors to be considered in the selection of Plant location; Break - even analysis- Significance and managerial applications; Importance of Production Planning and Control and its Functions; Human Resource Management and Functions of Human Resource Manager (in brief); Functions of Marketing; Methods of Raising Finance.

Entrepreneurship : Definition, Characteristics and Skills , Types of Entrepreneurs, Entrepreneur vs. Professional Managers, , Growth of Entrepreneurs, Nature and Importance of Entrepreneurs, Women

Entrepreneurs, Problems of Entrepreneurship. Entrepreneurial Development and Project Management: Institutions in aid of Entrepreneurship Development, Idea generation: Sources and Techniques; Stages in Project formulation ; Steps for starting a small enterprise - Incentives for Small Scale Industries by Government.

TEXT BOOKS:

1. Sharma, S.C., and Banga, T.R., Industrial Organization & Engineering Economics, Khanna Publishers, Delhi, 2000.

2. Vasant Desai, The Dynamics of Entrepreneurial Development and Management (Planning for future Sustainable growth), Himalayan Publishing House, 2018.

REFERENCE BOOKS:

1. Aryasri, A.R., Management Science, McGraw Hill Education (India) Private Limited, New Delhi 2014.

2. Sheela, P., and Jagadeswara Rao, K., Entrepreneurship, Shree Publishing House, Guntur, Andhra Pradesh, 2017.

CH-2206 : HEAT TRANSFER LABORATORY

Course Objectives:

The student will calculate the thermal resistance and calculation of heat transfer coefficients for both natural and forced convection scenarios. The student will conduct experiments to calculate emissivity of the given plate, radiation constant of the given rod and Stefan Boltzman constant.

Course Outcomes:

At the end of the course, the student will be able to

- Determine thermal conductivity of composite solids and thermal conductivities of lagging material in lagged pipe apparatus
- Determine heat transfer coefficients in forced and natural convection
- Determine the Stefan Boltzman constant and emissivity of the given plate
- Calculate radiation constant for hot rod losing heat to the infinite stagnant ambient
- Analyze the heat exchanger performance (double pipe) for co-current and counter-current flows and determine overall heat transfer coefficient.

List of Experiments:

1. Determination of total thermal resistance and thermal conductivity of composite wall.
2. Determination of total thermal resistance and thermal conductivity of lagged pipe.

3. Determination of the natural convective heat transfer coefficient for a vertical tube.

4. Determination of forced convective heat transfer coefficient for air flowing through a pipe.

5. Determination of over-all heat transfer coefficient in double pipe heat exchanger.

6. Study of the temperature distribution along the length of a pin fin under natural and forced convection conditions.

7. Estimation of unsteady state film heat transfer coefficient between the medium in which the body is cooled.

8. Determination of Stefan-Boltzmann constant.

9. Determination of emissivity of a given plate at various temperatures.

10. Determination of radiation constant of a given surface.

11. Determination of the thermal conductivity of a metal rod.

12. Determination of critical heat flux point for pool boiling of water

CH-2207 : FLUID MECHANICS LABORATORY

Course Objectives:

The student will be exposed to various fluid measuring devices. The pressure drop calculation experimentally across the pipe fittings, valves, packed bed, fluidized bed and annulus will also be dealt in this lab.

Course Outcomes:

At the end of the course, the student will be able to

- Distinguish laminar and turbulent flows.
- Determine the characteristics of flow meters
- Determine the characteristics of packed & fluidized beds and centrifugal pumps
- Calculate pressure drop across a pipe, valves and fittings.

List of Experiments:

1. Identification of laminar and turbulent flows (Reynolds apparatus)
2. Measurement of point velocities (Pitot tube)
3. Verification of Bernoulli equation
4. Calibration of rotameter
5. Variation of orifice coefficient with Reynolds number
6. Determination of venturi coefficient
7. Friction losses in fluid flow in pipes
8. Pressure drop in a packed bed for different fluid velocities

9. Pressure drop and void fraction in a fluidized bed
10. To study the coefficient of contraction for a given open orifice
11. To study the coefficient of discharge in a V - notch
12. To study the characteristics of a centrifugal pump

CH-2208 : ASPEN PLUS (Process Design)

Course Objectives:

- To familiarize students with basic programming skills required for solving chemical engineering problems.
- To analyze the data obtained from simulation with theoretical concepts.
- To compare different thermodynamic property estimation methods and analysing the results.
- To familiarize students with fundamental applications of chemical engineering in ASPEN PLUS.

Course Outcomes:

At the end of the course, the student will be able to

- Carry out thermodynamic property estimations using Aspen
- Simulate Mixer, splitter, pumps, compressors and flash units
- Apply sensitivity, design specification and case study tools in Aspen
- Design heat exchangers, reactors and distillation columns
- Optimize process flowsheets using sequential modular and equation oriented approaches.

SYLLABUS

Solve the following steady state simulation exercises using Aspen:

1. Physical property estimations.
2. Simulation of individual units like, mixers, splitters, heat exchangers, flash columns and reactors
3. Design and rating of heat exchangers
4. Design and rating of distillation columns.
5. Mass and Energy balances.
6. Handling user specifications on output streams – Sensitivity and design Spec tools.
7. Simulation of a flowsheet
8. Simulation exercises using calculator block
9. Optimization Exercises
10. Simulation using equation oriented approach

TEXT BOOKS:

1. Lab manuals / Exercise sheets
2. A.K.Jana, Chemical Process Modelling and Computer Simulation, Prentice Hall India, 3rd Edition, 2018.

CH-2209 : PROFESSIONAL ETHICS AND HUMAN VALUES

Course Objectives:

- To inculcate Ethics and Human Values into the young minds.
- To develop moral responsibility and mould them as best professionals.
- To create ethical vision and achieve harmony in life.

Course Outcomes:

At the end of the course, the student will be able to

- Understand the importance of ethics and moral values in life and society.

SYLLABUS

Ethics and Human Values: Ethics and Values, Ethical Vision, Ethical Decisions, **Human Values** – Classification of Values, Universality of Values.

Engineering Ethics: Nature of Engineering Ethics, Profession and Professionalism, Professional Ethics, Code of Ethics, Sample Codes – IEEE, ASCE, ASME and CSI.

Engineering as Social Experimentation: Engineering as social experimentation, Engineering Professionals – life skills, Engineers as Managers, Consultants and Leaders, Role of engineers in promoting ethical climate, balanced outlook on law.

Safety Social Responsibility and Rights: Safety and Risk, moral responsibility of engineers for safety, case studies – Bhopal gas tragedy, Chernobyl disaster, Fukushima Nuclear disaster, Professional rights, Gender discrimination, Sexual harassment at work place.

Global Issues: Globalization and MNCs, Environmental Ethics, Computer Ethics, Cyber Crimes, Ethical living, concept of Harmony in life.

TEXT BOOKS:

1. Govindharajan, M., Natarajan, S. and Senthil Kumar, V.S., Engineering Ethics, Prentice Hall of India, (PHI) Delhi, 2004.
2. Subramainam, R., Professional Ethics, Oxford University Press, New Delhi, 2013.

REFERENCE BOOKS:

1. Charles D, Fleddermann, "Engineering Ethics", Pearson / PHI, New Jersey 2004 (Indian Reprint).

CH-2210 : SUMMER INTERNSHIP PROGRAM (2MONTHS)

All the students have to undergo Summer Internship / Community Service for two months in the industries / nearby villages and report the same in the Department.

CH-3101 : CHEMICAL ENGINEERING THERMODYNAMICS

Course Objectives:

Knowledge of thermodynamics helps student compute heat and work requirements of a process.

The student would also learn

- how to estimate data in case of absence of experimental data,
- Solution thermodynamics and its applications
- Concept of Phase & Chemical reaction equilibrium.

Course Outcomes:

At the end of the course, the student will be able to

- Apply the first and second laws of thermodynamics to chemical processes and Compute the properties of ideal and real gas mixtures.
- Evaluate heat effects involved in industrial chemical processes
- Evaluate the efficiency of expansion and compression flow processes and analyze refrigeration and liquefaction processes.
- Determine thermodynamic properties of gaseous mixtures and solutions, Estimate Bubble-P & T, Dew-P & T for binary and multi-component systems and Calculate vapor-liquid equilibrium (VLE) composition for ideal and non-ideal systems
- Determine equilibrium constant and composition of product mixture for single and multiple reactions.

SYLLABUS

The first law and other basic concepts Introduction to Basic laws and Terminologies in Thermodynamics- Statement of First law, the steady-state, steady-flow process, the reversible process. Volumetric properties of pure fluids: PVT behavior of pure substances, the ideal gas, virial equations and its applications, cubic equations of state, generalized correlations for gases and liquids.

Heat effects: Latent heats of pure substances, Temperature dependence of heat effects of chemical reactions. The Second law of thermodynamics: Statements of second law- Clausius Inequality- Mathematical Statement of Second law, Third law of thermodynamics. Thermodynamic properties of pure fluids: Property relations for homogeneous phases, residual properties.

Solution Thermodynamics: chemical potential, partial properties, ideal gas mixtures, fugacity and fugacity coefficient for a pure species and species in solution, generalized correlations for the fugacity coefficients, the ideal solution, excess properties. VLE-Duhem's theorem, VLE- qualitative behavior, Raoult's law and modified Raoult's law, dew point and bubble point calculations, flash calculations. VLE for Ideal solutions, Calculation of activity coefficients.

Chemical Reaction Equilibria: Criteria for chemical reaction equilibrium, the standard Gibbs energy change and the equilibrium constant, Effect of temperature, pressure, composition and other factors.

TEXT BOOK:

1. 'Introduction to Chemical Engineering Thermodynamics' by J.M.Smith, H.C.Van Ness and M.M.Abbott., 6th Edition, Tata McGraw-Hill Edition 2003.

REFERENCE BOOKS:

1. 'Chemical Engineering Thermodynamics' by B.F.Dodge, McGraw-Hill Book Co.,

2. 'Schaum Outline of Theory and Problems of Thermodynamics' by Michael M. Abbott and Hendrick C.VanNess, McGraw-Hill International Book Co., Singapore, 1981.

3. 'Chemical Engineering Thermodynamics' by Y.V.C.Rao, University Press (India) Ltd., Hyderabad 1997.

4. K.V.Narayanan, A Textbook of Chemical Engineering Thermodynamics, PHI Learning, 2004.

CH-3102 : MASS TRANSFER –I

Course Objectives:

- To explain the students with the basic principles of mass transfer operations and other separation processes with examples.
- To impart knowledge on how certain substances undergo the physical change with diffusion/mass transfer of components from one phase to other phases.
- To describe the students with equipment used in operations involving mass transfer and other separation processes and their advantages and disadvantages.
- To focus on absorption and distillation operations and the process design aspects of the same operations.
- To provide the knowledge on humidification and dehumidification operations and their applications in real situations

Course Outcomes:

At the end of the course, the student will be able to

- Identify diffusion phenomena in various chemical processes
- Determine diffusivity coefficient in gases and liquids.
- Calculate mass transfer coefficients at interfaces of multiphase mass transfer systems
 - Understand the VLE concepts and application to different distillations
 - Understand the importance of humidification and dehumidification processes and their industrial applications
 - Design equipment for gas-liquid mass transfer operations

SYLLABUS

Introduction: Mass transfer Operations.

Molecular diffusion in fluids: Binary solutions, Fick's law, equation of continuity, Steady state equimolar counter current diffusion, Stefan's diffusion, estimation of diffusivity of gases and liquids, application of molecular diffusion.

Mass transfer coefficients: Mass transfer coefficients in turbulent flow, theories of mass transfer, analogy between momentum, heat and mass transfer in laminar and turbulent flow, correlations for mass transfer coefficients in simple situations, diffusion in solids.

Interphase mass transfer: Concept of equilibrium, diffusion between phases, two resistance theory, material balances in steady state co-current and counter-current stage processes, Murphy stage efficiency.

Equipment for gas-liquid operations: Sparged vessels, mechanically agitated vessels for single phase liquids and gas-liquid mixtures, tray towers, sieve tray for absorption and distillation, venturi scrubbers, spray towers and spray chambers, packed towers for absorption and distillation, tray towers versus packed towers.

Humidification operations: Definition of fundamental terms, Psychrometric charts, theory of adiabatic saturation and wet bulb temperature, Lewis relation, gas-liquid contact operations, water cooling with air, dehumidification of air-water-vapor mixture, cooling towers, evaporative cooling.

Absorption: Solubility's of gases in liquids, two component systems, multi-component systems, ideal and non-ideal solutions, choice of solvent for absorption, single component absorption material balances, counter current multistage operations, dilute gas mixtures, on-isothermal operation, tray efficiency, continuous contact equipment, HETP, HTU, NTU concepts for single operation absorption with chemical reaction.

Distillation: Principles of VLE for binary systems, phase diagrams, relative volatility, ideal solutions, azeotropes, enthalpy concentration

diagrams, flash vaporization, partial condensation, differential distillation, steam distillation, continuous distillation, McCabe-Thiele method, Ponchon-Savarit method, tray efficiencies, introduction to multi-component distillation, azeotropic and extractive distillations.

TEXT BOOK:

1. Mass transfer Operations, Robert E. Treybal, 3rd edition, McGraw-Hill Book Co.,

REFERENCE BOOKS:

1. "Unit Operations in Chemical Engineering" by McCabe, W.L., Smith, J.C. and Harriot, P., 5th Edition, McGraw-Hill Book Co.,
2. "Chemical Engineering Hand Book" by J.H. Perry.

CH-3103 : CHEMICAL REACTION ENGINEERING – I

Course Objectives:

- To learn principles of rate law and stoichiometry. Isothermal reactors- Batch, plug flow reactor and mixed flow reactor. Design of single and multiple reactors.
- To endow with the knowledge on thermal characteristics of various reactions.

Course Outcomes:

At the end of the course, the student will be able to

- Derive the rate law for non-elementary chemical reactions and determine the kinetics of chemical reaction using integral, differential and fractional life methods.
- Design reactors for homogenous reactions under isothermal conditions for single and multiple reactions.
- Select optimal sequence in multiple reactor systems.

SYLLABUS

Introduction and overview of chemical reaction engineering – Variables affecting a chemical reaction – Kinetics of homogeneous reactions – Concentration dependent term of rate equation – Elementary and nonelementary reactions – Temperature dependent term – Arrhenius law, activation energy, collision theory, transition state theory Searching for a mechanism.

Interpretation of batch reactor data – Methods of analysis, integral, differential and half life methods – Analysis of different types of reactions, irreversible and reversible – Variable volume reactor.

Ideal reactors for a single reaction – Performance equations for batch, mixed flow and plug flow reactors – Space time, space velocity and mean residence time.

Design for single reactions – Size comparison of reactors – Multiple reactor systems – Recycle reactor. Design for parallel reactions – Qualitative and quantitative discussion about product distribution.

Design for series reactions – Qualitative and quantitative discussion about product distribution.

TEXTBOOK:

1. "Chemical Reaction Engineering", Levenspiel, O. 3rd Edition, John Wiley and Sons.

REFERENCE BOOKS:

1. "Chemical Engineering Kinetics", Smith, J.M, 3rd Edition. McGraw Hill Inc.

2. "Elements of Chemical Reaction Engineering", Fogler, H.S, 3rd Edition, Prentice Hall India Ltd.

CH-3104 : CORROSION ENGINEERING (OPEN ELECTIVE-I)

Course Objectives:

- Basic aspects of electrochemistry relevant to corrosion phenomena,
- Importance and forms of corrosion.
- Knowledge on corrosion rate expressions and measurement techniques.
- Basic knowledge on remedial measures for corrosion.

Course Outcomes:

At the end of the course, the student will be able to

- Identify various forms of corrosion.
- Determine corrosion rates for metals from their polarization curves
- Analyze corrosion rate characteristics from electrochemical impedance spectroscopy
- Select suitable corrosion resistant coatings, oxide layers for various applications

SYLLABUS

Introduction and scope: Corrosion definition, wet and dry corrosion, mechanism, electro-chemical principles and aspects of corrosion, Faradays laws, resistance, specific resistance, conductance, specific conductance, transport numbers, ionic mobility, corrosion rate expressions, calculation of corrosion rates, thermodynamic aspects of corrosion, equilibrium potential, Nernst equation for electrode potential, EMF series, over voltage, application of Nernst equation to corrosion reactions,

Polarisation and corrosion potentials: References electrodes for corrosion measurements, types of polarisation, concentration, activation and

resistance polarizations, Tafel constant, Evans diagrams, anodic control, cathodic control, mixed control, Pourbaix-diagram for Fe-H₂O system,

Various forms of corrosion: Uniform attack, galvanic corrosion, crevice corrosion, pitting corrosion, intergranular corrosion, selective leaching (dezincification), cavitation damage, fretting corrosion, erosion corrosion, and stress corrosion and remedial measures,

Prevention techniques: Modification of the material by alloying, appropriate heat treatment, chemical and mechanical methods of surface treatment, metallic, non-metallic linings, inhibitors, passivity, Cathodic protection and anodic protection.

TEXT BOOKS:

1. 'Corrosion Engineering' by Mars G. Fontana, Tata McGraw Hill Publishing Company, New Delhi

2. 'Corrosion and Corrosion Control' by H.H.Uhlir, John Wiley & Sons Inc., America.

REFERENCE BOOKS:

1. 'Electrochemistry' by Samuel Glasstone, Litton Educational Publishing Company

2. 'Electrochemistry, Principles & Applications' by Edmond C.Potter, Cleaver Hume Press Limited.

**CH-3105 (A) : GENERAL CHEMICAL TECHNOLOGY
(CORE ELECTIVE-I)**

Course Objectives:

- To provide the student understanding of importance of chemical process industries over the other manufacturing industries.
- To provide the brief introduction of chemical process equipments, the application of thermodynamics, the chemical process principles, the equipment design and also the corrosion and the safety aspects to consider in the chemical manufacturing processes.
- To provide basic inorganic chemistry background required for the undergraduate students of engineering.
- To provide an overview of chemical properties of inorganic chemicals and the manufacturing processes.
- To provide an overview of applications of materials which the engineers are likely to use during their professional career.

Course Outcomes:

At the end of the course, the student will be able to

- Selection of a process for manufacture of chemicals
- Draw process flow diagrams

- Identify the engineering problems in chemical processes
- List chemical reactions and their mechanism involved

SYLLABUS

Nitrogen industries: Manufacture of ammonia, nitric acid, urea and ammonium nitrate.

Phosphorous and phosphoric acid industries: Methods for production of phosphorous and phosphoric acid, manufacture of super phosphate and triple super phosphate.

Cement: Types of cement, manufacture of ordinary Portland cement, slag cement.

Coal and Coal chemicals: distillation of coal and coal tar, low and high temperature carbonization of coal.

Petrochemicals: Derivatives of C_2 : Polyethylene, Ethanol, Ethylene oxide; Derivatives of C_3 : Isopropanol, Acetone, Propylene oxide

Extraction of vegetable oils: Purification, acid value, hydrogenation of oils, Manufacture of fatty acids, soaps and detergents classification and manufacture.

Paints and varnishes: Constituents of paints, functions of paint, manufacturing procedures, Pigments-manufacture of lithophone, varnishes

Manufacture of pulp and paper: Kraft process and sulphite process, production of paper Manufacture of Sugar.

TEXTBOOKS:

1. "Dryden's Outlines of Chemical Technology" by M.Gopala Rao & Marshall Sittig (Editors). Affiliated East West Press Pvt. Ltd.
2. "Shreve's Chemical Process Industries" by G.T.Austin, McGraw Hill Books.

REFERENCE BOOKS:

1. "Encyclopedia of Chemical Technology" by R.E.Kirk & D.F.Othmer (Editors)Interscience.

CH-3105 (B) : CERAMIC RAW MATERIALS (CORE ELECTIVE – I)

Course Objectives:

- To procure knowledge about the earth
- To gain knowledge regarding the rocks which are most useful ores.
- To know about the physical and optical properties of the minerals and ores.
- To gain acquaintance with formation of different raw materials.
- To collect information about the different types of clays

- To put on the knowledge regarding other raw materials used in the ceramics.
- To get information regarding the distribution of the deposits.

Course Outcomes:

At the end of the course, the student will be able to

- Identify the sources/ availability of raw materials for ceramics
- Examine different clays as raw materials for various ceramic products
- Explain the behavior of silicates as ceramic raw materials
- Acquire knowledge about accessory ceramic raw materials.

SYLLABUS

General geology and mineralogy: Formation of rocks, their characteristics, classification into igneous, sedimentary and metamorphic groups, formation of mineral deposits, physical and mineral characteristics of minerals – composition, color, streak, luster, fracture, cleavage, hardness, density and tenacity, elements of optical mineralogy.

Clays: Clay minerals, clay structure – kaolinite and montmorillonite groups, geology of clay deposits, their classification - china clay, ball clay, fire clay, building clay etc., beneficiation of clays, mica chlorite, illite group, talc, pyrophyllite, wollastonite group, chemical properties, physical properties. Fluxes: Soda and potash feldspar, other feldspars, nephelinesyenite, geology of formation, physical and chemical properties, beneficiation.

Silica and silicate materials: Silica, polymorphic modification, silica structure, physical and chemical properties of silica, silicate chemistry, minerals, sillimanite, kyanite, and alusite, availability in India and their uses in ceramic industry.

Other raw materials: Geology of bauxite, magnesite, dolomite, chrome, limestone, rutile, zircon, beryllia minerals, alumina, carbides, nitrides, properties and uses.

TEXTBOOKS:

1. 'Fine Ceramics Technology and Applications' by F.H.Norton, McGraw Hill Publishers, New York,
2. 'Ceramic Raw Materials' by W.E.Worrall, Pergamon press, New York.

REFERENCE BOOKS:

1. 'Forming Minerals' by W.A.Deer, R.A. Howie & J.Rock, Longman Publishers, London
2. 'Properties of Ceramic Raw Materials' by W.Ryan, Pergamon press, 2nd Edition
3. 'Clay Mineralogy' by M.J.Wilson, Chapman & Hall.

CH-3105 (C) : FUEL CELL TECHNOLOGY (CORE ELECTIVE – I)

Course Objectives:

- To provide deeper knowledge, a wider scope and improved understanding of theory, analysis, performance, design and the operational principles of various fuel cell components and systems.
- To provide the design and analysis emphasis on the thermodynamics and heat transfer for all thermal systems of a fuel cell stack.

Course Outcomes:

At the end of the course, the student will be able to

- Understand fuel cell fundamentals.
- Analyze the performance of a fuel cell and stack.
- Demonstrate the operation of fuel cell stack and fuel cell system
- Apply the modeling techniques for fuel cell systems.

SYLLABUS

Introduction – fuel cell; brief history of fuel cells, types of fuel cells and fuel cell applications.

Thermodynamics and Electrochemical kinetics – Engineering thermodynamics, conversion efficiencies of heat engines and fuel cells, chemical reactions, chemical thermodynamics and electrochemical kinetics.

Fuel cell components and their impact on performance – General design features, fuel cell performance: the MEA and the current/voltage curve, MEA components and the fuel cell stack.

Stack design – Sizing of a fuel cell stack, stack configuration, uniform distribution of reactants inside each cell, heat removal from a fuel stack and stack clamping.

Fuel cell modeling – Theory and governing equations, modeling domains and modeling examples.

Fuel cell system design – Hydrogen-air system, fuel cell systems with fuel processor, electrical subsystems and system efficiency.

Fuel cell applications – Transportation applications, stationary power, backup power and fuel cells for small portable power.

TEXT BOOKS:

1. For chapters 1 to 3: Fuel Cell Technology Hand Book, Edited by Gregor Hoogers, CRC Press.
2. For Chapters 4 to 7: PEM Fuel Cells: Theory and practice By Frano, Elsevier Academic Press.

REFERENCE BOOKS:

1. Fuel cells principles and applications by B.Viswanathan and M. Aulice Scibioh, Universal Press. (India) Private Limited, Hyderabad.

2. Fuel Cell Systems Explained, second edition, by James Larminie and Andrew Dicks, John Wiley & Sons Ltd.

CH-3105(D) : POLYMER TECHNOLOGY (CORE ELECTIVE – I)

Course Objectives:

- To make a thorough understanding of the classification, characterization of the polymers and their structure and its applications
- To introduce the manufacturing methods of different polymers and different additives, blends and composites used in the process

Course Outcomes:

At the end of the course, the student will be able to

- Classify polymers and determine molecular weight of the polymer
- Understand thermodynamics of polymer structures
- Select polymerization reactor for a polymer product.
- Characterize polymers.
- State polymer additives, blends and composites
- Understand polymer rheology
- Identify suitable polymer processing methods

SYLLABUS

Introductory concepts and fundamentals: Definitions and concepts of plastics and polymers, comonomer, co-monomer, mesomer, co-polymer, functionality, visco-elasticity,

Classification of polymers, methods of determining molecular weights of polymers-

- (i) Methods based on colligative properties
- (ii) Sedimentation velocity method
- (iii) Sedimentation equilibrium method
- (iv) Gel-chromatography method
- (v) Light scattering analysis method
- (vi) End-group analysis method

Natural polymers- brief study of rubber, shellac, rosin, cellulose, proteins, Lignin's,

Chemistry of polymerization: Elementary concepts of addition polymerization, condensation polymerization and co-polymerization, glass transition temperature of polymers, methods of determining T_g, degradation of polymers due to mechanical, hydrolytic, thermal and backbone effects,

Relation of the mechanical, thermal, electrical, physical and chemical properties with the structure of the polymer,

Methods of polymerization: Mass, solution, emulsion and suspension, role of the initiators, catalysts, inhibitors, solvents, fillers, reinforcing agents, stabilizers, plasticizers, lubricants, blowing agents, coupling agents, flame retardants, photo-degradants and bio-degradable on polymerization,

Methods of manufacture, properties and uses of the following addition products;

Polyethylene (LDPE and HDPE), polypropylene, PVC and its copolymers, Polystyrene and its copolymers, acetals and PTFE (polytetrafluoroethylene),

Methods of manufacture, properties and uses of the following condensation products: (i) Polyesters-PMMA, PET and ALKYO, (ii) PF-, UF- and MF-resins (iii) epoxy resins, polyurethanes and silicones,

Description of the following processing methods: (with the principles involved and equipments used) Mixing and compounding, extrusion, calendaring, laminating, moulding-compression, transfer, injection and blow moulding.

TEXT BOOKS:

1. 'Plastic Materials' by J.A.Brydson, Newnes-Butterworths (London) 1989
2. 'Textbook of Polymer Science', Billymeyer, F.W.Jr., 3rd edition, John Wiley & Sons.

REFERENCE BOOKS:

1. 'Introduction to Plastics' by J.H.Briston and C.C. Gosselin, Newnes, London
2. 'Polymeric Materials' by C.C.Winding and G.D.Hiatt, McGraw-Hill Publishers.

CH-3106 : MASS TRANSFER-I LABORATORY

Course Objectives:

The student will be made familiarised with distillation process and will be able to determine liquid and vapour diffusion coefficient. The student will be able to calculate VLE, HTU, HETP and rate of evaporation by conducting experiments.

Course Outcomes:

- At the end of the course, the student will be able to
- Determine separation performance of batch distillation, steam distillation, sieve plate and packed bed distillation

- Estimate the diffusion coefficient of vapour in gas
- Estimate the diffusion coefficient of liquid
- Determine the rate of evaporation

List of Experiments:

1. Steam distillation
2. Differential distillation
3. Height equivalent to a theoretical plate
4. Vapor-liquid equilibria
5. Determination of liquid diffusion coefficient
6. Determination of vapor diffusion coefficient
7. Surface evaporation
8. Height of a transfer unit.

CH-3107 : CHEMICAL TECHNOLOGY LABORATORY

Course Objectives:

The student will be made familiar with analysis of water, oils, coal, lime stone, bleaching powder saw dust etc. and preparations of soap, copper and chrome yellow pigments, Phenol formaldehyde resins.

Course Outcomes:

At the end of the course, the student will be able to

- Synthesize products such as soap, phenol formaldehyde resin, Chrome yellow pigment, and Copper pigment
- Estimation of total solids, dissolved solids, pH, chlorides, sulphates, temporary and permanent hardness in water
- Analyse acid value, Iodine value and saponification value of oil
- Estimate the purity of various materials

List of experiments:

- A. Analysis of water :
1. Total solids, dissolved solids, pH
 2. Chlorides and sulphates
 3. Temporary, permanent and total hardness.
- B. Analysis of oils :
4. Acid value
 5. Iodine value
 6. Saponification value
- C. Miscellaneous analysis:
7. Analysis of coal: Proximate analysis

8. Analysis of lime: Estimation of acid insoluble's, available lime and calcium carbonate

9. Analysis of bleaching powder: Estimation of chlorine content.

10. Analysis of starch/glucose: Estimation of total reducing sugars

11. Analysis of saw dust: Estimation of total cellulose and –cellulose

D. Miscellaneous preparations:

12. Preparation of soap

13. Preparation of copper pigment

14. Preparation of chrome yellow pigment

15. Preparation of phenol formaldehyde resin.

CH-3108 : SEMINAR/MINOR PROJECT

Course Objectives:

- To make the student to think about the new methodologies for the Chemical Engineering problems and implement them either experimentally or theoretically.

- To enhance communication skills of the student to present his/her work and to interact with the students/ faculty/ industry people.

Course Outcomes:

At the end of the seminar/ Minor project, the student will be able to

- Conduct an independent research project involving experimentation/modelling/simulation/optimization in chemical engineering

- Analyze the results

- Communicate the research results orally to an audience

- Present a detailed written report.

CH-3109 : INDIAN CONSTITUTION

Course Objectives:

- The student learns about the scope and scheme of fundamental duties and fundamental rights.

- The student understands federal structure and distribution of legislative and financial powers and the parliamentary form of government of India.

Course Outcomes:

At the end of the course, the student will be able to

- Identify the scope and scheme of fundamental rights and fundamental duties

- Understand the features and characteristics of the Constitution of India

- Explain the Federal structure and distribution of legislative and financial powers between the Union and the States

- Explain Parliamentary Form of Government in India

- Describe Emergency Provisions.

SYLLABUS

1. Meaning of the constitution law and constitutionalism

2. Historical perspective of the Constitution of India

3. Salient features and characteristics of the Constitution of India

4. Scheme of the fundamental rights

5. The scheme of the Fundamental Duties and its legal status

6. The Directive Principles of State Policy – Its importance and implementation

7. Federal structure and distribution of legislative and financial powers between the Union and the States

8. Parliamentary Form of Government in India – The constitution powers and status of the President of India

9. Amendment of the Constitutional Powers and Procedure

10. The historical perspectives of the constitutional amendments in India

11. Emergency Provisions : National Emergency, President Rule, Financial Emergency

12. Local Self Government – Constitutional Scheme in India

13. Scheme of the Fundamental Right to Equality

14. Scheme of the Fundamental Right to certain Freedom under Article 19

15. Scope of the Right to Life and Personal Liberty under Article 21.

CH-3110 : SUMMER INTERNSHIP EVALUATION

All the students have to undergo Summer Internship for two months in the industries at the end of the second year second semester. Evaluation of the same will be conducted in this semester by the Department.

CH-3201 : MASS TRANSFER –II

Course Objectives :

To explore about different mass transfer operations and its applications in industrial scale.

Course Outcomes:

At the end of the course, the student will be able to

- Analyse VLE, LLE, and SLE data
- Select a suitable mass transfer operation for a given separation
- Determine number of stages in distillation, extraction and adsorption operations
- Estimate the height of packed column in distillation, extraction and adsorption operations
- Calculate drying rates and moisture content for batch and continuous drying operations.

SYLLABUS

Liquid-liquid operations: Extraction: Introduction, liquid-liquid equilibria, analytical and graphical solutions for single and multistage operations, continuous counter current operation without and with reflux, fractional extraction, equipment for liquid-liquid contacting operations, single stage, multistage and continuous contacting equipment,

Leaching: Preparation of solid, steady and unsteady state operation, equipment, analytical methods both theoretical and problematic approaches for single and multistage operations,

Adsorption: Theory of adsorption, Industrial adsorbents, adsorption equilibria, Freundlich equation, single and multistage operations, unsteady state adsorption, equipment for single stage and continuous contact, ion-exchange,

Drying: Equilibria, drying rate curve, batch and continuous drying, time of drying and calculations, mechanism of batch drying, equipment's for batch and continuous drying operations,

Crystallization: Equipment and analytical methods, factors governing nucleation and crystal growth rates, controlled rate of crystals, incorporation of principles into the design of the equipment,

Less conventional operations: Dialysis, thermal diffusion, mass diffusion,

Membrane separation processes: Separation of gases, separation of liquids, dialysis, membranes for liquid extraction, pervaporation, reverse osmosis.

TEXT BOOK:

2. 'Mass Transfer Operations', by Robert E. Treybal, III Edition, McGraw-Hill Book Co.

REFERENCE BOOKS:

1. 'Unit Operations in Chemical Engineering' by McCabe, W.L., Smith, J.C. and Harriot, P., 5th Edition, McGraw-Hill Book Co.

2. 'Chemical Engineering Hand Book' by J.H. Perry

CH-3202 : CHEMICAL REACTION ENGINEERING-II

Course Objectives:

- To endow with the knowledge on thermal characteristics of various reactions
- To accomplish knowledge on non-ideal reactors
- To impart the knowledge on heterogeneous reacting systems
- To study the design aspects of heterogeneous catalytic systems
- To impart the knowledge on mass transfer with reaction situations.

Course Outcomes:

At the end of the course, the student will be able to

- Explain the thermal characteristics and design of adiabatic reactors for single and multiple reactions
- Apply the non-ideality concepts in the reacting system for better understanding the deviations from ideality
- Apply the tanks-in-series model, and the dispersion (single parameter) models for a first-order reaction, to account for the non ideality
- Develop the progressive conversion model and shrinking core model for explaining the fluid particle reaction
- Understand the principles and mechanism involved in heterogeneous catalysis and analyze the data of heterogeneous catalytic reactions.
- Understand the rate controlling mechanisms in heterogeneous catalysis and their rate determinations.

SYLLABUS

Temperature and pressure effects – Heats of reaction and temperature – Equilibrium constants from thermodynamics – Equilibrium conversion – General graphical design procedure – Optimum temperature progression – Adiabatic operations.

Non ideal flow – Basics – C, E and F curves – Conversion in non ideal flow reactors – Dispersion model – Tanks-in-series model.

Heterogeneous catalysis – Physical adsorption – Chemisorption – Catalytic properties – Estimation of surface area, pore volume and porosity – Catalyst preparation – Catalyst poisons – Catalytic deactivation.

Solid catalysed reactions – Rate equations – Pore diffusion combined with surface kinetics – Thiele modulus – Effectiveness factor – Performance equations for reactions containing porous catalyst particles – Experimental methods for finding rates – Determining controlling resistances.

Noncatalytic systems – Design of fluid-fluid reactors – Factors to consider in selecting a contractor – Various contractors and contacting patterns for G/L reactions.

Design of fluid particle reactions – Progressive Conversion Model (PCM), Shrinking Core Model (SCM) – Comparison – Controlling mechanisms – Determination of rate controlling step.

TEXT BOOK:

1. 'Chemical Reaction Engineering' Levenspiel O, 3rd Edition, John Wiley & Sons.

REFERENCE BOOKS:

1. "Chemical Engineering Kinetics" by Smith, J.M. 3rd Edition, McGraw Hill Inc.

2. "Elements of Chemical Reaction Engineering" by Fogler, H.S, 3rd Edition, Printice Hall India Ltd.

CH-3203 : PROCESS INSTRUMENTATION AND CONTROL

Course Objectives:

In studying this course Chemical Engineering students will come to know the measurement of various process variables and acquire the knowledge of the operation of various process control systems effectively. The students learn.

- how physical quantities are measured and how they are converted to electrical or other forms.
- to use various types of instruments.
- represent the processes in terms of mathematical equations
- the concept of stability and know how to operate a control system in a stable way.
- to deal with various controllers and their functions and applications.

Course Outcomes:

At the end of the course, the student will be able to

- Recommend suitable instrument for the measurement temperature
- Select a method of measurement for pressure, composition, flow and level
- Develop transfer functions for the processes
- Examine the stability of various control systems
- Apply advanced control schemes for processes and identify the characteristics of control valves.

SYLLABUS

Qualities of measurement: The elements of instruments, static and dynamic characteristics, dynamic response of first order and second order instruments.

Expansion thermometers: Temperature scales, constant-volume gas thermometer, bimetallic thermometer, pressure spring thermometer, theory of volumetric and pressure thermometers, static accuracy of thermometer, comparison of pressure-spring thermometers.

Thermoelectric temperature measurement: Thermoelectricity, industrial thermocouples, thermocouple lead wires, thermal wells, response of thermocouples, the mill voltmeter.

Resistance thermometers: Thermal coefficient of resistance, industrial resistance thermometer bulbs, resistance thermometer circuits, null-bridge resistance thermometers, deflectional resistance thermometers.

Radiation temperature measurement: Introduction, blackbody devices and radiation receiving elements, radiation pyrometers, photoelectric pyrometers and optical pyrometers.

Methods of Composition analysis: Spectroscopic analysis, absorption, Emission and Mass spectroscopy- IR, UV absorption and mass spectrometers, Gas analysis by thermal conductivity, analysis of moisture in gases (humidity), psychrometer method, hygrometer method, dew-point method for moisture analysis in gases, measurement of moisture in paper, textile and lumber.

Measurement of pressure and vacuum: Pressure, vacuum and head, liquid column manometers, measuring elements for gauge pressure and vacuum, indicating elements for pressure gauges, measurement of absolute pressure, measurement of pressure in corrosive fluids, static accuracy of pressure gauges.

Measurement of Head and Level: Density and specific gravity, direct measurement of liquid level, pressure(level) measurement in open vessels, level measurement in pressure vessels, density measurement, level measurement by weighing.

Introduction to process dynamics and control, Response of First Order Systems - Physical examples of first order systems.

Response of first order systems in series, higher order systems: Second order and transportation lag.

Control systems Controllers and final control elements, Block diagram of a chemical reactor control system.

Closed loop transfer functions, Transient response of simple control systems.

Stability Criterion, Routh Test, Root locus. Transient response from root locus, Application of root locus to control systems Introduction to frequency response, Control systems design by frequency response.

Advanced control strategies, Cascade control, Feed forward control, ratio control, Smith predictor, dead time compensation, internal model control. Controller tuning and process identification. Control valves.

TEXT BOOKS:

1. Donald P Eckman. Industrial Instrumentation, CBS Publishers, New Delhi, 2004.
2. D.R. Coughanowr. Process Systems Analysis and Control, Mc Graw Hill, 1991.

REFERENCE BOOKS:

1. Hand Book of Instrumentation and control, Considine.
2. Chemical Process Control, G. Stephanopolous, Prentice Hall, 1984.

**CH-3204 (A) : PROCESS MODELING & SIMULATION
(CORE ELECTIVE-II)**

Course Objectives:

- To introduce different types of models along with examples related to chemical engineering
- To instruct how to develop empirical models using different tools and the use of numerical methods for solution of Non- Linear Algebraic equations
- To disseminate the use of different numerical techniques for carrying out numerical integration and differentiation.
- To impart knowledge on modelling of various equipment and their simulation using different numerical techniques.
- To guide selection of the solution method based on the computational requirements of various solution options.
- To elucidate process simulation using modular and equation based solving approaches.

Course Outcomes:

At the end of the course, student will be able to:

- Classify different types of mathematical models
- Develop mathematical model for the given chemical engineering problem from basic engineering principles.
- Identify the appropriate numerical method for solving a given model.
- Solve ODEs and PDEs using different numerical methods.
- Simulate binary distillation column, gravity flow tank, batch reactor, Non-isothermal CSTR, and counter-current heat exchanger.

- Compare and contrast modular approaches with equation oriented approach.

SYLLABUS

Mathematical models for chemical engineering systems: classification of mathematical models- steady state vs dynamic models, lumped vs distributed parameter models, deterministic vs stochastic models. Examples of mathematical models- Two heated tanks, batch reactor, constant volume CSTRs, non-isothermal CSTR, reactor with mass transfer, ideal binary distillation column, batch distillation with holdup.

Empirical model building- method of least squares, linear, polynomial and multiple regression, non-Linear regression. Solution of Non- Linear Algebraic equations- bisection, false position, Quasi Newton and Newton-Raphson methods.

Numerical integration- Trapezoidal rule, Simpson's rule and Newton-Cotes formula.

Numerical solution of differential equations- Euler's method, Runge-Kutta methods, predictor corrector methods.

Numerical solution of partial differential equations- elliptic, parabolic and hyperbolic equations, finite difference methods, Leibman's method, Crank Nicholson method. Applications to steady state and Unsteady state heat conduction and temperature distribution problems.

Process Simulation examples: VLE dew point and bubble point calculations, binary distillation column, gravity flow tank, batch reactor, Non-isothermal CSTR, countercurrent heat exchanger.

Process simulation using modular and equation based solving approaches: Developing a simulation model, a simple flow sheet, Sequential modular approach, Simultaneous modular approach, Equation solving approach.

TEXTBOOKS:

1. Process modelling, Simulation and Control for Chemical Engineers, 2nd ed., W. L. Luyben, McGraw-Hill, New York, 1990.
2. Numerical Methods for Engineers, S.K. Gupta, Wiley Eastern, New Delhi, 1995.

REFERENCE BOOKS:

1. Numerical Methods for Engineers and Scientists, S.S. Rao
2. Introduction to Numerical Methods in Chemical Engineering, P. Ahuja, PHI learning Pvt. Ltd., New Delhi, 2010
3. Process Modelling and Simulation, Amiya K. Jana, 2012.

CH-3204 (B) : PETROLEUM REFINERY ENGINEERING (CORE ELECTIVE – II)

Course Objectives:

- To introduce the basics of refinery engineering subject for petroleum specialization students to gain knowledge of the overall refinery operations, refinery products and its test methods.
- To learn various primary and secondary cracking process available to produce normal and value added products.
- Further, to learn the treatment process available to remove the impurities in the crude and finished products and its test methods for quality check.

Course Outcomes:

At the end of the course, the student will be able to

- Compare various theories on origin and formation of petroleum, to explain and summarize the composition of crude oil, to prepare a report on the world wide scenario of reserves and deposits and the Indian petroleum refining industry scenario.
- Describe and summarize various petroleum products, to know various analytical tests available for estimating various physico chemical properties and classify the crude into different classes.
- Classify the crude processing methods and describe the treatment process i.e. Desalting and Dehydration and infer the preliminary process i.e. Atmospheric Distillation and Vacuum Distillation Units.
- Summarize and infer various secondary cracking process to produce value added products and to design the equipment in the refining industry.

SYLLABUS

Origin and formation of Petroleum. Reserves and deposits of the world, Composition of crudes, Refinery introduction and Indian petroleum refining industry scenario.

Refinery products and test methods, Evaluation of crudes, Crude pretreatment-Dehydration and desalting, Pipe still heater. Atmospheric and Vacuum distillation of crude oil.

Thermal Conversion Process- Vis Breaking, Delayed Coking.

Catalytic Conversion Process- Fluid Catalytic Cracking, Hydrocracking, Hydrotreating, Alkylation, Isomerization, Polymerization and Reforming.

Lube Oil Process – Solvent deasphalting, solvent Extraction, Solvent Dewaxing and Hydro finishing.

Treatment of kerosene, additives, blending of gasoline, Asphalt and air blown asphalt.

TEXTBOOKS:

1. Petroleum Refining Technology by Dr. Ram Prasad
2. Modern Petroleum Refinery Engineering by B K Bhaskar Rao
3. Gary, J.H., Handwerk, G.E. and Kaiser, M.J. (2007) Petroleum Refining: Technology and Economics. 5th Edition, CRC Press, Boca Raton, 488 p.
4. Petroleum Refining. Vol. 3 Conversion Processes, Pierre Leprince (Editor).

CH-3204 (C) : WHITEWARE AND HEAVY CLAYWARE (CORE ELECTIVE - II)

Course Objectives:

- The applications for advanced ceramics have received major attention in recent years, particularly for use as parts in a future ceramic heat engine.
- The properties like corrosion resistance, chemical inertness, thermal shock resistance and other properties made both traditional and advanced ceramics highly attractive in a large number of applications.

Course Outcomes:

At the end of the course, the student will be able to

- Classify whiteware products
- Identify raw materials for heavy clayware and products of heavy clayware
- Importance of fine ceramics.
- How to use resources more efficiently.
- Demonstrate the tests and quality control measures of clay ware products

SYLLABUS

Classification of whiteware products: Body formulation and properties, tableware, earthenware talc bodies, vitreous bodies, high alumina bodies, porcelain, bone china, sanitary ware, stoneware, majolica, terracotta, art ware, physical properties of mixtures, role of water.

Whiteware: Classification, body composition, white wares at home, construction, electrical appliances, industrial uses, manufacturing and properties.

Heavy clayware: Raw materials, methods of winning and handling, classification of building materials, manufacture of building bricks, hollow bricks and other bricks, roof tiles, paving tiles, sewer pipes.

Fine ceramics: Packing of two component system, porosity, effect of grain size, unfired porosity, experimental verifications, wet to dry contraction, unfired strength, permeability and casting rate, dry to fired contraction.

Tests and quality control: IS inspection, LOI, plasticity, strength, MOR, thermal shock resistance, abrasion resistance, porosity, acid and alkali resistance, chipping resistance, chemical analysis, electrical and thermal conductivity.

TEXT BOOKS:

1. 'Pottery Science: Materials, Processes and Products' by Allen Dinsdale, Ellis Horwood Ltd., New York,
2. 'Ceramic White Ware' by Sudhir Sen, Oxford & IBH Publishing Co., New Delhi.

REFERENCE BOOK:

1. 'Industrial Ceramics' by F. Singer and S. Singer, Oxford & IBH Publishing Company.

**CH-3204 (D) : COMPUTATIONAL FLUID DYNAMICS
(CORE ELECTIVE - II)**

Course Objectives:

- The course provides an introduction to computational fluid dynamics.
- The students will train the numerical solution of model problems.
- The students will learn to assess the quality of numerical results and the efficiency of numerical methods for basic fluid flow model problems.

Course Outcomes:

- At the end of the course, the student will be able to
- Solve numerically ordinary differential equations with initial condition
 - Discretize the equations using Finite difference and volume formulation
 - Solve the discretized equations using different techniques
 - Understand the concept of finite volume method and discretization procedure
 - Understand grid generation techniques

SYLLABUS

Numerical solution of ordinary differential equations: Initial value problems of first order, Runge-Kuta methods, linear multi-step and predictor-corrector methods, R-K method for two simultaneous first order equations,

Finite difference discretization of first and second derivatives: Implementation of finite difference equations, explicit and implicit methods, errors and stability analysis,

Selected examples for finite difference applications in heat conduction: Heat dissipation through a constant area fin, two-dimensional steady heat conduction in rectangular geometry, one dimensional transient heat conduction in a slab, Crank-Nicolson method, Thomas algorithm,

Fundamentals of fluid flow modeling: Upwind scheme, transportive property, second upwind differencing, hybrid scheme,

Solution of unsteady Navier-Stokes equations for incompressible flows: Staggered grid, introduction to MAC method, MAC formulation of momentum balance equation, pressure correction equation,

Introduction to SIMPLE method: One-dimensional convection, diffusion equation, formulation of flow problem, discretized continuity and momentum equations, pressure correction equation,

Concept of finite volume **method**: Regular finite volumes, discretization procedure for continuity equation.

TEXT BOOK:

1. 'Computational Fluid Flow and Heat Transfer' 2nd edition by K. Muralidharan and T. Sundararajan, Narosa Publishing House, New Delhi, 2003

REFERENCE BOOK:

1. 'Computational Fluid Dynamics - The Basics and Applications' by John D. Anderson, Jr., McGraw-Hill Inc., New Delhi, 1995.

**CH-3204 (E) : MULTI COMPONENT SEPARATION PROCESSES
(CORE ELECTIVE - II)**

Course Objectives:

- Provide an introduction to design methods of equilibrium and non-equilibrium multi-component mass transport processes
- The student will learn how to solve different shortcut and rigorous models
- The student will make use of conceptual design methods in designing and troubleshooting industrial mass transport processes

Course Outcomes:

- At the end of the course, the student will be able to
- Predict multi component VLE data from the model constants of constituent binaries
 - Determine high pressure equilibria
 - Understand flash vapourization and multicomponent differential distillation
 - Interpret the design considerations of fractionating process
 - Design of distillation column for azeotropic and extractive distillation

- Differentiate tray design and operation versus packing design and operation

SYLLABUS

Multi component vapor –liquid equilibria: Ideal mixtures at low pressures, non-ideal mixtures, activity coefficient models - Wilson, NRTL, UNIQUAC and UNIFAC equations, evaluation of model constants from binary experimental data, prediction of multicomponent VLE from the model constants of the constituent binaries,

High pressure equilibria: Vaporization constants, K, Thermodynamic method for K, graphical charts, Chao-Seader correlation,

Equilibrium and Simple Distillation: Multicomponent equilibrium, flash vaporization(EFV), multicomponent differential distillation,

Design considerations in fractionating process: Quantitative relationships, ternary and multicomponent system fractionation, key fractionation concepts, selection of key components, column pressure, material balance, rigorous and approximate minimum reflux calculations, recommended short-cut methods for minimum reflux minimum plates at total reflux, FUG methods, Smith Brinkley method,

Multicomponent fractionation rigorous design procedures: Sorel method, Lewis-Metheson method, Thiele-Geddes method and its versions in distillation column design, techniques of separating azeotropic and close boiling mixtures by fractional distillation, azeotropic and extractive distillation, selection of solvents, design considerations, pseudo binary methods, solvent recovery,

Tray design and operation: The common tray types, tray capacity limits, tray hydraulics parameters, flow regimes on trays, column sizing, tray efficiency, fundamentals, tray efficiency prediction,

Packing design and operation: Packing types, packing hydraulics, comparing packings and trays, packing efficiency and scale-up.

TEXT BOOKS:

1. 'Distillation' by M. Van Winkle, McGraw Hill Book Company
2. 'Phase Equilibria in Chemical Engineering' by S.M. Wales, Butterworth publishers, 1985
3. 'Distillation Design' by Henery Z Kister, McGraw Hill Book Company

CH-3204 (F) : CHEMICAL ENGINEERING MATHEMATICS (CORE ELECTIVE - II)

Course Objectives:

- To learn various computational techniques for analyzing and solving chemical engineering problems.

Course Outcomes:

At the end of the course, the student will be able to

- Understand the fundamental mathematics and to solve problems of algebraic and differential equations, simultaneous equations and partial differential equations.
- Evaluate problem solving strategies to procedural algorithms and to write program structures.
- Solve engineering problems using computational techniques.

SYLLABUS

Mathematical formulation of the physical problems: i). Application of the law of conservation of mass, salt accumulation in stirred tank, starting an equilibrium still, solvent extraction in N stages, diffusion with chemical reaction and ii). application of the law of conservation of energy, radial heat transfer through a cylindrical conductor, heating a closed kettle, flow of heat from fin,

Analytical (explicit) solution of ordinary differential equations encountered in Chemical engineering problems: i). First order differential equations, method of separation of variables, equations solved by integration factors, certain examples involving mass and energy balances and reaction kinetics and ii). second order differential equations, non-linear equations, linear equations, simultaneous diffusion and chemical reaction in a tubular reactor, continuous hydrolysis of tallow in a spray column, Partial differential equations: i). Formulation of partial differential equations, unsteady-state heat conduction in one dimension, mass transfer with axial symmetry, continuity equation, ii). boundary conditions- function specified, derivative specified and mixed conditions and iii). particular solutions of partial differential equation- compounding the independent variable into one variable, superposition of solutions, the method of images and particular solution suggested by the boundary conditions,

Finite differences: i). The difference operator, properties of the difference operator, difference tables, other difference operators, ii). linear finite difference equation, complementary solution, particular solution, simultaneous linear difference equations and iii). non-linear finite difference equations, analytical solutions,

Solutions for the following type of problems by finite difference method: a). Calculation of the number of plates required for an absorption column, b). calculation of the number of theoretical plates required for distillation column and c). calculation of number of stages required for a counter current extraction and leaching operation,

Application of statistical methods: i). Propagation of errors of experimental data, ii). parameter estimation of algebraic equations encountered in heat and mass transfer, kinetics and thermodynamics by method of averages, linear least squares and weighted linear least squares methods and iii). design of experiments - factorial and fractional factorial methods.

TEXT BOOK:

1. 'Mathematical Methods in Chemical Engineering' by V.G. Jenson and G.V. Jeffreys, Academic Press, London

REFERENCE BOOKS:

1. 'Applied Mathematics in Chemical Engineering' by Harold S. Mickley, Thomas S. Sherwood and Charles E. Reed, Tata McGraw Hill Publications.

2. 'Introductory Methods of Numerical Analysis' By S.S. Sastry, Prentice Hall of India Private Limited, New Delhi.

CH-3204 (G) : FERTILIZER TECHNOLOGY (CORE ELECTIVE - II)

Course Objectives:

- To introduce various nutrients and their role in growth of a plant
- To introduce different types of the nitrogenous, phosphatic, potassic and compound fertilizers
- To introduce different fertilizer production methods

Course Outcomes: At the end of the course, the student will be able to

- understand different raw material availability
- Explain the beneficiation of rock phosphate
- Discuss the production of all types of fertilizers
- Formulate different fertilizer mixtures

SYLLABUS

Details about indigenous fertilizer production – raw materials, details of various nutrients with their importance, sources of nitrogen and hydrogen, steam reforming of hydrocarbons, partial oxidation of fuel cells with gas purification including high and low temperature shift conversion, carbondioxide removal processes and methanation.

Coal gasification, ammonia synthesis, thermodynamic principles associated with ammonia synthesis, ammonia reactors, nitric acid and sulfuric acid. Urea – total recycle and stripping processes, process details of ammonium sulfate, ammonium chloride, ammonium nitrate, calcium ammonium nitrate.

Phosphate rock – availability and beneficiation methods for upgrading, bone meal, basic slag, single super phosphate, triple super phosphate, phosphoric acid by wet process and furnace process, AMI process with hydrochloric acid, complex fertilizers like mono and di-ammonium phosphates, urea ammonium phosphate.

Text book :

1. 'Hand Book of Fertilizers' published by fertilizer Association of India, New Delhi

Reference Books :

1. 'Chemistry and Technology of Fertilizers' by V. Sauchelli, Reinhold Publications

2. 'Fertilizers Manual, a UNIDO Publication from International Fertilizer Development Centre, Alabama, USA.

3. 'Chemical Technology-II' published by IIT, Madras.

CH-3205 (A) : NANO SCIENCE & TECHNOLOGY (OPEN ELECTIVE-II)

Course Objectives:

- To give foundational knowledge of the Nano science and related fields.
- To make the students acquire an understanding the Nano science and Applications
- To help the students understand in broad outline of Nanoscience and Nanotechnology.

Course Outcomes:

- At the end of the course, the student will be able to
- Understand the properties of nanomaterials and their applications
 - Synthesize nanoparticles
 - Characterize nanomaterials
 - Scale up the production of nanoparticles
 - Understand applications of nanoparticles in nanobiology and nanomedicine

SYLLABUS

General Introduction: Basics of quantum mechanics, harmonic oscillator, magnetic phenomena, band structure in solids, Mossbauer and Spectroscopy, optical phenomena bonding in solids, anisotropy,

Silicon Carbide: Application of silicon carbide, nano materials preparation, sintering of SiC, X-ray diffraction data, electron microscopy sintering of nano particles, nano particles of alumina and zirconia, nano materials preparation, characterization, wear materials and nano composites,

Mechanical properties: Strength of nano crystalline SiC, preparation for strength measurements, mechanical properties, magnetic properties,

Electrical properties: Switching glasses with nanoparticles, electronic conduction with nano particles,

Optical properties: Optical properties, special properties and the coloured glasses Process of synthesis of nano powders, electro deposition, important nano materials Investigating and manipulating materials in the nanoscale: Electron microscope, scanning probe microscope, optical microscope for nano science and technology, X-ray diffraction

Nanobiology: Interaction between biomolecules and nanoparticle surface, different types of inorganic materials used for the synthesis of hybrid nanobio assemblies, application of nano in biology, nanoprobe for analytical applications - a new methodology in medical diagnostics and biotechnology, current status of nano biotechnology, future perspectives of nanobiology, nanosensors,

NanoMedicines: Developing of nano-medicines, nanosystems in use, protocols for nanodrug administration, nanotechnology in diagnostics applications, materials for used in diagnostics and therapeutic applications, molecular nanomechanics, molecular devices, nanotribology, studying tribology at nanoscale, nanotribology applications.

TEXT BOOKS:

1. 'Nano Materials' by A.K.Bandyopadhyay, New Age Publishers
2. 'Nano Essentials' by T.Pradeep, TMH.

CH-3205 (B) : INDUSTRIAL SAFETY & MANAGEMENT (OPEN ELECTIVE-II)

Course Objectives:

- To know about Industrial safety programs and toxicology, Industrial laws, regulations and source models
- To understand about fire and explosion, preventive methods, relief and its sizing methods
- To analyse industrial hazards and its risk assessment.

Course Outcomes:

At the end of the course, the student will be able to

- Analyze the effects of release of toxic substances
- Select the methods of prevention of fires and explosions
- Understand the methods of hazard identification and prevention.
- Assess the risks using fault tree diagram
- Explain safety management in general and in industry specific

- Plan emergency preparedness and understand the occupational health hazards.

SYLLABUS

Introduction :Industrial Safety, Incident, accident, near miss, hazard, risk, emergency, disasters, risk criteria, Safety at work.

Prediction and evaluation of unsafe conditions : Identification of unsafe areas, unsafe acts, manifestation of unsafe conditions to emergency situation, lessons from accidents and disasters, safety audit and its elements, safety in plant layout, equipment design. Construction, erection, commissioning, material handling.

Hazards – chemical hazards, thermodynamic hazards, electrical & electromagnetic hazards, mechanical hazards.

Risk – Definition, causes, potential and adverse effects. Hazard Analysis – incident scenarios, residual risk, Concept Hazard Analysis (CHA), Preliminary Process Hazard Analysis PPHA, HAZOP, Fault Tree Analysis (FTA), Event Tree Analysis (ETA).

Risk Assessment – Risk criteria, causes of death/damage, individual risk, societal risk, criteria for acceptable risk tolerable risk, application of risk assessment, computation of fatality rates, severity rates, vulnerability analysis, introduction to computerized risk assessment techniques.

Safety Management (General) – safety policy perceptions, safety organization, safety audit techniques, project and Construction Safety – welding & cutting operations, fabrication, material handling, equipment spacing, safe plant layout procedures, storage tanks, erection & commissioning works, housekeeping methods, maintenance of storage yards, erection & maintenance of electrical panels and MCC rooms, electrical & mechanical safe guarding.

Emergency Preparedness – onsite & offsite emergency preparedness, emergency preparedness plans, site specific action plans and contingency plans, emergency facilities, rehabilitation & rescue operations, post emergency actions.

Safety Management (Industry Specific)

Chemical Manufacturing Plants, Fertilisers, Steel Plants, Petrochemical Plants, Metallurgical Plants, Mineral Process Industries, Sugar plants, semiconductor industry, Polymer manufacturing plants, Paper industry, Pharmaceutical and bulk drug industries, Vessel manufacturing industry, LPG bottling plants, Power Plants, tanneries and textiles.

Statutory framework – key provisions of Factories Act, Environmental Protection Act, Manufacture, Storage and Import of Hazardous Chemical rules, Static and Mobile Pressure Vessels rules, NFPA specifications, OSHA regulations.

Occupational health management – occupational health perspectives, pre-employment & periodical medical examinations, diseases, causes, consequences, Occupational health hazards in various industries – aluminium industry, asbestos, battery manufacturing, sugar, cement, coke ovens, cotton ginning, dairy, electro plating, fish canning, poultries, irrigation, lead smelting, mining, pesticides, power plants, refineries, pulp & paper industry, PVC processing, steel plants, fertilizers, sulphuric acid plants, tanneries and textiles.

International standards – British council's five star rating systems, International Safety Rating Systems (ISRS), ISO 14001 EMS, ISO 18001 OHSAS, BIS 14489 Code of Conduct for conducting safety audits.

TEXT BOOKS:

1. "Hazards in Chemical industries, 3rd edition" – Authored by Frank P. Lees
2. "Hazard identification and risk assessment" – Authored by Geoff Wells; Published by Institution of Chemical Engineers, Davis Building, 165-189 Railway Terrace, Rugby, Warwickshire CV21 3HQ, UK.

REFERENCE BOOKS:

1. "Safety Management 5th edition" – Authored by John V. Grimaldi and Rollin H. Simonds; Published by A.I.T.B.S. Publishers & Distributors, J-5/6, Krishna Nagar, Delhi – 110051.
2. "Environmental Health and Safety Management" – Authored by Nicholas P. Cheremisinoff and Madelyn L. Graffia; Published by Jaico Publishing House, Hyderabad.

CH-3205 (C)

**ENVIRONMENTAL POLLUTION CONTROL ENGINEERING
(OPEN ELECTIVE-II)**

Course Objectives:

To understand the types of emissions from chemical industries and their effects on environment, methods of analysis of air pollutants, general methods of control like primary, secondary, tertiary treatment methods, solid waste management and Industrial safety.

Course Outcomes:

At the end of the course, the student will be able to

- Analyze the effects of pollutants on the environment
- Distinguish air pollution control methods
- Assess treatment technologies for wastewater
- Identify treatment technologies for solid waste
- Explain the hazards and safety measures in waste treatment

- Propose treatment methods for various industrial effluents

SYLLABUS

Types of emission from chemical industries and their effects on environment, Environmental legislation, noise pollution, occupational health hazards, meteorological factors in pollution dispersion (ALP and ELP), plume behaviour and characteristics, chimney design considerations: Plume rise, effective stack height.

Methods of analysis of air pollutants, particulate matter, SO_x , NO_x , CO_x analysis, removal of particulate matters: principles and design of settling chambers, solid traps, cyclone separators, fabric and design of fibre filters, scrubbers and electrostatic precipitators.

General methods of control and removal of sulphur dioxide, oxides of nitrogen, organic vapors from gaseous effluents with design aspects, sources of waste waters, effluent guidelines and standards, characterization of effluent streams, oxygen demanding wastes, oxygen sag curve, BOD curve, analysis of water pollutants.

Methods of primary treatment: Screening, sedimentation, floatation and neutralization, biological treatment, bacteria and bacterial growth curve, aerobic processes suspended growth processes, activated sludge process, extended aeration, contact stabilization, aerated lagoons and stabilization ponds, attached growth process with design aspects, trickling filters, rotary drum filters, fluidized bed contactors, anaerobic processes,

Methods of tertiary treatment: Carbon adsorption, ion exchange, reverse osmosis, ultra filtration, chlorination, ozonation & sonozone process, sludge treatment and disposal,

Solid waste management: solid waste collection, transportation, solid waste processing and recovery, hazards in waste management, risk assessment and safety measures, types of hazardous wastes, health effects, safety measures, risk assessment response measures, case studies or pollutants removal and safety measures in fertilizer, petrochemical, paper, pharmaceutical industries and petroleum refinery,

TEXT BOOK:

1. 'Environmental Pollution Control', by C.S. Rao, Wiley Eastern Limited.

REFERENCE BOOK:

1. 'Environmental Engineering' by Arcadio P. Sincero and Geogoria Sincero.

CH-3206 : MASS TRANSFER-II LABORATORY

Course Objectives:

- The student will learn about the LLE, dynamics and mass transfer in spray tower, packed tower and sieve tray tower.

- The students will learn the drying characteristics of the given solid material.

Course Outcomes:

At the end of the course, the student will be able to

- Determine the LLE
- Determine the critical moisture content in drying
- Determine separation performance and mass transfer coefficients of sieve plate
- Identify the axial mixing characteristics in packed bed
- Evaluate the dynamics of liquid drops.

List of experiments:

1. Ternary liquid equilibria (Binodal curve)
2. Liquid-liquid equilibria.
3. Limiting flow rates in spray tower
4. Hydrodynamics of perforated plate tower
5. Volumetric mass transfer coefficients in perforated plate tower
6. Dynamics of liquid drops (Single drop extraction tower)
7. Studies of axial mixing characteristics in a packed bed
8. Gas-liquid mass transfer in packed tower
9. Drying characteristics of a given material

CH-3207 : CHEMICAL REACTION ENGINEERING LABORATORY

Course Objectives:

- To familiarize students with main type of chemical reactors
- To analyze the experimental data to obtain the reaction rate expression (reaction order and specific reaction rate constant)
- To compare the conversion of reactants for a specific reaction in various types of reactor.
- To understand the concept of residence time distribution in reactor systems.
- To determine mass transfer coefficient of systems with chemical reaction

Course Outcomes:

At the end of the course, the student will be able to

- Determine the kinetics of a reaction in a batch reactor, CSTR, & PFR

- Determine the mass transfer coefficient (solid-liquid reacting system)
- Determine the kinetics by fractional conversion method
- Determine the temperature dependency of a reaction
- Evaluate the performance of reactors through RTD studies
- Compare the performance of single reactor with combination of reactors

List of experiments:

1. Determination of the order of a reaction using a batch reactor and analyzing the data by (a) differential method and (b) integral method
2. Determination of the activation energy of a reaction using a batch reactor
3. To determine the effect of residence time on conversion and to determine the rate constant using a CSTR
4. To determine the specific reaction rate constant of a reaction of a known order using a batch reaction.
5. To determine the order of the reaction and the rate constant using a tubular reactor
6. Determination of RTD and dispersion number in a tubular reactor using a tracer
7. Mass transfer with chemical reaction (solid-liquid system) – Determination of mass transfer coefficient
8. Axial mixing in a packed bed - Determination of RTD and the dispersion number for a packed bed using tracer
9. Langmuir adsorption isotherm - Determination of surface area of activated charcoal.
10. Performance of reactors in series: (i) A plug flow reactor followed by a CSTR and (ii) A CSTR followed by a plug flow reactor.

CH-3208 : PROCESS INSTRUMENTATION & CONTROL LABORATORY

Course Objectives:

- To understand the dynamic behavior of the systems
- To evaluate response of first and higher order characteristics.
- Study the installed characteristics of the valve.
- Study if there is a hysteresis in the control valve and sensor.
- Evaluate the tuning of a PID control via manual and automatic tuning.

Course Outcomes:

At the end of the course, the student will be able to

- Identify the dynamics of first order, second order, interacting and non-interacting processes

- Determine control valve characteristics
- Evaluate the hysteresis characteristics of Bourdon pressure gauge
- Implement PID controller on a level control, temperature control and pressure control process
- Demonstrate PID control trainer.

List of experiments:

1. Response of mercury-in glass thermometer
2. Response of mercury-in glass thermometer with thermal well.
3. Calibration & response of resistance thermometer
4. Response of manometer
5. Calibration of thermocouples
6. Response of single-tank liquid level system
7. Response of two-tank non-interacting liquid level system
8. Response of two tank interacting liquid level system
9. Study of on-off control – Control let off position.
10. Valve characteristics of equal % control valve
11. Valve characteristics of linear control valve
12. On-off control – controller on position
13. Studies on hysteresis characteristics of Bourdon pressure gauge
14. Hysteresis characteristics of equal % control valve
15. Studies on hysteresis characteristics of linear control valve
16. Response studies for different types of controller (P, PI, PID) using PID control trainer.
17. Level control trainer
18. Pressure control trainer
19. Temperature control trainer

CH-3209 : INTELLECTUAL PROPERTY RIGHTS

Course Objectives:

- To introduce fundamental aspects of intellectual property rights.
- To disseminate knowledge on copyrights and its related rights and registration
- To provide comprehensive knowledge to the students regarding Indian position of patent law, procedure for granting patent, Infringement
- To provide knowledge to the students regarding registration of trade mark, Infringement of trade mark.

Course Outcomes:

At the end of the course, the student will be able to

- Identify the types of IP and the importance of protection of IP

- Differentiate the foundation and patent laws in India and developed countries
- Explain how to obtain copy right and law of copy rights
- Learn the purpose and function of trade marks and registration of trade mark
- Describe risks involved and legal aspects of Trade Secret Protection
- Understand IP Infringement issue and enforcement.

SYLLABUS

Introduction to Intellectual Property: Historical Perspective, Different Types of IP, agencies and treaties, Importance of protecting IP, international organizations, Innovations in products, processes, services and procedures - product life cycles, favorable and unfavorable aspects in innovation; Inventions as intellectual property.

Patents :Historical Perspective, Basic and associated right, WIPO, PCT system, Traditional Knowledge, Patents and Healthcare – balancing promoting innovation with public health, Software patents and their importance for India, Foundation of patents and patent laws, procedures in India and developed countries; study of patents in different fields and their innovative content; patent searching process, ownership rights and transfer.

Copyrights: Introduction, How to obtain a copy right and Law of copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law, Differences of copyrights from Patents.

Geographical Indications: Definition, rules for registration, prevention of illegal exploitation, importance to India.

Trade Marks: Introduction to trademarks, Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting, and evaluating trade mark, trade mark registration processes.

Trade Secrets: Introduction and Historical Perspectives, Scope of Protection, Trade secret law, Risks involved and legal aspects of Trade Secret Protection, Determination of trade secret status, liability for misappropriations of trade secrets, protection for submission, trade secret litigation, Unfair competition: Misappropriation right of publicity, false advertising.

New developments and Infringement Issues of IP:

New development of intellectual property: New developments in trade mark law; copy right law, patent law, intellectual property audits. International overview on intellectual property, international – trade mark law, copy right law, international patent law, and international development in trade secrets law, motivating and encouraging innovative attitude in

individuals and organizations; entrepreneurial qualities and skills, learning and training.

IP Infringement issue and enforcement– Role of Judiciary, Role of law enforcement agencies – Police, Customs etc. Economic Value of Intellectual Property – Intangible assets and their valuation, Human attitudes, risks, hardships, examples of failure, case studies of inventors; Intellectual Property in the Indian Context – Various laws in India Licensing and technology transfer.

REFERENCE BOOKS:

1. Ganguli, P. Intellectual Property Rights: Unleashing the Knowledge Economy, Tata McGraw-Hill (2001).
2. Intellectual property right, Deborah. E. Bouchoux, Cengage learning.
3. Acharya, N.K. Textbook on intellectual property rights, Asia Law House (2001).
4. Miller, A.R. & Davis, M.H. Intellectual Property: Patents, Trademarks and Copyright in a Nutshell, West Group Publishers (2000).
5. Watal, J. Intellectual property rights in the WTO and developing countries, Oxford University Press, New Delhi.

CH -3210 : ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

Course Objectives:

- To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.
- To make the students understand the traditional knowledge and analyse it and apply it to their day to day life

Course Outcomes:

At the end of the Course, Student will be able to:

CO 1:Identify the concept of Traditional knowledge and its importance.

CO 2:Explain the need and importance of protecting traditional knowledge.

CO 3:Illustrate the various enactments related to the protection of traditional knowledge.

CO 4:Interpret the concepts of Intellectual property to protect the traditional knowledge.

CO 5:Explain the importance of Traditional knowledge in Agriculture and Medicine.

SYLLABUS

Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional

knowledge, Indigenous Knowledge (IK), characteristics, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge

Protection of traditional knowledge:The need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.

Legal framework and TK: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act); The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016.

Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge

Traditional Knowledge in Different Sectors: Traditional knowledge and engineering, Traditional medicine system, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK

TEXT BOOKS:

1. Traditional Knowledge System in India, by Amit Jha, 2009.

REFERENCE BOOKS:

1. Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002.
2. "Knowledge Traditions and Practices of India" Kapil Kapoor, Michel Danino.

SUMMER INTERNSHIP PROGRAM (2MONTHS)

All the students have to undergo Summer Internship for two months in the industries at the end of the third year second semester.

CH-4101 : TRANSPORT PHENOMENA

Course Objectives:

- To make students understand the use of basic laws of mass, momentum and energy transport in the engineering analysis.
- Momentum transport deals with evaluation of velocity distributions in steady and unsteady laminar flow problems in simple geometries of Newtonian and non-newtonian fluids.
- Energy transport deal with the evaluation of steady/ unsteady temperature distributions in solids and in laminar flow.

- Mass transport deals with the evaluation of steady state concentration profiles with or without chemical (Homogeneous/ heterogeneous) reaction.

Course Outcomes:

At the end of the course, the student will be able to

- Identify the transport properties of solids, liquids and gases
- Formulate a mathematical representation of flow / heat / mass transfer phenomena
- Solve steady state flow/heat/mass transfer problems for simple geometries analytically
- Solve unsteady flow/ heat problems for simple geometries

SYLLABUS

PART - A

Momentum transport: Viscosity and the mechanism of momentum transport- i). Newton's law of viscosity, ii). Non-Newtonian fluids and iii). pressure and temperature dependence of viscosity,

Velocity distributions in laminar flow: i). Shell momentum balances boundary conditions, ii). flow of a falling film, iii). flow through a circular tube and iv). flow through an annulus,

The equations of change for isothermal systems: i). The equations of continuity, motion and mechanical energy in rectangular and curvilinear coordinates, ii). use of the equations of change to set up steady flow problems and iii). dimensional analysis of the equations of change, Velocity distributions with more than one independent variable and unsteady viscous flow,

PART-B

Energy transport: Thermal conductivity and the mechanism of energy transport- i). Fourier's law of heat conduction and ii). temperature and pressure dependence of thermal conductivity in gases and liquids,

Temperature distributions in solids and in laminar flow: i) Shell energy balances-boundary conditions, ii). heat conduction with an electrical heat source, iii). heat conduction with a viscous heat source, iv). heat conduction through composite walls, v). forced convection and vi). free convection,

The equations of change for non-isothermal systems: i). The equation of energy in rectangular and curvilinear coordinates, ii). the equations of motion for forced and free convection in non-isothermal flow, iii). use of the equations of change to set up steady state heat transfer problems and iv). dimensional analysis of the equations of change,

Temperature distribution with more than one independent variable: Unsteady state heat conduction in solids,

PART-C

Mass transport: Diffusivity and mechanism of mass transport- i). Definitions of concentrations, velocities and mass fluxes, ii). Fick's law of diffusion and iii). temperature and pressure dependence of mass diffusivity.

Concentration distribution in solids and in laminar flow: i). Shell mass balances – boundary conditions, ii). diffusion through a stagnant gas film, iii). diffusion with heterogeneous chemical reaction, iv). diffusion with homogeneous chemical reaction and v). diffusion into a falling liquid film,

The equations of change for multi-component systems: i). The equations of continuity for a binary mixture, ii). the equations of continuity of A in curvilinear coordinates and iii). dimensional analysis of the equations of change for a binary isothermal fluid mixture,

TEXT BOOK:

1. 'Transport Phenomena' by R. Byron Bird, W.E. Steward and Edwin N. Lightfoot, John Wiley & Sons Inc., New York

REFERENCE BOOKS:

1. Transport phenomena' by Robert S. Brodkey & Harry C. Hershey, McGraw Hills Company, New York

2. Transport Phenomena-for engineers' by Louis Theodore, International Book Company, London

3. 'Transport Phenomena' by W.J. Book and K.M.K. Murtzall, JW & Sons Ltd.

4. 'Fundamentals of Momentum, Heat and Mass Transfer' by M. M. El-Wakeel, Charles Wicks and Robert E. Wilson, J W & Sons Inc., New York

5. Fluid Dynamics and Heat Transfer' by James G. Knudsen and Donald L. Katz., McGraw Hills Company Inc., New York.

CH-4102 : PROCESS ENGINEERING & ECONOMICS

Course Objectives:

- To introduce types of interests, annuity, perpetuity, bond, debenture
- To introduce depreciation and cost accounting methods
- To introduce cash flow tree diagram, methods of cost estimation.
- To introduce profitability, profitability evaluation
- To introduce optimization in industries
- To introduce economic balance of various operations.

Course Outcomes:

At the end of the course the student will be able to

- Determine costs involved in process plants.
- Estimate depreciation costs and various ratios to tell about financial status of the company

- Perform economic analysis and optimum design of the processes
- Evaluate project profitability.

SYLLABUS

Value of money - equivalence: Value of money, equations for economic studies, equivalence, types of interest- discrete and continuous, annuities - relation between ordinary annuity and the periodic payments, continuous cash flow and interest compounding, present worth of an annuity, perpetuities and capitalized costs, bonds and debentures, value of a bond and yield rate,

Depreciation: Types and various methods of calculating depreciations, depreciation accounting.

Cost accounting: Basic relationship in accounting, balance sheet and income statement, various ratios to study the balance sheet and income statements,

Cost estimation: Cash flow for industrial operations, factors affecting investments and production costs, estimation of capital investment, cost indices, cost factors in capital investment, methods of estimating capital investment, estimation of total product cost- manufacturing costs and general expenses,

Profitability: Alternate investments and replacements. mathematical methods for profitability evaluation, economic production charts for plants operating below 100%, above 100% and under dumping conditions, general procedure for determining optimum conditions, break even chart for production schedule and its significance for optimum analysis, Economic balance in fluid flow, heat transfer and mass transfer operations; optimum economic pipe diameter in fluid dynamics, optimum flow rate of cooling water in condenser in heat transfer and optimum reflux ratio in distillation operation,

Economic balance in cyclic operations and semi continuous cyclic operations, economic balance in yield and recovery, economic balance in chemical reactors, batch and flow reactors.

TEXT BOOKS:

1. 'Plant Design and Economics for Engineers' by Max S. Peters and K.D. Timmerhans, McGraw Hill Book Company,
2. 'Process Engineering Economics' by Herbert E. Schweyer, McGraw Hill Book Company.

CH-4103: CHEMICAL PROCESS EQUIPMENT DESIGN

Course Objectives:

This subject introduces the student to the science and art of chemical engineering design. By applying all the knowledge acquired so far, the

student will be trained to develop project reports and to carryout design calculations of various process equipment. Finally the student will be able to come out the investment needed for a particular process and also finds out the returns on investment.

Course Outcomes:

At the end of the course, the student will be able to

- Develop process design
- Enumerate general design consideration
- Design incompressible/compressible flow systems and estimate cost of filters.
- Select high and low pressure vessels
- Design of distillation column, heat exchangers and evaporators

SYLLABUS

Introduction of plant design and costs,

Process design development: Design project procedure, design information from the literature and other sources of information, flow diagrams, preliminary design, comparison of different processes, firm process design, equipment design and specialization, scale up in design, safety factors specifications, materials of construction,

General design considerations: Health and safety hazards, fire and explosion hazards, personnel safety, loss prevention, thermal pollution control, noise pollution and control, plant location, plant layout, plant operation and control, utilities, structural design, storage, materials handling, materials and fabrication selection.

Material transfer, handling and treatment equipment design and costs: Pumps and piping, frictional effects due to end losses, fittings, orifices and other installations, piping standards, pumps, tanks, pressure vessels and storage equipment, filters.

Mechanical design of process equipment: Design and selection of storage vessels and low pressure vessels, design of roofs, bottom plates, formed heads, flat plate and conical closures, tall vertical columns, supports to process vessels, distillation columns, heat exchangers, evaporators.

Heat transfer equipment design and costs: Basic theory of heat transfer, consideration in selection of heat transfer equipment, General methods for process design of heat exchangers, evaporators.

Mass transfer equipment design: Finite stage and continuous contactors, plate and column efficiencies, other design factors for finite stage contactors, packed towers, relative merits of plate and packed towers, mass transfer equipment costs, reactors.

TEXT BOOKS:

1. 'Plant design & Economics for Chemical Engineers', 4th edition, M.S.Peters&K.D.Timmerhaus, McGraw Hills Publishing Company
2. 'Process Equipment Design', 3rd Edition, M.V.Joshi, MacMillan India Ltd 1981

REFERENCE BOOKS:

1. 'Process-Plant-Design' by J.R.Backhurst&J.H.Harker, Heieman Education London
2. 'Chemical Engineering' Volume-VI (An introduction to Chemical Engineering Design) by J.M.Coulson & J.F.Richardson

CH-4104(A) : COMPUTER AIDED DESIGN (CORE ELECTIVE -III)

Course Objectives:

To revise the basic concepts in Fluid Mechanics, Heat Transfer, Mass Transfer and Chemical Reaction Engineering and apply the numerical methods with the aid of computer in designing such systems.

Course Outcomes:

At the end of the course, the student will be able to

- Elaborate the need of computer aided design and advantages of simulation
- Design the size of the pipe for a given pressure drop for Newtonian and non-newtonian fluids
- Evaluate pressure drop in compressible fluid flow, pipe line networks and two phase flow
- Develop the rating and design calculations in heat exchangers, distillation columns, extraction cascades, plate/packed bed absorbers and isothermal flash.
- Design ideal reactors, packed bed and fluidized bed reactors
- Estimate rate of extent of reaction vector for simultaneous reactions

SYLLABUS

CAD of fluid flow system:

Flow of Newtonian fluids in pipes

Pressure drop in compressible flow

Flow of Non-Newtonian fluids in pipes

Pipe network calculations

Two phase flow system,CAD of Heat transfer equipment: Shell and tube exchangers without phase change,Condensers, Reboilers,Furnaces,CAD of Mass transfer equipment: Distillation,Gas absorption ,Liquid extraction,CAD of chemical Reactors: Chemical reaction

equilibrium ,Analysis of rate data, Ideal reactor models,Non-ideality in chemical reaction,Performance analysis using residence time distribution,Temperature effects in homogeneous reactors,Heterogeneous systems, Fluidized bed reactors.

TEXT BOOK:

1. Chemical Process Computations by Raghu Raman.Elsevier Scientific Publishers, London, 1987

REFERENCE. BOOKS:

1. Fundamentals and Modelling of Separation process by C D Holland, rentice Hall Inc. New Jercey, 1975
2. Catalytic Reactor Design by Orhan, Tarhan, Mc Graw Hill, 1983
3. Chemical Engineering, Vol 6 by Sinnot, Pergamon Press, 1993

CH-4104 (B) :

INDUSTRIAL POLLUTION AND CONTROL ENGINEERING (CORE ELECTIVE -III)

Course Objectives:

1. To understand the types of emissions from chemical industries and their effects on environment, remedial measures.
2. To enable the students to design water treatment system & to acquire knowledge on proper management of solid wastes.
3. To provide a general idea about safety in chemical industries.

Course Outcomes:

At the end of the course, the student will be able to

- Analyze the effects of pollutants on the environment
- Distinguish air pollution control methods
- Assess treatment technologies for wastewater
- Identify treatment technologies for solid waste
- Identify and manage industrial hazards

SYLLABUS

Types of emission from chemical industries and their effects on environment, Environmental legislation, noise pollution, occupational health hazards, meteriological factors in pollution dispersion (ALP and ELP), plume behaviour and characteristics, chimney design considerations: Plume raise, effective stack height,

Methods of analysis of air pollutants, particulate matter, SO_x, NO_x, CO_x analysis, removal of particulate matters: principles and design of setting

chambers, solid traps, cyclone separators, fabric and design of fibre filters, scrubbers and electrostatic precipitators,

General methods of control and removal of sulphur dioxide, oxides of nitrogen, organic vapors from gaseous effluents with design aspects, sources of waste waters, effluent guidelines and standards, characterization of effluent streams, oxygen demanding wastes, oxygen sag curve, BOD curve, analysis of water pollutants,

Methods of primary treatment: Screening, sedimentation, floatation and neutralization, biological treatment, bacteria and bacterial growth curve, aerobic processes suspended growth processes, activated sludge process, extended aeration, contact stabilization, aerated lagoons and stabilization ponds, attached growth process with design aspects, trickling filters, rotary drum filters, fluidized bed contactors, anaerobic processes,

Methods of tertiary treatment: Carbon adsorption, ion exchange, reverse osmosis, ultra filtration, chlorination, ozonation & sonozone process, sludge treatment and disposal,

Solid waste management: solid waste collection, transportation, solid waste processing and recovery, hazards in waste management, risk assessment and safety measures, types of hazardous wastes, health effects, safety measures, risk assessment response measures, case studies or pollutants removal and safety measures in fertilizer, petrochemical, paper, pharmaceutical industries and petroleum refinery,

Industrial safety: Why safety, accidents, causes and remedial measures, safety aspects of site selection, plant layout and unit plot planning, hazards of commercial chemical operations and reactions, safety aspects of process design, instrumentation for safe operations, safety aspects in design and inspection of pressure vessels, effect of toxic agents, toxicity vs hazards, respiratory hazards, safe experimentation and testing of reactions, materials for safety,

Flamable materials: Fire extinguishing agents and their applications, eye safety in chemical processing, personnel protective equipment, permit systems, hazard evaluation techniques, modern safety management systems, safety effectiveness.

TEXT BOOKS :

1. 'Environmental Pollution Control', by C.S. Rao, Wiley Eastern Limited

2. 'Safety and Accident Prevention in Chemical Operations' by Fawcett and Wood.

REFERENCE BOOKS:

1. 'Environmental Engineering' by Arcadio P. Sincero and Geogoria Sincero

2. 'Loss Prevention in Chemical Industries' by Frank P. Lees

CH-4104(C) : PROCESS OPTIMIZATION (CORE ELECTIVE -III)

Course Objectives:

Optimization of Chemical Process is an important of subject for Chemical Engineers. It deals with various optimization techniques in reducing cost of production, energy consumption, maximum throughput and minimum labour cost etc. On studying the course one can understand how to write a model of the process optimize the process using the model

Course Outcomes:

At the end of the course, the student will be able to

- Understand the definition of Optimization and how to write an Objective function
- Understand various types of Objective functions like Concave and Convex functions and its properties
- Study the Optimization of uni&multi dimensional search problems
- Solve the Optimization problems by Linear and Non-Linear Programming methods

SYLLABUS

Definition of optimization Applications of optimization optimal insulation thickness Requirements for an optimization technique, Writing an objective function Production schedule, material balance requirements, six steps of solving an optimization problem

Basic concepts of optimization continuous and discontinuous, unimodal and multi modal functions concave and convex functions, Finding the optimal point, definition of maximum, minimum and saddle points with examples

Unconstrained unidimensional search, Newton method Quasi Newton method and Secant method, Speed of iterations linear, order p and super linear, Quadratic interpolation, cubic interpolation, Region elimination method, Fabonacci and Golden section method

Multivariable unconstrained optimization, direct methods Powell method, Conjugate search direction, Gradient and conjugate Gradient, Fletcher Reeves method, Positive definite of Hessian matrix Marquadt method

Linear programming, definition, solving the refinery schedule problem by linear programming method using graph, Simplex method and definition

Non linear programming, Lagrange multiplier method, Iterative linearization and Quadratic programming method, Necessary and sufficient condition for a minimum value, Kuhn-tucker conditions

TEXT BOOKS:

1. Optimization of Chemical Process by Edgar and Himmelblau, 2nd edition, Mc GrawHill Publications.
2. Optimization Theory and Applications by S.S. Rao, 2nd Edition, Wiley Eastern Limited.
3. Formulation and optimization of Mathematical Models by C.L.Smith, R.W. Pike and P.W.Mur.

CH-4104(D) : RESERVOIR ENGINEERING (CORE ELECTIVE -III)

Course Objectives:

To know the fundamental concepts of reservoir engineering, basic properties of reservoir rocks, various types of reservoirs and driving mechanisms for the production of Oil and gas from an oil reservoir.

Course Outcomes:

At the end of the course, the student will be able to

- Identify the type of oil reservoirs by knowing the characteristics and mechanisms.
- Predict the reservoir performance by knowing the past performance history of the oil reservoir.

SYLLABUS

Fundamental concepts of Reservoir Engineering: Porosity, fluid saturation, permeability, flow through layered beds, flow through series beds, Klinkenberg effect, effective permeability data, phase behavior.

Oil reservoirs: Reservoir driving mechanisms, basic equation and tools, volatile oil reservoirs, identification of volatile oil reservoirs, ultimate recovery, predicting reservoirs behavior, performance, mechanics of reservoir performance, prediction procedure, limitations of predictions, relating reservoir performance to time, factors affecting ultimate recovery, analysis of gas oil ratio history.

Depletion drive reservoirs: Producing characteristics and methods of identification, detailed procedure for predicting reservoir performance, limitations of predictions, factors affecting ultimate recovery.

Water drive reservoirs: Effect of free gas saturation on recovery, predicting reservoirs performance, calculating water influx, use of the unsteady state equation in predicting reservoir performance, validity of performance prediction, limitations in predicting reservoir performance, the material balance equation as a straight line.

Gravity drainage reservoirs: Permeability in the direction dip, dip of the reservoir, reservoir producing rates, oil viscosity, relative permeability characteristics, fundamental recovery process, predicting reservoir performance, apparent relative permeability, oil saturation method.

Combination of drive reservoirs: Index of drives, equations used, material balance equations, instantaneous gas- oil ratio equation.

Pressure maintenance: Pressure maintenance by gas injection, condensing gas drive, predicting performance by gas injected gas drive index, pressure maintenance by water injection, predicting performance by water injection, index of injected water drive, control of the gas cap, typical water injection pressure maintenance operations.

Improving oil recovery: Improving oil recovery by fluid immiscible gas–water, miscible fluid injection thermal oil recovery, predicting recovery from fluid injection products, Stiles's method of water flood prediction, derivation of water cut and recovery equations, frontal advance techniques for prediction result of either water or gas injection, well arrangements, peripheral water flooding, predicting behavior of peripheral water floods, special consideration involved in water flooding, water flood case history, predicting the results of water flooding.

TEXT BOOK:

1. 'Reservoir Engineering Manual' – 2nd Edition by Frank W. Cole, Gulf Publishing Company, Houston, Texas, 1969.

CH-4104(E)

FUELS, REFRACTORIES AND FURNACES (CORE ELECTIVE - III)

Course Objectives:

The main objective of this course is to study the different minerals used for the manufacturing of different types of refractories and its large scale applications in industries.

Course Outcomes:

At the end of the course, the students will be able to

- Understand the importance, types of refractories, properties, design and installation and different types of coatings on refractories.
- Explain about special refractories
- Describe refractories for iron & steel industry, Glass industry and cement & nonferrous industry

SYLLABUS

Introduction of Refractories

Production, demand and growth of refractories in India – layout of modern refractory plant – fundamental properties of refractories – Indian and international standards – factors for selection and use of refractories – test and quality control procedures.

Silica Refractories

Raw materials and composition – manufacturing process steps – quality of raw materials and process parameter on quartz inversion – glassy phase and other micro structural features – porosity, strength, RUL dependence on micro structure – specifications of silica refractories.

ALUMINA – SILICA REFRACTORIES

Al_2O_3 – SiO_2 phase diagram – clay, pyrophyllite, sillimanite, grog, bauxite and diaspore as raw materials – manufacturing processes – micro structure and properties

BASIC PROPERTIES

Magnesite, forsterite, dolomite and chrome based refractories – raw materials and composition – manufacturing processes – micro structure and properties.

SPECIAL REFRACTORIES

Oxide based, carbide based and nitride based refractories – cordierite – zirconia – carbon – fusion cast refractories, slide gate, purging refractories, and continuous casting refractories – ceramic fibres.

REFRACTORIES FOR IRON AND STEEL INDUSTRY

Coke oven, blast furnace, twin hearth, LD converter – continuous casting – electric arc furnace, induction furnaces – reheating furnaces – slide plate system – nozzle, shroud/ SDN – ladle and tundish lining practices – monolithic - gunning techniques – refractor, slag and metal interactions.

REFRACTORIES FOR CEMENT AND NON FERROUS INDUSTRY

Wet/ dry process for cement making – preheater and pre calcinatory and zone lining – alkali and wear resistance – refractory requirement and use in copper, aluminum and hydro carbon industry – use of monolithic.

REFRACTORIES FOR GLASS INDUSTRY

Design of glass tank for container, sheet, lamp, float glasses, refractory practices in side wall, throat, forehearth, and roof of glass tanks – regenerator systems – alumina and AZS fused cast refractories – glass corrosion resistance, oxidation, seed potential tests – glass defects and analysis – feeder expendables

REFRACTORIES FOR CERAMIC INDUSTRY

Kiln furniture – types – properties of requirement - silicon carbide, mullite, cordierite, alumina, zirconia – mullite, zirconia types – kiln design – LTM concept – fast firing technology

REFRACTORIES FOR ENERGY CONSERVATION

Insulation refractories – types- ceramic fiber product – design and installation – ceramic coatings – case studies in ceramic fiber usage.

TEXTBOOK:

1. B. M. Coop and E. M. Piekson, Raw Materials for the refractory industries and industry materials and consumer survey, 1981.

REFERENCE BOOKS:

1. J. H. Eheslers Refractories: production and Properties. Iron and Steel Institute, London, 1972.

2. Akira Nistrikawa, Technology of monolithic refractories, Plibrico japan co. Tokyo 1984

3. D.N. Nandi, Hand Book Refractory's, Tata Mc Graw hill publishing Co. New Delhi 1991

4. K.Shaw, Refractories and thick uses ADP sciences publisher U K 1972

5. Keishi GOTON, Powder Technology Hand Book, Marcel Dekker Inc. 1997

6. Chester J.H., Steel Plant Refractories, 2nd Edition, 1973, United Steel Companies Limited, Sheffield UK

7. Advances in Refractory Technology, Ed. Robert E Fisher, Ceramic Transaction Vol 4., American Ceramic society, 1990, Westerville, Ohio, USA.

CH-4104(F) : BIOCHEMICAL ENGINEERING (CORE ELECTIVE - III)

Course Objectives:

- To apply the chemical engineering principles in biological systems.

Course Outcomes

At the end of the course, the student will be able to

- Understand cell and enzyme kinetics
- Discuss methods of immobilization
- Calculate volume of a fermentor
- State sterilization methods
- Select downstream process to separate the products
- Estimation using various Bioanalytical techniques

SYLLABUS

Introduction to Biochemical engineering and Biotechnology: Overall view of biotechnology since its practice–to date, enzyme kinetics, derivation of M.M. equation of single as well as multiple substrates, enzyme inhibition, determination of M.M. parameters, industrial applications of enzymes,

Cell cultivation & kinetics: Microbial, animal and plant cell cultivation, cell immobilization, batch growth of cells, yield coefficient, monod growth kinetics,

Analysis and design of fermenters: Batch fermenter, mixed flow fermenter (chemostat), plug flow fermenter, mixed flow fermenters in series, and cell recycling,

Genetic engineering: DNA and RNA, cloning of genes, stability of recombinant microorganisms, gene manipulation,

Sterilization: Sterilization of media and air, thermal death kinetics, design criterion, continuous sterilization methods, Aeration and agitation in fermenters: Correlations of mass transfer coefficient, measurement of interfacial area and gas holdup, power consumption, scale up concepts,

Bioanalytical techniques: Gas chromatography, thin layer and paper chromatography, HPLC, affinity, gel, adsorption and ion exchange chromatography.

TEXT BOOK :

1. 'Biochemical Engineering Fundamentals' 2nd edition by J.E.Bailey and D.F.Ollis, McGraw-Hill Publishers, Newyork, 1986

REFERENCE BOOKS:

1. 'Chemical Engineering' volume-3, 3rd Edition by J.F Richardson and D.G. peacock, (Chapter-5: Biochemical Reaction Engineering), Pergomon Press, U.K, 1994

2. 'Bioprocess Engineering: Basic Concepts' 2nd edition by M.L.Shuler and F.Kargi, Prentice Hall India, New Delhi, 2003

3. 'Biochemical engineering' by D.G. Rao, Tata McGraw-Hill Publishers, New Delhi,

4. 'Biochemical Engineering' by J.M. Lee, Prentice Hall, Englewood Clifts, 1992.

CH-4104(G) : PAPER TECHNOLOGY (CORE ELECTIVE - III)

Course Objectives:

To understand the growth prospects of Indian paper mills, history of paper industry, different types, composition and uses of paper, raw materials for paper making, preparation of raw materials, classification of fibers, recovery of cooking chemicals from spent cooking liquors, Pulping processes, manufacture of paper and Testing of different properties of pulp and paper and the types of pollutants from paper industry and their treatment.

Course Outcomes: At the end of the course, the student will be able to

- Understand the history of development of paper industry in India and Importance of paper industry, historical background of paper making.
- Explain growth prospects of Indian Paper mills.
- Design the equipment used for the manufacture of paper.

- Explain how to reduce the paper wastes
- Maximize the production rate and recovery of useful chemicals.

SYLLABUS

History: Importance of paper industry, historical background of paper making, development of paper industry in India, Different types and uses of paper: Different types and uses of papers and paper boards, composition, method of making different types of papers and boards, Raw materials for paper making: Classification of fibres, characteristics and composition of some important vegetable fibers (hard woods, softwoods, bagasse, straws, rags and paper stock)Preparation of raw materials: Wood preparation – pulp wood measurement, barking, chipping, screening and conveying of chips)Pulping processes: Mechanical pulping, alkaline pulping (Soda and Kraft), sulfite pulping, semi-chemical pulping, recovery of cooking chemicals from spent cooking liquors, Pulp bleaching: Bleaching agents, bleaching methods – single stage and multi stage bleaching, Stock preparation: Beating and refining, sizing and loading (filling),Manufacture of paper: Paper machines (Fourdrinier and Cylinder), making of paper – forming section, press section, dryer section, calendaring section, Testing of different properties of pulp and paper: Testing and evaluation of pulp, various properties of pulp and paper and their testing.

TEXT BOOKS:

1. 'Handbook of Pulp and Paper Technology' by Kenneth W.Britt, Vols.I&II

2. 'Modern Pulp and Paper Making' edited by John B.Calkin

3. 'Pulp and Paper: Science and Technology - Vols.I&II' by E.Libby, McGraw Hill Books Co.

4. 'Pulp and Paper Manufacture- Vols. I & II' by R.C.McDonald & Others, McGraw Hill Books Company.

CH-4105 : OPEN ELECTIVE –III

Open Elective –III and Open Elective-IV are MOOCS courses
(To be specified/ approved by BOS)

CH-4106 : OPEN ELECTIVE-IV

Open Elective –III and Open Elective-IV are MOOCS courses
(To be specified/ approved by BOS)

CH-4107

CHEMICAL PROCESS EQUIPMENT DESIGN LABORATORY (Open book practical examination)

Course Objectives:

The objective of the course is to design the heat exchangers and to check the suitability of the given heat exchanger and to learn how to

formulate problems involving use of “new” and “old” equipment. The students will solve problems mass transfer equipments and chemical reactors

Course Outcomes:

At the end of the course, the student will be able to

- Design double pipe heat exchanger and shell and tube heat exchanger with/ without phase change
- Evaluate the suitability of given heat exchanger for the process
- Design the plate column absorption/ distillation tower
- Evaluate the performance and design of continuous/batch reactors

SYLLABUS

The following equipment are to be designed in detail:

1. Double pipe Heat Exchangers
2. Sensible heat exchangers (1-2 or 2-4),
3. Condenser and reboiler,
4. Multiple effect evaporator
5. Fractionating / Absorption column-Plate and packed columns,
6. Packed bed absorber,
7. Continuous and Batch reactors (homogeneous and heterogeneous)

CH-4108 : SUSTAINABLE PROCESS ENGINEERING

Course Objectives: This subject attempts to address the gap existing between industry and institute. The student is introduced to various terminology and practices that are followed in the industry. This subject also deals with the application of core chemical engineering knowledge to the modern aspects of chemical engineering such as sustainability, green engineering, process safety and enterprise resource planning.

Course Outcomes:

At the end of the course, the student will be able to

- Explain the sustainability concepts
- Summarize waste minimization in reactors, separation processes and operations
- Identify waste in utility systems
- Identify hazards and implement safety management
- Plan enterprise resource and sustainable industries

SYLLABUS

Sustainability concepts – the concept of sustainable development, sustainability in the context of the process industries, some temporal characteristics of sustainability, the sustainable project or industry, conflicts in achieving sustainability objectives.

Cleaner production – introduction, the concept of cleaner production, the product life cycle, hierarchy of waste management, concepts and sources of waste, impacts of waste, driving forces for cleaner production, resistances to introducing cleaner production.

Industrial ecology – basic concepts, energy and materials recovery from waste streams, resource flow through the economy, transport and storage of raw materials and products, integrated site manufacture, some examples of industrial ecology initiatives.

Waste minimization in reactors – introduction, a checklist for reaction systems and reactors, chemistry of process route, impurities in reactor feed stocks, mixing of reactants, minimizing secondary reactions, recycle of unreacted feed from reactor outlet, reversible reactions, catalysis, agent materials, case studies.

Waste minimization in separation processes – classification of separation processes, sources of waste in separation processes, distillation, gas absorption, adsorption, filtration, drying, evaporation and condensation, extraction, use of extraneous materials, case studies.

Identification of waste in utility systems – introduction, fuels, fuel combustion, common fuels, environmental impacts of flue gases, theoretical flame temperature, furnaces, flare stacks, steam generation, steam use, water sources and uses, recirculated cooling water from cooling towers, sea water cooling, air cooling, refrigeration, electricity demand and supply, distribution and use of electricity, compressed air, inert gas, vacuum.

Energy conservation – introduction, energy consumption in compression of gases and pumping of liquids, pressure losses in piping and through equipment, agitation and mixing, heat recovery, energy recovery from high pressure streams, insulation, plant layout.

Materials recycling – introduction, recycling of materials in chemical processes, closed loop and open loop recycling, onsite and offsite recycling, producer and consumer waste, hierarchical approach to materials recycling, plastics recycling, glass recycling, recycling of materials from products, waste treatment option, aqueous effluent treatment and water recycling, disposal of wastes.

Waste minimization in operations – non-flow sheet emissions from a process plant, plant startup, shut down of a plant, abnormal operation, plant maintenance, cleaning of plant and equipment, fouling, transport and

storage of raw materials and products, fugitive emissions, environmental risks resulting from storm water, risks in mining and extraction of materials.

Life cycle assessment – introduction, product and process applications, basic steps, goal definition, inventory analysis, example of inventory data estimation, classification, improvement analysis, some challenges and uncertainties in LCA, alternative or supplementary approaches to LCA, LCA software, LCA case studies

Planning for sustainable process industries – introduction, forecasting, scenario development, technology innovation transition to renewable feed stocks, site selection, integration of process plants and process industries, distributed manufacture, government legislation, stakeholder engagement, lifestyle implications.

Process safety management- Process safety basics, The need for process safety, Process safety for engineering disciplines, Process safety in design, Process safety in work place

Hazard Identification and Risk Assessment – Introduction – concept hazard analysis – Preliminary process hazard analysis – critical analysis of system safety – HAZOP – FTA – Task Analysis – Task Analysis and Hazard Identification – Risk criteria – Risk assessment – Development of P&I diagrams – Hazchek list – A HAZOP study – Hazard Identification techniques – HAZID – LOPA – RAST – Whatif – Checklists – FMEA – ETA – Bow tie.

Environmental management in the chemical industry – Introduction – preamble – environmental communication – stakeholder's reaction – Impact of legislation – voluntary action by industry – standardization and certification of EMS – International aspects of environmental management.

Enterprise resource planning – Introduction to business functions and business processes, functional areas of operation, business processes, marketing and sales, supply chain management, accounting and finance, human resources, Information systems in functional areas, Development of ERP system, ERP soft wares and implementation, choosing consultants and vendors, significance and benefits of ERP software and systems.

Statutes and codes – Factories act 1948, The air (prevention and control of pollution) act 1981, The water (prevention and control of pollution) act 1974, The Environment (Protection) act 1986, Factories act 1948, ISO 9000 (QMS), ISO 14000 (EMS).

TEXT BOOKS:

1. David Brennan, Sustainable Process Engineering, 2012, CRC Press. (Chapters 1 to 11, 14 and 15)
2. Introduction to process safety for undergraduates and engineers by CCPS of AIChE, Wiley, 2016.

3. Geoff Wells, Hazard Identification and Risk Assessment, Antony Rowe Ltd, UK.

4. Frank Crawley, A guide to hazard identification methods, 2/e, Elsevier, 2020.

5. Ullman's encyclopaedia of industrial chemistry

6. Ellen F Monk, Bret J Wagner, Concepts in enterprise resource planning, 4/e, 2013, Course Technology. (Chapters 1 and 2)

CH-4109 : SUMMER INTERNSHIP EVALUATION

All the students have to undergo Summer Internship for two months in the industries at the end of the third year second semester. Evaluation of the same will be conducted in this semester by the Department.

CH-4201 : PROJECT WORK

(6 months Project Work/ Internship shall be carried out in the Industry)

Course Outcomes:

At the end of the course, the student will be able to

- Carry out literature review
- Formulate the problem involving manufacture of a chemical product/ experimentation/modelling/simulation/optimization/design
- Carry out the project involving manufacture of a chemical product/ experimentation/ modelling/simulation/optimization/design/industrial problem
- Discuss the results
- Communicate results orally to audience
- Present the detailed written report.

B.TECH. (HONORS) : CHH-1001

PROCESS MODELING AND SIMULATION

Course Objectives:

Deals with writing various process models based on basic physical process. It also deals with solving the various models by means of numerical methods by computer simulation. By studying this course, one can simulate various chemical processes by computer simulation.

Course Outcomes:

At the end of the course, the student will be able to

- Understand the writing of a model of a process based on basic physical processes like mass, momentum and energy balances.
- Develop a model equation for Tanks, Isothermal and Non-Isothermal Systems

- Understand the models for binary distillation column, batch reactors, etc.
- Solve the model equations by numerical methods.

SYLLABUS

Principles of formulation - Continuity equations – Energy equation – Equation of motion – Equations of state – Transport equations – Chemical Kinetics – Algebraic and Integral / differential equations, Explicit and Implicit equations – Numerical Integration, Feed forward and feed backward control.

Basic modeling for tank system, mixing vessel – Simultaneous mass and energy balances – Models for boiling, batch distillation, and partial condenser. Models for Reactor – Model for heterogeneous catalysis – Models for pumping system – Model for heat exchanger.

Operational blocks in simulation- Simulation Programming – Simulation examples of three CSTR's in series, gravity flow tank, binary distillation column, non-isothermal CSTR.

Implicit function convergence, Internal-halving convergence, Newton-Raphson method, False position convergence, Explicit convergence methods, Numerical Integration, Euler Integration, Runge - Kutta (fourth order) method.

TEXTBOOKS:

1. Process Modeling, Simulation and Control for Chemical Engineers by Luyben, W.L., McGraw Hill Books Co.
2. Mathematical Modeling in Chemical Engineering by Roger, G.E. Franks – John Wiley Sons Inc.

REFERENCE BOOKS:

1. Mathematical Methods in Chemical Engineering by V.G. Jenson and G.V. Jefferys, Academic Press – 2nd Edition.

CHH-1002 : ADVANCED MASS TRANSFER

Course Objectives:

- To develop skills in the process design of mass transfer operations
- To understand problems involving mass transfer using the principles of material and energy balances.

Course Outcomes:

- At the end of the course, the student will be able to
- Design process equipment for various mass transfer operations.
 - Demonstrate the use of equations of change for multi-component systems.
 - Solve problems of mass transfer in laminar and turbulent regimes.

- Solve problems of interphase transport in non-isothermal systems.

SYLLABUS

Flux Definition :

- Mass and molar transport by convection
- Summary of mass and molar fluxes
- Fick's law

Differential Equations of Mass transfer :

- Differential equation for mass transfer
- Boundary conditions

Molecular diffusivities :

- Diffusivities in gases
- Diffusivities in liquids

Molecular diffusion :

- Steady state molecular diffusion
- Steady-State Equimolar counter diffusion in gases
- Steady state Equimolar unidirectional diffusion in gases
- Molar diffusion in liquids
- Diffusion through a stagnant gas film
- Diffusion with a moving interface
- Diffusion through a Nonisothermal Spherical film
- Diffusion with a homogeneous Chemical reaction
- Diffusion with a slow Heterogeneous Chemical reaction
- Diffusion with a Heterogeneous Chemical reaction
- Unsteady state diffusion in a slab
- Unsteady state diffusion in a Cylinder
- Unsteady state diffusion in a sphere

Mass Transfer coefficients

- Individual Mass transfer coefficients
- Overall Mass Transfer coefficients
- Mechanism of Mass transfer
- The two-film theory
- The penetration theory
- The theory of penetration with Random surface renewal

Mass transfer in Laminar Flow :

- Mass transfer in the laminar boundary layer on a flat plate (Integral Solution)
- Mass transfer in laminar Natural convection on a vertical plate
- Mass transfer in a falling liquid film in a laminar flow
 - o Mass transfer between a gas phase and a falling liquid film (gas absorption)
 - o Mass transfer between an inclined plate and a falling liquid film (Solid dissolution)
 - o Gas absorption with rapid reaction

Mass Transfer in turbulent flow

- Mass transfer in the turbulent boundary layer on a flat plate
- Mass transfer in turbulent Natural convection on a vertical plate
- Mass transfer between inclined plate and a falling liquid film in turbulent flow
 - Analogies between momentum, heat and mass transfer
 - o Reynolds analogy
 - o Prandtl analogy
 - o Von Karman analogy
 - o Analogies in terms of j factor

TEXTBOOKS:

1. "Transport phenomena" R. Byron Bird, Warren E. Stewart and E.N. Light foot, Wiley & Sons, Inc., New York.
2. 'Mass Transfer Operations' Robert E. Treybal, third edition, Mc Graw-Hill International Edition, Chemical Engineering Series.

REFERENCE BOOKS:

1. "Transport Processes and separation Processes Principles" Geankoplis, Prentice-Hall of India, New Delhi
2. "Fundamentals of Momentum, Heat and Mass Transfer" James R. Welty, Charles E. Wicks and Robert E. Wilson, John Wiley & Sons, Inc., New York.
3. "Principles of Mass Transfer and Separation Processes" Dutta B.K, Prentice-Hall of India, New Delhi.

CHH-1003 : POLLUTION CONTROL

Course Objectives:

- Focus on classification of air pollutants, water pollutants and solid waste –causes, effects and control methods, need of environmental Legislation.

Course Outcomes:

At the end of the course, the student will be able to

- Identify the sources, effects and analysis of air/ solids/ water pollutants
- Evaluate the preventive measures for the control of air pollutants, waste water treatment methods, and solid waste management methods in domestic, municipal waste.
- Importance of environmental legislation
- Propose control measures of pollutants emitted from different industries like Paper and pulp, fertilizer, sugar and alcohol, petrochemical and petroleum refinery, pharmaceutical and metal finishing industries.

SYLLABUS

Kinds of ecology, environment and ecofactors, types of ecosystems, sulphur cycles, phosphorous cycle, Nitrogen cycle and hydrological cycle

Sources for water, Air and solid pollution, Analysis and effects of the pollutants in air, in water, Solids(particulate matter, SO_x, NO_x, CO_x, CH_x).

Limits of pollutants, Environmental Legislation.

Control aspects of various pollutants Air (Particulate matter, SO_x, NO_x, CO_x, CH_x, Noise) water (primary, secondary and tertiary treatment techniques) Solids (recycling, incineration, bio-conversion).

Case studies of Industries: Paper and pulp, petrochemical, Fertilizer, Pharmaceuticals, tannery, sugar and alcohol industries, metal finishing industries.

TEXT BOOKS:

1. S.P.Mahajan., Pollution control in process Industries, Tata McGraw hill publishing company.
2. Arcadio P. Sincero and Georgia Sincero., Environmental Engineering
3. Environmental Pollution Control., by C.S.Rao, wiley eastern Ltd.

CHH-1004 : CORROSION ENGINEERING

Course Objectives:

- Basic aspects of electrochemistry relevant to corrosion phenomena,
- Importance and forms of corrosion.
- Knowledge on corrosion rate expressions and measurement techniques.

- Knowledge on factors influencing corrosion of iron and steel exposed to atmospheric, soil and aqueous medium.

- Basic knowledge on remedial measures for corrosion.

Course Outcomes:

At the end of the course, the student will be able to

- Understand basic principles of electrochemistry, importance of corrosion, corrosion tendency and electrode potentials.
- Identify the nature of corrosion and form in which it attacks (Uniform attack, Galvanic Corrosion, Crevice Corrosion, Pitting, Intergranular Corrosion, Selective Leaching, Erosion Corrosion and Stress Corrosion. Hydrogen damage.
- Estimate corrosion rates using polarization
- Understand the mechanism and propose viable remedial measures.

SYLLABUS

Basic Concepts and Outlines of Electrochemistry: Fundamentals of Electrochemical reactions, Faraday's Laws Electrolytic and ionic conductance, ionic mobility's, Transport Nos. Galvanic Cell and Electrolytic cells.

Definition and importance of corrosion, Dry cell, analogy, Corrosion Cells, Types of Corrosion Cells- a) Dissimilar electrode cells b) Concentration cells such as a salt concentration cells, differential aeration cells c) differential Temperature cells. Corrosion Rate Expressions - mdd, ipy, cpy, mpy, etc.

Corrosion Tendency and Electrode Potentials: Free Energy changes, Development of Nernst Equation for calculation of Half-cell potentials, Hydrogen electrode, Spontaneity of a reaction, Reversible cells and potentials – convention of Sign and calculations of EMF from standard Equilibrium potentials., EMF Series and Galvanic series, Reference Half Cells – Calomel, Silver-Silver Chloride and Saturated Copper-Copper Sulphate Half Cells. Pourbaix Diagram for Iron, Aluminum and magnesium, limitations of pourbaix diagrams.

Polarization and Corrosion Rates: Polarization and a Polarized Cell, Causes of Polarization – Concentration Polarization, Activation Polarization and IR drop. Hydrogen Over potentials, combined polarization and Mixed potential theory. Tafel Slopes and Tafel Equation. Graphical method of expressing Corrosion Reactions (Polarization diagrams/ Evans diagrams), Derivation of Stern-Geary Equation, Influence of Polarization on Corrosion rates.

Passivity: Characteristics of Passivation, Flade potential, behavior of passivators, transpassivity, Theories on Passivity.

Forms of Corrosion: Uniform attack, Galvanic Corrosion, Crevice Corrosion, Pitting, Intergranular Corrosion, Selective Leaching, Erosion Corrosion and Stress Corrosion. Hydrogen damage. Factors influencing, mechanisms, testing and prevention techniques for all forms of corrosion. Calculation of Corrosion rates using weight lost method and Polarization data. Electrochemical Impedance Spectroscopy.

Effect of Dissolved Oxygen (Air saturated Water, High Partial Pressure of Oxygen and Anaerobic bacteria), Temperature, pH, Galvanic coupling, velocity, dissolved salts concentration. Wet and dry corrosion.

TEXTBOOKS :

1. Corrosion and Corrosion Control by Herbert, H. Uhlig John Wiley and Sons Inc., New York.
2. Corrosion Engineering by Mars F Fontana, McGraw Hill.
3. An Introduction to Electrochemistry by Samuel Glass stone, Affiliated East West Press Pvt. Ltd.,

REFERENCE BOOKS :

1. Corrosion Volumes 1 & 2 by L.L. Shrier, Newnes - Butter-worths, London.

CHH-1005 : PETROLEUM REFINERY ENGINEERING

Course Objectives:

To introduce the basics of refinery engineering subject for petroleum specialization students to gain knowledge of the overall refinery operations, refinery products and its test methods. To learn various primary and secondary cracking process available to produce normal and value added products. Further, to learn the treatment process available to remove the impurities in the crude and finished products and its test methods for quality check.

Course Outcomes :

- At the end of the course, the student will be able to
- Classify and understand the methods available for quality check
 - Evaluate crudes and crude pretreatment
 - Describe various treatment processes available to increase the quality of the product.
 - Select the heat transfer equipment for refineries
 - Design atmospheric/Vacuum distillation column and catalytic cracking units.

SYLLABUS

Origin and formation of petroleum: Reserves and deposits of the world – Indian petroleum industry – Composition of crudes.

Refinery products specifications and test methods: Evaluation of crudes. Crudes Pretreatment dehydration and desalting. Physical properties of petroleum oils and products.

Introduction to processing- Refinery distillation – processes – catalytic cracking, Reforming Hydro cracking , and hydro treating, hydrosulfurization. Chemical treatments & Extraction Processes :Alkylation, polymerization Lube oil processing.

De-waxing : Asphalt and air blown asphalt.

Treatment of products, additives, blending of gasoline, treatment of gasoline, Kerosene etc., Heat transfer equipment in Refinery– Heat exchangers and pipe still heaters. Design – atmospheric distillation tower and Vacuum distillation tower, catalytic cracking units.

TEXT BOOKS:

1. Petroleum Refinery Engineering – Nelson.
2. Refinery distillation - Watkins.

CHH-1006 : ENERGY ENGINEERING

Course Objectives:

To learn overview of solar radiation and its potential for collection to meet the energy needs of mankind and potential for solar energy option. To learn measuring techniques of solar radiation and its compilation.

To learn various design and operational aspects of solar energy collection and storage.

To learn the design and operation of solar energy appliances like liquid flat plate collectors, Solar Air Heaters, Thermal energy storage, Thermal energy storage, Solar Pond, Solar thermal power generation.

To learn theory and application of Photovoltaic cells

Course Outcomes:

At the end of the course, the student will be able to

- Estimate the availability of solar radiation
- Design of various equipment operated on solar energy
- Explain the principles and practice of Photo voltaic cells
- Classify collectors and analyze their performances
- Describe the production of solar thermal power generation
- Select thermal power storage methodologies.

SYLLABUS

The Solar Energy option

Thermal conversion – collection and storage Thermal applications – photovoltaic conversion – wind energy – Energy from Bio – mass – ocean thermal energy conversion.

Solar Radiation

Solar Radiation outside the earth's – atmosphere Solar radiation at the Earth's surface – Instruments for measuring Solar Radiation – Solar Radiation data – Solar Radiation Geometry Empirical equations for predicting the availability of Solar Radiation – Solar radiation on tilted surface.

Liquid flat – Plate Collectors

Components of liquid flat plate – various types of collectors – Performance Analysis – Transmissivity – Absorptivity product – Overall loss coefficients and heat Transfer correlations – Collector efficiency heat removal factors – effect of various parameters on performance. Transient Analysis – Testing procedures.

Solar Air Heaters

Various types of solar Heaters – Performance Analysis of a conventional Air Heater – Testing procedures – Concentrating collectors – various types of concentrating collectors cylindrical and parabolic collectors – General receiver collectors.

Thermal energy storage

Sensible heat storage – Latent heat storage – Thermochemical storage

Solar Pond

Description – Performance analysis – Experimental studies – Operational Problems.

Solar Air Conditioning and Refrigeration

Heat pump cycle – Coefficient of performance of the heat pumps – solar air-conditioning with absorption – Refrigeration system (Ammonia water and lithium bromide – water systems).

Solar thermal power generation

Thermal and direct electricity generation – Major sub-stations of a solar thermal power plant, Examples of installed systems – Concentration ratio. Temperature and efficiency concepts – Solar farm and tower – Economics.

Photovoltaic Energy Conversion

Photovoltaic Energy Conversion Fundamentals – band theory of solids – Physical processes in a solar cell – Solar cell with light incidence – Solar cell module – Silicon Solar Cells – Copper Sulphate / Cadmium sulphide Solar Cells.(Banasal et al., chapters 9; Taylor, chapters 6, pages 256-298.

TEXT BOOKS:

1. Solar Energy: Principles of thermal collection and storage by S.P. Sukhatme, Tata McGraw Hill, New Delhi 1984 (Chapters 2 to 8)
2. Renewable energy sources and conversion technology by N. K. Bansal, M. Kleemann, Michael McIliss, 1990 (Chapters 2 – 9).

CHH-1007 : TRANSPORT PHENOMENA-II

Course Objectives:

- To be able to analyze various transport processes with understanding of solution approximation methods and their limitations.

Course Outcomes:

- At the end of the course, the student will be able to
- Understand the chemical and physical transport processes and their mechanism.
- Analyze heat, mass and momentum transfer problems with relevant approximations and boundary conditions.
- Develop steady and time dependent velocity/ temperature/ concentration distributions for laminar and turbulent flow.
- Calculate friction factor/ heat transfer coefficient / mass transfer coefficient.

SYLLABUS

Momentum Transport

- 1.1 The Equations of change for isothermal systems.
- 1.2 Velocity distributions with more than one independent variable.
- 1.3 Velocity distributions in turbulent flow.
- 1.4 Inter phase transport in isothermal systems.

Energy Transport

- 1.1 The Equations of change for non – isothermal systems.
- 1.2 Temperature distributions with more than one independent variable.
- 1.3 Temperature distributions in turbulent flow
- 1.4 Interphase transport in nonisothermal systems.

Mass Transport

- 1.1 The Equations of Change for multicomponent systems.
- 1.2 Concentration distribution with more than one independent variable.
- 1.3 Concentration distribution in turbulent flow.

TEXTBOOK:

1. “Transport phenomena” R. Byron Bird, Warren E. Stewart and E.N. Light foot, Wiley & Sons, Inc., New York.

REFERENCE BOOKS:

1. “Transport Processes and separation Processes Principles” Geankoplis, Prentice-Hall of India, New Delhi
2. “Fundamentals of Momentum, Heat and Mass Transfer” James R. Welty, Charles E. Wicks and Robert E. Wilson, John Wiley & Sons, Inc., New York.
3. “Boundary – Layer Theory”, Dr.H.Schlichting, McGraw – Hill Book Company, New York.

CHH-1008 : CHEMICAL REACTION ENGINEERING-III

Course Objectives:

- To focus on the thermal characteristics of various reactions and the design aspects of non isothermal and adiabatic reactors
- To focus on Heterogeneous data analysis and design
- To focus on CVD reactors
- To study the design aspects of heterogeneous catalytic systems
- To impart the knowledge on mass transfer with reaction in process catalysts

Course Outcomes:

- At the end of the course, the student will be able to
- Understand the design aspects of non isothermal and adiabatic reactors
- Analyze heterogeneous data and design aspects of heterogeneous catalytic systems
- Derive the rate laws for CVD
- Develop the rate laws for heterogeneous fluid solid catalyzed reactions under rate limiting situations.

SYLLABUS

Review of Fundamentals Rate laws and stoichiometry, reactions with phase change (Scope: Chapter 3 of Fogler) Least squares Analysis of rate data: differential reactors: Laboratory reactors (Scope: sections 5.4 to 5.6 of Fogler) Multiple reactions (Scope: Chapter 9 of Fogler).

Isothermal reactor design (Scope: Chapter 4 of Fogler) Batch reactor, PFR, CSTR design. Pressure drop in reactors, Reversible reactions, unsteady state operation of reactors, Simultaneous reaction and separation

Catalysis and catalytic reactors (Scope: Chapter 6 of Fogler) Steps in catalytic reaction: derivation of rate laws, design for gas-solid reactions, heterogeneous data analysis and design; Chemical vapour deposition, catalyst reactivation, moving bed reactions.

Diffusion and reaction in process catalysts (Scope: Chapter 11 of Fogler).

Diffusion and reaction in spherical catalyst.

Internal effectiveness factor, falsified kinetics; estimation of diffusion and reaction limited regimes. Mass transfer and reaction in packed bed. Determination of limiting situations from reaction data, CVD reactors.

Non-isothermal reactor design (Scope: Chapter 8 of Fogler), Energy Balance, equilibrium conversion under adiabatic conditions unsteady state operation, multiple steady states.

TEXTBOOK:

1. Fogler. H.S: Elements for Chemical Reaction Engineering 2nd Edition, Prentice Hall, New Delhi, 1992.

REFERENCE BOOK:

1. Smith J.M: 'Chemical Engineering Kinetics' 3rd Edition, McGraw Hill, 1981.

CHH-1009 : ADVANCED PROCESS DYNAMICS AND CONTROL

Course Objectives:

The main purpose of teaching Process Dynamics & Control for first year postgraduate students is to take the student from basic mathematics to a variety of design applications in a clear, concise manner. This course is focused on the use of the digital computer in complex problem solving and in process control instrumentation. For chemical engineering problem solving students need more advanced mathematical preparation like partial differential equations, linear algebra and Fourier series all are introduced in this course.

Course Outcomes:

- At the end of the course, the student will be able to
- Understand sampled data control systems with Z- transforms.
 - Describe the process in which the flow of the signals is interrupted periodically like in chromatograph.
 - Calculate the open loop and closed loop response of a sampled data system
 - Develop a pulse transfer function
 - Identify nonlinear systems and explain phase plane analysis
 - Demonstrate the control of heat exchangers, distillation columns and chemical reactors

SYLLABUS

Review of time domain, Laplace domain and frequency domain dynamics of process and control system. Sampled data control system – sampling and Z-Transforms, open loop and closed loop response, Stability. State space methods – representation of physical systems – transfer function matrix – Multivariable systems – Analysis and control. Non linear control –examples of non linear systems – Methods of phase plane analysis. Control of heat exchangers, distillation columns and Chemical Reactors.

TEXTBOOKS:

1. Process system Analysis and control, 2nd edition, Donald R Coughanower and Koppel.
2. Automatic process Control by Peter Harriot.
3. Process Modeling, Simulation and control for Chemical Engineers by W.L. Luyben.

CHH-1010 : ANALYTICAL TECHNIQUES

Course Objectives:

To understand the different types of analysis methods used in chemical industries. The course consists of both chemical and instrumental methods and also both qualitative and quantitative methods of analysis. In this course, the chemical methods of quantitative analysis include all the aspects such as: selection and sampling of materials, preparation of solutions, and analysis of various chemical raw materials and products. In instrumental methods colorimetric, spectrophotometric, spectrographic, flame emission, photo meter have been discussed.

Course Outcomes:

- At the end of the course, the student will be able to
- Understand the selection and preparation of the sample.
 - Select sophisticated instruments for the analysis of mineral ores and chemical samples.
 - Make use of instruments like X- Ray, flame emission spectroscopy.
 - Describe instrumental methods for mineral investigation.
 - Explain electrochemical methods of analysis

SYLLABUS

Theory of sampling, sampling of ores, minerals and coals, proximate and ultimate analysis of coal; coking index, calorific value of coal, its determination and calculation, analysis of ash,

Wet assaying of ores of iron, copper, lead, zinc and manganese, dry assaying process, fire saving methods for gold and silver,

Instrumental methods of mineral investigation: Theory and techniques of colorimetry and absorptiometry, photometer, spectrophotometers, atomic absorption spectrophotometer,

Electrochemical methods of analysis, Electrogravimetry methods, potentiometric titration, polarography, DTA,

X-ray techniques, emission of X-rays, X-rays instrumentation, X-ray diffraction, flame emission spectroscopy - source, equipment and application of emission spectroscopy.

REFERENCE BOOKS:

1. 'An Introduction to Metallurgical Analysis: Chemical & Instrumental' by S.K. Jain, Vikas Publishing House
2. A Text Book of Metallurgical Analysis' by B.C.Agarwal & S.P.Jain, Khanna Publications.
3. 'A Text Book of Quantitative Inorganic Analysis' by A.I.Vogel, ELBS Edition

Under Graduate Degree Course

B.Tech. (Biotechnology) Scheme & Syllabi

Effective from 2020-21 Admitted Batch Group- A

(For the branches of Civil Engg., Chemical Engg, **Biotechnology**, Computer Science Engg and Information Technology)

B.Tech I Year - I Semester Scheme of Instruction and Examination

Course Credits Marks	Category code	Course Title	Hours per week	Internal	External	Total Marks	
			L T P				
BT-1101	BS	Mathematics – I	3 0 0	30	70	100	3
BT-1102	BS	Chemistry	3 0 0	30	70	100	3
BT-1103	HSS	English	3 0 0	30	70	100	3
BT-1104	ES	CPNM	3 0 3	30	70	100	3

BT-1105	ES	Biology	3 0 0	30	70	100	3
BT-1106	HSS	English Language Lab	0 0 2	50	50	100	1.5
BT-1107	BS	Chemistry Lab	0 0 3	50	50	100	1.5
BT-1108	ES	CPNM Lab	0 0 3	50	50	100	1.5
Total Credits						19.5	

B.Tech I Year - IISemester

Course Credits Marks	Category code	Course Title	Hours per week	Internal	External	Total Marks	
			L T P				
BT-1201	BS	Mathematics – II	3 0 0	30	70	100	3
BT-1202	BS	Physics	3 0 0	30	70	100	3
BT-1203	ES	Engineering Graphics	1 0 4	30	70	100	3
BT-1204	ES	Genetics	3 0 0	30	70	100	3
BT-1205	ES	Microbiology	3 0 0	30	70	100	3
BT-1206	ES	Workshop Lab	0 0 3	50	50	100	1.5
BT-1207	BS	Physics Lab	0 0 3	50	50	100	1.5
BT-1208	ES	Microbiology lab	0 0 3	50	50	100	1.5
Total Credits						19.5	

B.Tech II Year - I Semester

Course Credits Marks	Category code	Course Title	Hours per week	Internal	External	Total Marks	
			L T P				
CH-2101	BS	Mathematics-III	3 0 0	30	70	100	3
BT-2101	PC	Biochemistry	3 0 0	30	70	100	3
CH-2103	HSS	Managerial Economics	3 0 0	30	70	100	3
BT-2102	PC	Bio-analytical Techniques	3 0 0	30	70	100	3
BT-2103	PC	Downstream processing	3 0 0	30	70	100	3
BT-2104	PC	Biochemistry and Bio-analytical techniques lab	0 0 3	50	50	100	1.5
BT-2105	PC	Downstream processing lab	0 0 3	50	50	100	1.5
CH 2108	SC	MATLAB (Software)	1 0 2	50	50	100	2
CH-2109	MC	Environmental Science	0 0 0	-	100	100	0
Total Credits						20	

B.Tech. II Year - I Semester

Course Credits Marks	Category code	Course Title	Hours per week	Internal	External	Total Marks	

			L	T	P				
BT-2201	ES	Basic Electrical and Electronics Engineering	3	0	0	30	70	100	3
CH-2202	PC	Material and Energy balances	3	0	0	30	70	100	3
BT-2202	PC	Fluid Mechanics and heat transfer	3	0	0	30	70	100	3
BT-2203	PC	Biochemical Thermodynamics	3	0	0	30	70	100	3
CH-2205	HSS	Industrial management & Entrepreneurship	0	0	3	50	50	100	3
BT-2204	PC	Plant cell and tissue culture	3	0	0	30	70	100	3
BT-2205	PC	Fluid mechanics and heat transfer Lab.	0	0	3	50	50	100	1.5
BT-2206	PC	Plant cell and tissue culture Lab.	0	0	3	50	50	100	1.5
CH-2208	SC	ASPEN PLUS(Process design)	1	0	2	50	50	100	2
CH-2209	MC	Professional ethics and human values	0	0	0	-	100	100	0
Total Credits									23

Summer Internship (Community Service)

B.Tech. III Year - I Semester

Course	Category	Course Title	Hours per			Internal	External	Total	
Credits	code		L	T	P		week	Marks	Marks
Marks									
BT-3101	PC	Mass transfer	3	0	0	30	70	100	3
BT-3102	PC	Enzyme Engineering	3	0	0	30	70	100	3
BT-3103	OE	Open Elective- I	2	0	2	30	70	100	3
BT-3104	PE	Core Elective -I	3	0	0	30	70	100	3
BT-3105	PC	Cell and molecularbiology	3	0	0	30	70	100	3
BT-3106	PC	Mass transfer lab	0	0	3	50	50	100	1.5
BT-3107	PC	Cell and molecular biology lab	0	0	3	50	50	100	1.5
BT-3108	SC	Seminar/ Minor project	0	0	3	100	-	100	2
CH-3109	MC	Indian constitution	2	0	0	-	100	100	0
BT-3109	MC	Summer internship 2 months (Mandatory after second year) to be evaluated during Vsemester -	-	-	-	100	0	100	2
Total Credits									22

- A. Food technology
C. Energy Engineering
- B. Process optimization
D. Systems Biology

B.Tech. III Year - II Semester

Course Credits Marks	Category code	Course Title	Hours per week	Internal	External	Total Marks	Marks
			L	T	P		
BT-3201	PC	Immunology	3	0	0	30	70 100 3
BT-3202	PC	Bioinformatics	3	1	0	30	70 100 3
BT-3203	PC	Genetic Engineering	3	0	0	30	70 100 3
BT-3204	PC	Process control	3	0	0	30	70 100 3
BT-3205	PE	Core elective- II	3	0	0	30	70 100 3
BT-3206	OE	Open Elective-II	2	0	2	30	70 100 3
BT-3207	PC	Process control lab	0	0	3	50	50 100 1.5
CH-3209	SC	Intellectual Property Rights	3	0	0	30	70 100 2
CH-3210	MC	Essence of Indian traditional knowledge	2	0	0	-	100 100 0
Total Credits							21.5

SUMMER INTERNSHIP (2 MONTHS)

Core Elective-II: (BT 3205)

- A. Pharmaceutical Biotechnology
C. Cancer Biology
- B. Animal cell culture and Hybridoma technology
D. Stem cells in health care.

B.Tech IV Year - I Semester

Course Credits Marks	Category code	Course Title	Hours per week	Internal	External	Total Marks	
			L	T	P		
BT-4101	PC	Engineering economics & Bioprocess design	3	1	0	30	70 100 3
BT-4102	PC	Biochemical ReactionEngineering3	0	0	0	30	70 100 3
BT-4103	PC	Industrial Biotech Products	3	0	0	30	70 100 3
BT-4104	OE	Open Elective -III	3	0	0	30	70 100 3
BT-4105	OE	Open Elective - IV	2	0	2	30	70 100 3
BT-4106	PC	Biochemical reaction Engineering lab	0	0	3	50	50 100 1.5
BT-4107	SC	Biostatistics	2	1	0	50	50 100 2
BT-4108	MC	Summer internship 2 months (Mandatory after third year) to be evaluated during VII semester	-	-	-	100	- 100 2
Total Credits						20.5	

B.Tech IV Year - II Semester

Course	Category	Course Title week	Internal Marks	External Marks	Total Marks	Credits Marks
BT-4201	Major Project	Project work (6 Months Internship in industry)	50	50	100	14
						14

MINOR REQUIREMENTS IN BIOTECHNOLOGY

Total Credit requirement: 20

Student must have acquired a minimum of 8 SGPA up to the end of 2nd semester without backlogs. In case after declaration 3rd semester results if student fails to score required minimum of 8 SGPA his/her registration for Minor programme stands canceled and he/she shall continue with regular programme.

Of the 20 additional credits to be acquired, 16 Credits shall be earned by selecting courses one from each of the following pools and 4 credits through MOOCs with two courses of minimum 8 weeks duration.

Subject	L-T-P	Credit
POOL 1		
Microbiology (BT-1204)	4-0-0	4
Genetics (BT-1205)	4-0-0	4
Biochemistry (BT-2101)	4-0-0	4
Plant cell and tissue culture (BT-2204)	4-0-0	4
POOL 2		
Genetic Engineering (BT-3203)	4-0-0	4
Cell and molecular biology (BT-3105)	4-0-0	4
Enzyme Engineering (BT-3102)	4-0-0	4
Downstream processing (BT-2103)	4-0-0	4
POOL 3		
Bioinformatics (BT-3202)	4-0-0	4
Bioanalytical techniques (BT-2102)	4-0-0	4
Biochemical Reaction Engineering (BT-4102)	3-1-0	4
POOL 4		
Industrial Biotech products (BT-4103)	4-0-0	4
Food Technology (BT-3104A)	4-0-0	4
Immunology (BT-3201)	4-0-0	4
Pharmaceutical Biotechnology (BT-3205A)	4-0-0	4

B.Tech. (Honors) in Biotechnology (Total Credits: 180)

20 additional credits are to be acquired for Honors.

Student must have acquired a minimum of 8 SGPA up to the end of 2nd semester without backlogs. In case after declaration 3rd semester results if student fails to score required minimum of 8 SGPA his/her registration for Honors programme stands canceled and he/she shall continue with regular programme.

Of the 20 additional credits to be acquired, 16 credits shall be earned by undergoing specified courses listed below with four courses each carrying 4 credits. The remaining 4 credits must be acquired through MOOCs, which shall be domain specific, each with 2 credits and with minimum duration of /12 weeks as recommended by board of studies

The courses that are offered for B.Tech. (Honors) in Biotechnology are

Subject	L-T-P	Credit
POOL 1		
BTH-1001Advanced Microbiology	4-0-0	4
BTH-1002Advanced Biochemistry	4-0-0	4
BTH-1003Advanced Biochemical Engineering	4-0-0	4
BTH-1004Advanced Down Stream Processing		
BTH-1005Environmental Biotechnology	4-0-0	4
BTH-1006Agricultural Biotechnology	4-0-0	4
BTH-1007Bio-Analytical Techniques	4-0-0	4
BTH-1008Genetic Engineering-II	4-0-0	4
BTH-1009Nanotechnology	4-0-0	4

BT-1101 MATHEMATICS-I

Course Objectives:

- To transmit the knowledge of Partial differentiation.
- To know of getting maxima and minima of function of two variables and finding errors and approximations.
- To evaluate double and triple integrals, volumes of solids and area of curved surfaces.
- To expand a periodical function as Fourier series and half-range Fourier series.

Course Outcomes:

At the end of the course, the student will be able to

- Find the partial derivatives of functions of two or more variables.
- Evaluate maxima and minima, errors and approximations.

- Evaluate double and triple integrals, volumes of solids and area of curved surfaces.
- To expand a periodical function as Fourier series and half-range Fourier series.
- Have a fundamental understanding of Fourier series and be able to give Fourier expansions of a given function.

SYLLABUS

(Partial Differentiation)

Introduction - Functions of two or more variables - Partial derivatives - Homogeneous functions – Euler's theorem - Total derivative - Change of variables – Jacobins. Mean value Theorems (without proofs)

(Applications of Partial Differentiation)

Geometrical interpretation -Tangent plane and Normal to a surface - Taylor's theorem for functions of two variables - Errors and approximations - Total differential. Maxima and Minima of functions of two variables - Lagrange's method of undetermined multipliers - Differentiation under the integral Sign - Leibnitz's rule.

(Multiple Integrals)

Introduction - Double Integrals - Change of Order of Integration - Double Integrals in Polar Coordinates - Triple Integrals - Change of Variables.

(Multiple Integrals-Applications)

Area enclosed by plane curves - Volumes of solids - Area of a curved surface - Calculation of Mass - Center of gravity - Moment of inertia - product of inertia – principal axes- Beta Function - Gamma Function - Relation between Beta and Gamma Functions. Error Function or Probability Integral.

(Fourier Series)

Introduction - Euler's Formulae - Conditions for a Fourier Expansion - Functions having points of discontinuity - Change of Interval - Odd and Even Functions - Expansions of Odd or Even Periodic Functions, Half-Range Series - Parseval's Formula. Practical Harmonic analysis.

TEXT BOOK:

1. Scope and Treatment as in "Higher Engineering Mathematics", by Dr. B.S. Grewal, 43rd Edition, Khanna publishers.

REFERENCE BOOKS:

1. Graduate Engineering Mathematics by V B Kumar Vatti., I.K.International publishing house Pvt. Ltd.
2. Advanced Engineering Mathematics by Erwin Kreyszig.

3. A text book of Engineering Mathematics, by N.P. Bali and Dr. Manish Goyal, Lakshmi Publications.

4. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.

5. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.

6. Higher Engineering Mathematics by Dr. M.K.Venkataraman.

BT-1102 CHEMISTRY

Course Objectives:

- To apply the basic knowledge of Chemistry to the Engineering Discipline.
- To develop knowledge about water and its treatment for industrial and potable purposes.
- To develop understanding in the areas of Polymers, Mechanism of Corrosion of Metals and Corrosion Control Methods, Fuels, Lubricants and Nanomaterials for of conducting polymers, bio-degradable polymers and fiber reinforced plastics and apply the knowledge for solving existing challenges faced in various engineering and societal areas.

Course outcomes:

At the end of the course, the student will be able to

- This course applies the basic concepts and principles studied in Chemistry to Engineering.
- It provides an application of chemistry to different branches of engineering
- The students will be able acquire knowledge in the areas of Water Chemistry, Polymers, Corrosion, Fuels and Lubricants and nanomaterials and suggest innovative solutions for existing challenges in these areas.

SYLLABUS

Water Chemistry

Sources of Water – Impurities and their influence of living systems – WHO Limits – Hardness and its Determination – Boiler Troubles and their removal – Water Softening Methods – Lime- Soda, Zeolite and Ion Exchange - Municipal Water Treatment-Break Point Chlorination – Desalination of Sea Water – Reverse Osmosis Method, Electro-dialysis.

Polymers and Plastics

Polymers: Definition – Types of Polymerization (Addition & Condensation) – Mechanisms of Addition Polymerization – Radical and Ionic – Thermodynamics of Polymerization Process.

Plastics: Thermosetting and Thermoplastics – Effect of Polymer Structure on Properties of Cellulose Derivatives – Vinyl Resins – Nylon (6,6), Reinforced Plastics – Conducting Polymers.

Corrosion :

Corrosion: Origin and Theory – Types of Corrosion: Chemical and Electrochemical; Pitting, Inter granular, Waterline, Stress – Galvanic Series – Factors Effecting Corrosion.

Corrosion Controlling Methods: Protective Coatings: Metallic Coatings, Electroplating and Electroless Plating – Chemical conversion Coatings – Phosphate, Chromate, Anodized, Organic Coatings – Paints and Special Paints.

Fuels and Lubricants :

Solid Fuels: Wood and Coal, Ranking of Coal – Analysis (Proximate and Ultimate) Coke Manufacture – Otto Hoffmann's Process – Applications; Liquid Fuels: Petroleum Refining – Motor Fuels – Petrol and Diesel Oil – Knocking – Octane number – Cetane Number; Gaseous Fuels: Biogas, LPG and CNG – Characteristics – Applications; Rocket Fuels: Propellants – Classification – Characteristics

Lubricants: Classification – Mechanism – Properties of Lubricating Oils – Selection of Lubricants for Engineering Applications.

Nanomaterials

Nanomaterials, Properties and application of fullerenes, fullerols, Carbon nanotubes and nanowires. Synthesis - Top-down and Bottom-up approaches - Nanocomposites - Nanoelectronics- Applications of nanomaterials in catalysis, telecommunication and medicine.

TEXT BOOKS:

1. Engineering Chemistry – PC Jain and M. Jain – Dhanpath Rai and Sons, New Delhi.

2. A Text book of Engineering Chemistry – S. S. Dara – S. Chand & Co. New Delhi.

REFERENCE BOOKS:

1. Engineering Chemistry – B. K. Sharma – Krishna Prakashan – Meerut.
2. Introduction to Nanoscience - S. M. Lindsay - Oxford University Press
3. Engineering Chemistry - B.L. Tembe, Kamaluddin and M.S. Krishnan, (NPTEL).

BT-1103 ENGLISH

Course Objectives:

- To make students understand the explicit and implicit meanings of a text/topic;

- To give exposure to new words and phrases, and aid to use them in different contexts;
- To apply relevant writing formats to draft essays, letters, emails and presentations; and
- To adapt oneself to a given situation and develop a functional approach to finding solutions: adaptability and problem solving.

Course Outcomes:

At the end of the course, the student will be able to

- Students will be able to analyze a given text and discover the various aspects related to language and literature;
- Learn the various language structures, parts of speech and figures of speech;
- Develop one's reading and writing abilities for enhanced communication; and
- Learn to apply the topics in real-life situations for creative and critical use.

SYLLABUS

On the conduct of life: William Hazlitt

Life skills: Values and Ethics

If: Rudyard Kipling

The Brook: Alfred Tennyson

Life skills: Self-Improvement

How I Became a Public Speaker: George Bernard Shaw

The Death Trap: Saki

Life skills: Time Management

On saving Time: Seneca

ChinduYellama

Life skills: Innovation

Muhammad Yunus

Politics and the English Language: George Orwell

Life skills: Motivation

Dancer with a White Parasol: Ranjana Dave

Grammar:

Prepositions – Articles – Noun-Pronoun Agreement, Subject-Verb Agreement – Misplaced Modifiers – Clichés, Redundancies.

Vocabulary:

Introduction to Word Formation – Root Words from other Languages – Prefixes and Suffixes – Synonyms, Antonyms – Common Abbreviations.

Writing:

Clauses and Sentences – Punctuation – Principles of Good Writing – Essay Writing – Writing a Summary

Writing : Essay Writing Life skills: **Innovation Muhammad Yunus**

TEXTBOOK:

Language and Life: A Skills Approach Board of Editors, Orient Blackswan Publishers, India. 2018.

REFERENCEBOOKS :

- *Practical English Usage*, Michael Swan. OUP. 1995.
- *Remedial English Grammar*, F.T. Wood. Macmillan.2007
- *On Writing Well*, William Zinsser. Harper Resource Book. 2001
- *Study Writing*, Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
- *Communication Skills*, Sanjay Kumar and PushpLata. Oxford University Press. 2011.
- *Exercises in Spoken English*, Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

BT-1104 CPNM

Course Objectives:

- The course is designed to provide complete knowledge of C language.
- To provide students with understanding of code organization and functional hierarchical decomposition with using complex data types.
- To provide knowledge to the Students to develop logics which will help them to create programs, applications in C.
- This course aims to identify tasks in which the numerical techniques learned are applicable and apply them to write programs, and hence use computers effectively to solve the task.
- This course provides the fundamental knowledge which is useful in understanding the other programming languages.

Course Outcomes:

At the end of the course, the student will be able to

- Identify basic elements of C programming structures like data types, expressions, control statements, various simple functions and Apply them in problem solving.

- Apply various operations on derived data types like arrays and strings in problem solving.
- Design and Implement of modular Programming and memory management using Functions, pointers.
- Apply Structure, Unions and File handling techniques to Design and Solve different engineering programs with minimal complexity.
- Apply Numerical methods to Solve the complex Engineering problems.

SYLLABUS

Introduction to C: Basic structure of C program, Constants, Variables and data types, Operators and Expressions, Arithmetic Precedence and associativity, Type Conversions. Managing Input and Output Operations Formatted Input, Formatted Output.

Decision Making, Branching, Looping, Arrays & Strings: Decision making with if statement, Simple if statement, The if...else statement, Nesting of if...else statement, the else..if ladder, switch statement, the (?:) operator, the GOTO statement., The while statement, the do statement, The for statement, Jumps in Loops ,One, Two-dimensional Arrays, Character Arrays. Declaration and initialization of Strings, reading and writing of strings, String handling functions, Table of strings.

Functions: Definition of Functions, Return Values and their Types, Function Calls, Function Declaration, Category of Functions: No Arguments and no Return Values, Arguments but no Return Values, Arguments with Return Values, No Argument but Returns a Value, Functions that Return Multiple Values. Nesting of functions, recursion, passing arrays to functions, passing strings to functions, the scope, visibility and lifetime of variables.

Pointers: Accessing the address of a variable, declaring pointer variables, initializing of pointer variables, accessing variables using pointers, chain of pointers, pointer expressions, pointers and arrays, pointers and character strings, array of pointers, pointers as function arguments, functions returning pointers, pointers to functions, pointers to structures-Program Applications

Structure and Unions: Defining a structure, declaring structure variables, accessing structure members, structure initialization, copying and comparing structure variables, arrays of structures, arrays within structures, structures within structures, structures and functions and unions, size of structures and bit-fields- Program applications.

File handling: Defining and opening a file, closing a file, Input/ Output operations on files, Error handling during I/O operations, random access to files and Command Line Arguments- Program Applications

Numerical Methods: Solutions of Algebraic and Transcendental Equations, Bisection Method, Newton Raphson Method. Newton's forward

and backward Interpolation, Lagrange's Interpolation in unequal intervals. Numerical Integration: Trapezoidal rule, Simpson's 1/3 rules. Solutions of Ordinary First Order Differential Equations: Euler's Method, Modified Euler's Method and Runge-Kutta Method.

TEXT BOOK:

1. Programming in ANSI C, E Balagurusamy, 6th Edition. McGraw Hill Education (India) Private Limited.
2. Introduction to Numerical Methods, SS Sastry, Prentice Hall.

REFERENCE BOOKS:

1. Let Us C, Yashwant Kanetkar, BPB Publications, 5th Edition.
2. Computer Science, A structured programming approach using C", B.A.Forouzan and R.F.Gilberg, " 3rd Edition, Thomson, 2007.
3. The C–Programming Language' B.W. Kernighan, Dennis M. Ritchie, PHI.
4. Scientific Programming: C-Language, Algorithms and Models in Science, Luciano M. Barone (Author), Enzo Marinari (Author), Giovanni Organtini, World Scientific.

BT-1105 BIOLOGY

Course Objectives:

- To study about the cell structure and function.
- To study about the plant structure, functions of various cells in the plants, flower structure, pollination and fertilization.
- To study about the physiological processes in the plant and various methods of plant breeding techniques.
- To study about the general characters of animals- invertebrates, vertebrates.
- To study about the general physiological processes like digestion, respiration, and excretion etc of the animals.

Course Outcomes:

At the end of the course, the student will be able to

- Obtain knowledge in the biological processes occurring in the cells.
- Make use of structure of plants, and understand the phenomena of Embryology so that they produce new varieties of plants.
- Analyze various physiological processes of the plants in plant breeding techniques.
- Understand the general characters of animals, the phenomena of reproduction and life cycle of plasmodium vival.

- Illustrate various physiological processes of the animals. Digestion, respiration Excretory system, Nervous system functions are understood to the student so that student can do research in their future studies.

SYLLABUS

Cell Biology: Structure and function of prokaryotic and eukaryotic cell, cell organelles, cell membrane, chloroplast, mitochondria, golgi complex, endoplasmic reticulum, lysosomes, ribosomes and nucleus, chromosome structure, mitosis and meiosis,

Plant Biology: Parts of a flowering plant; flower-structure of a typical flower, outline description of floral parts – androecium, gynoecium,

Embryology: Structure of anther, microsporogenesis and development of male gametophyte, structure of ovule, megasporogenesis, development of embryo sac. fertilization, process of fertilization and post fertilization changes,

Anatomy: Structure and function of xylem and phloem, internal structure of dicot root, stem and leaf, monocot root, stem and leaf, secondary growth of dicot stem,

Plant Physiology: Water relations of plants, absorption of water by plants, diffusion, water potential, osmosis, plasmolysis, imbibition, active and passive absorption,

Mineral nutrition: Criteria for essentiality, macro elements (nitrogen, phosphorus and potassium) and microelements,

Photosynthesis: photosynthetic pigments, light reaction-Emerson enhancement effect, photo system I and II, photolysis of water, photophosphorylation, CO₂ fixation – C₃, C₄ and CAM pathway, photorespiration, factors affecting photosynthesis – Blackman's law of limiting factors, Nitrogen metabolism: Introduction, nitrogen cycle, biological nitrogen fixation, Plant Growth Regulators: Auxins, gibberellins, cytokinins, abscisic acid and ethylene, Plant Breeding: Methods of plant breeding: selection, hybridization, hybrid vigor and mutational breeding,

Animal Biology: General characters of invertebrates, morphology, life cycle and reproduction of Plasmodium Vivax, general characters of vertebrates.

Animal Physiology: Animal nutrition- modes of nutrition, digestive system of humans and accessory digestive organs, gastrointestinal secretions, digestion, absorption and assimilation of digested products, egestion,

Respiration: Respiration in humans – respiratory system, mechanism of respiration, Circulatory system: Blood vascular system in humans, blood and its components, heart, pumping action of heart, heart beat and pulse,

important blood vessels and course of blood circulation, lymphatic system- lymph, lymph vessels, lymph nodes and lymphatic ducts and pacemakers,

Excretion: Elimination of nitrogenous waste- ammonotelic, ureotelic and uricotelic, structure of human excretory system, structure of urinary system, anatomy of kidney, and structure of nephron,

Nervous system: Structure of neuron, nerve impulse and its conduction, synapse, central nervous system- lobes of brain and its meninges, spinal cord, Peripheral nervous system- Cranial nerves and spinal nerves, autonomous nervous system, sympathetic and parasympathetic nervous system, reflex action, reflex arch of humans.

TEXT BOOKS:

1. 'Biology Text Book for class XI and XII', NCERT.
2. 'AP Academy Text Book for Botany and Zoology, for intermediate

BT-1106 ENGLISH LANGUAGE LAB

Course Objectives:

- To make students recognize the sounds of English through Audio-Visual aids;
- To help students build their confidence and help them to overcome their inhibitions and self- consciousness while speaking in English;
- To familiarize the students with stress and intonation and enable them to speak English effectively; and
- To give learners exposure to and practice in speaking in both formal and informal contexts.

Course Outcomes:

At the end of the course, the student will be able to

- Students will be sensitized towards recognition of English sound patterns and the fluency in their speech will be enhanced;
- A study of the communicative items in the laboratory will help students become successful in the competitive world;
- Students will be able to participate in group activities like roleplays, group discussions and debates; and
- Students will be able to express themselves fluently and accurately in social as well professional context.

SYLLABUS

Introduction to Phonetics: The Sounds of English (Speech sound – vowels and consonants) - Stress and Intonation - Accent and Rhythm.

Listening Skills: Listening for gist and specific information - listening for Note taking, summarizing and for opinions - Listening to the speeches of eminent personalities.

Speaking Skills: Self-introduction - Conversation Skills (Introducing and taking leave) - Giving and asking for information - Role Play - Just A Minute (JAM) session - Telephone etiquette.

Reading and Writing skills: Reading Comprehension – Précis Writing - E-Mail writing - Punctuation.

Presentation skills: Verbal and non-verbal communication - Body Language - Making a Presentation.

REFERENCE BOOKS:

1. Ashraf Rizvi. *Effective Technical Communication*. Tata McGraw Hill Education Private Limited, New Delhi.
2. *Speak Well*. Orient Blackswan Publishers, Hyderabad.
3. Allan Pease. *Body Language*. Manjul Publishing House, New Delhi.

BT-1107 CHEMISTRY LAB

Course Objectives:

- To develop the fine skills of quantitative determination of various chemical components through titrimetric analysis
- To prepare and use ionexchange/ zeolite columns for the removal of hardness of water
- To develop the skill of organic synthesis through the preparation of a polymer/ drug

Course Outcomes:

At the end of the course, the student will be able to

- Determine the amount of various chemical species in solutions by titrations and conduct the quantitative determinations with accuracy
- Develop novel materials to be used as zeolite and prepare columns for removal of hardness of water
- Produce a polymer or a drug

SYLLABUS

1. Determination of Sodium Hydroxide with HCl (Na₂CO₃ Primary Standard)
2. Determination of Alkalinity (Carbonate and Hydroxide) of water sample
3. Determination of Fe(II)/Mohr's Salt by Permanganometry
4. Determination of Oxalic Acid by Permanganometry

5. Determination of Chromium (VI) by Mohr's Salt Solution
6. Determination of Zinc by EDTA method
7. Determination of Hardness of Water sample by EDTA method
8. Determination of Chlorine in water by Iodometric Titration
9. Ionexchange/ Zeolite column for removal of hardness of water
10. Synthesis of Polymer/ drug.

REFERENCE BOOKS:

1. Vogel's Quantitative Chemical Analysis – V – Edition – Longman.
2. Experiments in Applied Chemistry (For Engineering Students) – Sinita Rattan – S. K. Kataria & Sons, New Delhi

BT-1108 CPNM LAB

Course Objectives:

- To impart writing skill of C programming to the students and solving problems.
- To write and execute programs in C to solve problems such as Modularize the problems into small modules and then convert them into programs.,
- To write and execute programs in C to solve problems such as arrays, files, strings, structures and different numerical methods.
- This reference has been prepared for the beginners to help them understand the basic to advanced concepts related to Objective-C Programming languages.

Course Outcomes:

At the end of the course, the student will be able to

- Understand various computer components, Installation of software. C programming development environment, compiling, debugging, and linking and executing a program using the development environment.
- Analyzing the complexity of problems, Modularize the problems into small modules and then convert them into programs.
- Construct programs that demonstrate effective use of C features including arrays, strings, structures, pointers and files.
- Apply and practice logical ability to solve the real world problems.
- Apply Numerical methods to Solve the complex Engineering problems.

SYLLABUS

1. Write a program to read x, y coordinates of 3 points and then calculate the area of a triangle formed by them and print the coordinates of

the three points and the area of the triangle. What will be the output from your program if the three given points are in a straight line?

2. Write a program, which generates 100 random integers in the range of 1 to 100. Store them in an array and then print the arrays. Write 3 versions of the program using different loop constructs. (e.g. for, while, and do while).

3. Write a set of string manipulation functions e.g. for getting a substring from a given position, Copying one string to another, Reversing a string, adding one string to another.

4. Write a program which determines the largest and the smallest number that can be stored in different data types like short, int, long, float, and double. What happens when you add 1 to the largest possible integer number that can be stored?

5. Write a program, which generates 100 random real numbers in the range of 10.0 to 20.0, and sort them in descending order.

6. Write a function for transposing a square matrix in place (in place means that you are not allowed to have full temporary matrix).

7. First use an editor to create a file with some integer numbers. Now write a program, which reads these numbers and determines their mean and standard deviation.

8. Given two points on the surface of the sphere, write a program to determine the smallest arc length between them.

9. Implement bisection method to find the square root of a given number to a given accuracy.

10. Implement Newton Raphson method to det. a root of polynomial equation.

11. Given table of x and corresponding f(x) values, Write a program which will determine f(x) value at an intermediate x value by using Lagrange's interpolation/

12. Write a function which will invert a matrix.

13. Implement Simpson's rule for numerical integration.

14. Write a program to solve a set of linear algebraic equations.

BT-1201 MATHEMATICS – II

Course Objectives:

- The way of obtaining rank, Eigen values and Eigen vectors of a matrix.
- To know the importance of Cayley-Hamilton theorem and getting canonical form from a given quadratic form.
- To solve the system of equations by using direct and indirect methods.

- To solve first order and higher order differential equations by various methods.
- To obtain the Laplace transforms and inverse Laplace transforms for a given functions and their applications.

Course Outcomes:

At the end of the course, the student will be able to

- Find rank, Eigen values and Eigen vectors of a matrix and understand the importance of Cayley-Hamilton theorem.
- Reduce quadratic form to canonical forms and solving linear systems by direct and indirect methods.
- Demonstrate solutions to first order differential equations by various methods and solve basic applications problems related to electrical circuits, orthogonal trajectories and Newton's law of cooling
- Discriminate among the structure and procedure of solving higher order differential equations with constant and variable coefficients.
- Understand Laplace transforms and its properties and finding the solution of ordinary differential equations.

SYLLABUS

(Linear Algebra)

Rank of a matrix- Echelon form, Normal Form - Solution of Linear System of Equations - Consistency of Linear System of Equations - Direct & Indirect Methods: Gauss elimination method, LU Factorization method, Gauss Seidal Method. Complex Matrices: Hermitian, Skew- Hermitian and Unitary Matrices and their Properties.

(Eigen Values and Eigen Vectors)

Eigen Values and Eigen Vectors of a Matrix - Cayley-Hamilton theorem - Inverse and Powers of a Matrix using Cayley-Hamilton's theorem and its applications. Diagonalization of a Matrix - Quadratic Forms - Reduction of Quadratic Form to Canonical Form - Nature of a Quadratic Form.

(Ordinary Differential Equations of First Order and its Applications)

Formation of ordinary differential equations (ODEs) - Solution of an ordinary differential equation - Equations of the first order and first degree - Linear differential equation - Bernoulli's equation - Exact differential equations - Equations reducible to exact equations - Orthogonal Trajectories - Simple Electric (LR & CR) Circuits - Newton's Law of Cooling - Law of Natural growth and decay.

(Differential Equations of Higher Order)

Solutions of Linear Ordinary Differential Equations with Constant Coefficients - Rules for finding the complimentary function - Rules for finding the particular integral - Method of variation of parameters - Cauchy's linear equation - Legendre's linear equation - Simultaneous linear differential equations.

(Laplace Transforms)

Introduction - Existence Conditions - Transforms of Elementary Functions - Properties of Laplace Transforms - Transforms of Derivatives - Transforms of Integrals - Multiplication by t^n - Division by t - Evaluation of integrals by Laplace Transforms - Inverse Laplace Transform - Applications of Laplace Transforms to Ordinary Differential Equations - Simultaneous Linear Differential Equations with Constant Coefficients - Second Shifting Theorem - Laplace Transforms of Unit Step Function, Unit Impulse Function and Laplace Transforms of Periodic Functions.

TEXT BOOK:

1. Scope and Treatment as in "Higher Engineering Mathematics", by Dr. B.S. Grewal, 43rd edition, Khanna publishers.

REFERENCE BOOKS:

1. Graduate Engineering Mathematics by V B Kumar Vatti., I.K. International publishing house Pvt. Ltd.

2. Advanced Engineering Mathematics by Erwin Kreyszig.

3. A text book of Engineering Mathematics, by N.P. Bali and Dr. Manish Goyal. Lakshmi Publications.

4. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.

5. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.

BT-1202 PHYSICS

Course Objectives:

- To impart knowledge in basic concept of physics of Thermodynamics relevant to engineering applications.
- To grasp the concepts of physics for electromagnetism and its application to engineering. Learn production of Ultrasonics and their applications in engineering.
- To Develop understanding of interference, diffraction and polarization: connect it to a few engineering applications.

- To Learn basics of lasers and optical fibers and their use in some applications.
- To Understand concepts and principles in quantum mechanics and Nanophase Materials. Relate them to some applications.

Course Outcomes:

At the end of the course, the student will be able to

- Understand the fundamentals of Thermodynamics and Laws of thermodynamics. Understand the working of Carnot cycle and concept of entropy.
- Gain Knowledge on the basic concepts of electric and magnetic fields. Understand the concept of the nature of magnetic materials. Gain knowledge on electromagnetic induction and its applications .
- Understand the Theory of Superposition of waves. Understand the formation of Newton's rings and the working of Michelson's interferometer. Remember the basics of diffraction, Evaluate the path difference. Analysis of Fraunhofer Diffraction due to a single slit
- Understand the interaction of matter with radiation, Characteristics of Lasers, Principle, working schemes of Laser and Principle of Optical Fiber. Realize their role in optical fiber communication.
- Understand the intuitive ideas of the Quantum physics and understand dual nature of matter. Compute Eigen values, Eigen functions, momentum of Atomic and subatomic particles using Time independent one Dimensional Schrodinger's wave equation. Understand the fundamentals and synthesis processes of Nanophase materials.

SYLLABUS

THERMODYNAMICS

Introduction, Heat and Work, First law of thermodynamics and applications, Reversible and Irreversible process, Carnot cycle and Efficiency, Second law of thermodynamics, Carnot's Theorem, Entropy, Second law in terms of entropy, Entropy and disorder, Third law of thermodynamics (statement only).

ELECTROMAGNETISM

Concept of electric flux, Gauss's law - some applications, Magnetic field - Magnetic force on current, torque on current loop, The Biot-Savart's Law, B near a long wire, B for a circular Current loop, Ampere's law, B for a solenoid, Hall effect, Faraday's law of induction, Lenz's law, Induced magnetic fields, Displacement current, Maxwell's equations (no derivation), Magnetic materials: Classification of magnetic materials and properties.

Ultrasonics :Introduction, Production of Ultrasonics – Piezoelectric and Magnetostriction methods, acoustic grating, applications of ultrasonics.

OPTICS

Interference: Principles of superposition – Young's Experiment – Coherence - Interference in thin films (reflected light), Newton's Rings, Michelson Interferometer and its applications.

Diffraction: Introduction, Differences between interference and diffraction, Fresnel and Fraunhofer diffraction, Fraunhofer diffraction at a single slit (Qualitative and quantitative treatment).

Polarisation: Polarisation by reflection, refraction and double refraction in uniaxial crystals, Nicol prism, Quarter and Half wave plate, circular and elliptical polarization.

LASERS and FIBRE OPTICS : Introduction, characteristics of a laser beam, spontaneous and stimulated emission of radiation, population inversion, Ruby laser, He-Ne laser, Semiconductor laser, applications of lasers

Introduction to optical fibers, principle of propagation of light in optical fibers, Acceptance Angle and cone of a fibre, Numerical aperture, Modes of propagations, classification of fibers, Fibre optics in communications, Application of optical fibers.

MODERN PHYSICS : Introduction, De Broglie concept of matter waves, Heisenberg uncertainty principle, Schrodinger time independent wave equation, application to a particle in a box. Free electron theory of metals, Kronig - Penney model (qualitative treatment), Origin of energy band formation in solids, Classification of materials into conductors, semi conductors and insulators. Nanophase Materials

Introduction, properties, Top-down and bottom up approaches, Synthesis - Ball milling, Chemical vapour deposition method, sol-gel methods, Applications of nano materials.

TEXT BOOKS:

1. Physics by David Halliday and Robert Resnick – Part I and Part II - Wiley.
2. A textbook of Engineering Physics, Dr. M. N. Avadhanulu, Dr. P.G. Kshirsagar - S. Chand
3. Engineering Physics by R.K. Gaur and S.L. Gupta –Dhanpat Rai

REFERENCE BOOKS:

1. Modern Engineering Physics by A.S. Vadudeva
2. University Physics by Young and Freedman

BT-1203 ENGINEERING GRAPHICS

Course Objectives:

- Understand the basics of Engineering Graphics and BIS conventions.
- Develop the graphical skills for communication of concepts, ideas and design of engineering products through technical drawings
- Demonstrate and practice the various profiles/curves used in engineering practice through standard procedures.
- Demonstrate and practice the orthographic projections of points, lines, planes, solids and section of solids
- Demonstrate and practice the development of surfaces of simple solids
- Familiarize the basic concept of isometric views clearly.

Course Outcomes:

At the end of the course, the student will be able to

- Develop simple engineering drawings by considering BIS standards.
- Able to draw different engineering curves with standard Procedures
- Comprehend the basics of orthographic projections and deduce orthographic projections of points, lines, planes and solids at different orientations in real life environment.
- Visualize clearly the sections of solids.
- Apply the concepts of development of surfaces while designing/analyzing any product.
- Recognize the significance of isometric drawing to relate 2D environment with 3D environment.

SYLLABUS

Introduction: Lines, Lettering and Dimensioning, Geometrical Constructions, and Scales.

Curves: Conic sections: General construction of ellipse, parabola and hyperbola. Construction of involutes of circle and polygons only. Normal and tangent to curves.

Projections of Points: Principal or Reference Planes, Projections of a point situated in any one of the four quadrants.

Projections of Straight Lines: Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane.

Projections of Straight Line Inclined to Both the Reference Planes: Projections of Planes: Projection of Perpendicular planes: Perpendicular to both reference planes, perpendicular to one reference plane and parallel to other reference plane and perpendicular to one reference plane and inclined

to other reference plane. Projection of Oblique planes. Introduction to Auxiliary Planes.

Projections of Solids: Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to other and axes inclined to both the reference planes.

Sections of Solids: Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids (Prism, Pyramid, Cylinder and Cone) in simple position only.

Development of Surfaces: Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.

Isometric Views: Isometric projection, Isometric scale and Isometric view. Isometric view of Prisms, Pyramids, cylinder, cone, and their combinations.

TEXT BOOK:

Elementary Engineering Drawing by N.D.Bhatt, Charotar Publishing House.

REFERENCE BOOKS:

Engineering Graphics by K.L. Narayana and P. Kannaiah, Tata Mc-Graw Hill

BT-1204 GENETICS

Course Objectives:

- To introduce Mendel's law of inheritance.
- To introduce interaction of Genes and inheritance.
- To introduce Gene linkage, crossing over and mapping.
- To introduce sex determination & linkage.
- To introduce chromosomes & chromosomal variation.

Course Outcomes:

At the end of the course, the student will be able to

- Define inheritance and classify the types of inheritance.
- Different methods available to study genetics
- Performing of polymerized chain reaction, cloning and transformation
- Describe complementary, duplicate genes and interaction between different two gene pairs.
- Interpret sex determination mechanisms and inheritance of sex linked traits.

- Differentiate types of cytogenetic effects and numerical changes in chromosomes.

SYLLABUS

Mendel's law of Inheritance: Mendel's experiments–Mendel's materials, crossing technique, results of Mendel's experiments, phenomenon of dominance, variation in dominance relation, incomplete dominance, co-dominance, principle of segregation- monohybrid cross, mechanism of segregation, monohybrid ratio, principle of independent assortment, Mendel's dihybrid cross, mechanism of independent assortment, dihybrid ratio, back cross and test cross, deviations from dihybrid phenotypic ratio,

Interaction of Genes: Interaction of genes-combs in fowls, Epistasis, complementary genes, duplicate genes, additional interactions involving two gene pairs, interaction between more than two gene pairs,

Quantitative / Multiple factor inheritance: Multiple factors, quantitative and quantitative traits, examples of quantitative inheritance, Kernel color in wheat, skin color in man, corolla length in tobacco, continuous variations,

Multiple alleles : (Based on classical concept of Allelomorphism): Multiple alleles and isoalleles, skin color in rodents, eye color in *Drosophila*, self sterility in *Nicotiana*, blood groups in humans, complementation test or cis-trans test,

Linkage, crossing over and mapping:

Linkage – coupling and repulsion hypothesis, Morgan's view on linkage, chromosome theory of linkage, kinds of linkage-complete linkage, incomplete linkage, linkage groups, significance of linkage, Crossing over – Types of crossing over - mitotic and meiotic crossing over, mechanism - synapsis, duplication of chromosomes, crossing over by breakage and union, terminalization,

Molecular mechanism of recombination- Holiday model, cytological basis of crossing over; significance of crossing over,

Construction of a genetic mapping: Two point and three point test crosses and gene mapping, interference and coincidence,

Sex Determination :Genetically controlled sex determining mechanisms, sex chromosomal mechanism of sex determination, types-heterogenetic males, heterogenetic females, genic balance mechanism (X/A ratio in *Drosophila*), sex determination in man (TDF and SRY genes), sex determination in plants; Single gene control of sex; haploid males in hymenoptera; hormonal control of sex, environmental control of sex, dosage compensation (in man and *Drosophila*),

Sex Linkage: Inheritance of sex linked (X-linked) traits-eye color in *Drosophila*, haemophilia and color blindness in human and barred plumage

in poultry, inheritance of Y-linked genes, inheritance of XY-linked genes, primary and secondary non-disjunction of sex chromosomes, sex influenced and sex limited traits, sex linked disorders in human beings,

Cytoplasmic Inheritance :Maternal effects-shell coiling in snails, pigment in flour moth, cytoplasmic inheritance involving dispensable heredity units, kappa particles in *Paramecium*, cytoplasmic inheritance by cellular organelles, plastid inheritance in variegated four-o'clock plant, mitochondrial inheritance, male sterility in plants, uniparental inheritance in *Chlamydomonas*,

Chromosomal variations: Origin, types and cytogenetic effects,

Structural changes in chromosomes: Duplications, translocations, inversions (paracentric and pericentric cross over suppressors),

Numerical changes in chromosomes: Aneuploidy (monosomy, nullisomy, trisomy, tetrasomy), euploidy (monoploidy, haploidy, polyploidy-autopolyploids and allopolyploids).

TEXT BOOKS:

1. "Genetics", by P.K.Gupta, Rastogi Publications
2. "Cell Biology, Genetics, Molecular Biology, Evolution and Ecology", by P.S. Verma & V.K. Agarwal, S. Chand & Company

REFERENCE BOOKS:

1. "Principles of Genetics", by E.J. Gardner, M.J.Simmons&D.PeterSnustard, John Wiley & Sons, INC. Publishing Co.
2. 'Essentials of Materials Science' by A.G. Guy.
3. An introduction to corrosion science and engineering By Herbert Uhlig and R. Winston Revie, Published by John Wiley and sons, New York

BT-1205 MICROBIOLOGY

Course objectives:

- To make the student learn about origin and evolution of microbes.
- To make the student understand structure and functioning of different microbial groups.
- To make them to acquaint the cultivation of microbes in artificial medium.

Course Outcomes:

At the end of the course, the student will be able to

- Demonstrate the origin and evolution of microbes
- Understand structure and functioning of different microbial groups.
- Understand the importance of microbes in ecosystem

- Explain why microorganisms are ubiquitous in nature, inhabiting a multitude of habitats and occupying a wide range of ecological habitats.

SYLLABUS

History and Development of Microbiology: Contributions of van Leeuwenhock, Joseph Lister, Pasteur, Koch, Jenner, Winogradsky, Beijerinck, further developments of microbiology, Microbial Taxonomy: Bacteria, archea and their broad classification. Molecular approaches to microbial taxanomy, physiology of extremophiles,

Morphology and Functions of Viruses, Yeast, Molds and Bacteria: Viruses-Morphology of viruses- size, shape and symmetry, replication of viruses- Lytic and Lysogenic cycle,

Yeast and Molds: Morphology, life cycle, economic importance of yeast and Aspergillus,

Bacteria :Ultra structure of bacteria, cell wall, cell membrane, flagella, pili, capsule, endospore, and cell inclusions, differences between prokaryotic and eukaryotic cell,

Microbial growth: Definition of growth- growth curve, measurement of bacterial growth (cell number and cell mass) growth yield, continuous culture- chemostat, turbidostat, synchronous growth, effect of environmental factors on growth, Microbial Nutrition and Control of Microorganisms: Nutritional requirements, nutritional types of bacteria, up-take of nutrients by cell, sterilization, and disinfection, effect of physical (moist and dry heat, radiation and filtration) and chemical agents, antibiotics- mode of action and resistance,

Methods in Microbiology: Culture media, synthetic and complex media, solidifying agents, types of media, isolation of pure cultures- spread plate, pour plate and streak plate, preservation of microorganisms, light (bright field only) and electron microscopy,

Applied Microbiology: Water, food and milk born contamination and remedy; basic microbial genetics- transformation, conjugation, transduction, strain improvement of industrially important micro-organisms.

TEXT BOOK:

1. 'Microbiology', by Prescott L.M., Herley J.P., Klein D.A., McGraw- Hill

REFERENCE BOOKS:

1. "Microbiology", Pelzar, M.J., Chan, E.C.S., Kreig N.R., Tata McGraw-Hill
2. "Brock biology of Microorganisms", Madigan M.T., Martinco J.M. and Parker J., Prentice Hall

BT-1206 WORKSHOP LAB

Course Objectives:

- Get hands on experience with the working skills in Carpentry trade.
- Know how to work with Sheet Metal tools.
- Get familiar with the working skills of Metal Fitting operations.
- Get hands on experience with house hold electrical wiring.

Course Outcomes:

At the end of the course, the student will be able to

- Work with Wood Materials in real time applications.
- Build various parts with Sheet Metal in day-to-day life.
- Apply Metal Fitting skills in various applications.
- Apply this knowledge to basic house electrical wiring and repairs.

SYLLABUS

Carpentry: Any three jobs from – Half lap joint, Mortise and Tenon joint, Half – lap Dovetail joint, Corner Dovetail joint, Central Bridle joint.

Sheet Metal: Any three jobs from – Square tray, Taper tray(sides), Funnel, Elbow pipe joint.

Fitting: Any three jobs from – Square, Hexagon, Rectangular fit, Circular fit and Triangular fit.

House wiring: Any three jobs from – Tube light wiring, Ceiling fan wiring, Stair-case wiring, Corridor wiring.

REFERENCE BOOKS:

1. Elements of workshop technology, Vol.1 by S. K. and H. K. Choudary.
2. Work shop Manual / P.Kannaiah/ K.L.Narayana/ SciTech Publishers.
3. Engineering Practices Lab Manual, Jeyapoovan, Saravana Pandian, 4/e Vikas.

BT-1207 PHYSICS LAB

Course Objectives:

- To enable the students to acquire skill, technique and utilization of the Instruments
- Draw the relevance between the theoretical knowledge and to imply it in a practical manner with respect to analyze various electronic circuits and its components.
- To impart the practical knowledge in basic concepts of Wave optics, Lasers and Fiber optics.

- To familiarize the handling of basic physical apparatus like Vernier callipers, screw gauge, spectrometers, travelling microscope, laser device, optical fibre, etc.

Course Outcomes:

At the end of the course, the student will be able to

- Design and conduct experiments as well as to analyze and interpret
- Apply experimental skills to determine the physical quantities related to Heat, Electromagnetism and Optics
- Relate theoretical knowledge and the means to imply it in a practical manner by performing various relative experiments.

SYLLABUS

1. Determination of Radius of Curvature of a given Convex Lens By forming Newton's Rings.
2. Determination of Wavelength of Spectral Lines in the Mercury Spectrum by Normal Incidence method.
3. Study the Intensity Variation of the Magnetic Field along axis of Current Carrying Circular Coil.
4. Determination of Cauchy's Constants of a Given Material of the Prism using Spectrometer.
5. Determination of Refractive Index of Ordinary ray and Extraordinary ray.
6. Determination of Thickness Given Paper Strip by Wedge Method.
7. Calibration of Low Range Voltmeter.
8. Calibration of Low Range Ammeter.
9. Determination of Magnetic Moment and Horizontal Component of Earth's Magnetic Field.
10. Lees Method - Coefficient of thermal Conductivity of a Bad Conductor.
11. Carey Foster's Bridge – Verification of laws of Resistance and Determination of Specific Resistance.
12. Melde's Apparatus – Frequency of electrically maintained Tuning Fork.
13. Photoelectric cell-Characteristics.
14. Planks Constants.
15. Laser- Diffraction.

BT-1208 MICROBIOLOGY LABORATORY

Course objectives:

- To provide the basic fundamental knowledge on growth of microorganisms

- To provide the basic fundamental knowledge on reaction of microorganisms with specific growth media

- To understand biochemical reactions with media used in identification.

Course outcomes:

At the end of the course, the student will be able to

- Explain the handling of microbes and basic instrumentation used in Microbiological laboratory.
- Evaluate the growth and reaction of microorganisms on specific media
- Understand the staining and motility of microbes
- Differentiate the morphology of Fungi and yeast
- Evaluate quality of milk and water

List of Experiments:

1. Preparation of Nutrient broth and inoculation of Bacteria.
2. Preparation of Nutrient agar and inoculation of Bacteria
3. Isolation of pure cultures
4. Staining of Microbes- Simple staining, Gram staining, Negative staining, Capsule staining and spore staining.
5. Motility of Microbes.
6. Morphology of Fungi- (*Aspergillus niger*)
7. Morphology of Yeast- (*Saccharomyces cerevisiae*)
8. Bio-chemical tests- IMViC test, Amylase test, Hydrogen Sulphide production test
9. Testing of Microbiological quality of milk.
10. Testing of Microbiological quality of water.
11. Microbial assay of antibiotics.
12. Evaluation of disinfectant.

TEXT BOOK:

'Microbiology- a Laboratory Manual' by Cappuccino T.G., Sherman N, Addison.

CH-2101 MATHEMATICS-III

Course Objectives:

The objectives, in particular are to learn about:

- Differentiation of vector functions of real variables, curves in space, differential operators, the concept of gradient, divergence and curl and their potential applications.

- The concepts of Line-, Surface and Volume integrals and transformation theorems such as Green's theorem in the plane, Stoke's theorem, Gauss Divergence theorem and their applications.

- Formation of Partial Differential Equations and solution of first order first degree linear, non-linear Partial Differential Equations, Homogeneous and Non homogeneous linear partial differential equations with constant coefficients.

- The method of separation of variables and how to use it to find the solution of one dimensional wave (string equation), one-and two-dimensional Heat flow equations, Laplace's equation in Cartesian and polar coordinates.

- The concept of integral transforms, namely, Fourier transforms, Fourier Sine, Cosine and related inverse transforms, and their applications in solving several Physical and Engineering problems.

Course Outcomes:

At the end of the course, the students would be able to

- Understand differential operations and the concepts of Gradient, Divergence and Curl and their applications.

- Apply the concepts of Line integrals, Surface Integrals, Volume Integrals and their potential applications: work done by a force field, circulation and Flux etc. Also, find out the relation between Line, Surface and Volume integrals: Green's theorem in the plane, Stoke's and Divergence theorems.

- Understand the formation of partial differential equations and the solving Linear and Non linear first order partial differential equations. Also, how to find the solution of Linear Partial Differential Equations with constant coefficients by finding the complementary function and particular integrals.

- Apply the method of separation of variables to solve the important governing equations of one dimensional wave equation, One and Two dimensional heat flow equations, Laplace's equations in Cartesian and polar coordinates.

- Apply the knowledge of Fourier transform techniques in solving several Initial and Boundary value problems of Engineering, such as problems in Conduction of heat / Thermodynamics, Hydraulics transverse vibrations of a string, oscillations of an elastic beam, bending of beams, electrical circuits, free and forced vibrations of a membrane and transmission lines , etc.

SYLLABUS

(Vector Calculus-Differentiation)

Differentiation of vectors, curves in space, velocity and acceleration, relative velocity and relative acceleration, scalar and vector point functions,

vector operator ∇ applied to scalar point functions- gradient, ∇ applied to vector point functions- divergence and curl. Physical

interpretation of gradient, divergence and curl (i.e.,

∇f ,

$\nabla \cdot F$,

$\nabla \times F$), Irrotational and

Solenoidal fields, the relations obtained after ∇ applied twice to point functions, ∇ applied to products of two functions.

(Vector Integration)

Integration of vectors, line integral, circulation, work done, surface integral-flux, Green's theorem in the plane, Stoke's theorem, volume integral, Gauss Divergence theorem. (All theorems without proofs)

Introduction of orthogonal curvilinear coordinates, cylindrical and spherical polar coordinates

(Partial Differential Equations)

Formation of partial differential equations, solutions of partial differential equations- equations solvable by direct integration, linear equations of first order: Lagrange's Linear equation, non- linear equations of first order, Charpit's method. Homogeneous linear equations with constant coefficients- rules for finding the complementary function, rules for finding the particular integral (working procedure), non- homogeneous linear equations.

(Applications Of Partial Differential Equations)

Method of separation of variables, One dimensional wave equation- vibrations of a stretched string, one dimensional Heat flow equation, Two dimensional heat flow in steady state - solution of Laplace's equation in Cartesian and polar coordinates (two dimensional).

(Integral Transforms (Fourier Transform)

Introduction, definition, Fourier integral, Sine and Cosine integrals, Complex form of Fourier integral, Fourier transform, Fourier Sine and Cosine transforms, Finite Fourier Sine and Cosine transforms, properties of Fourier transforms.

Convolution theorem for Fourier transforms, Parseval's identity for Fourier transforms, Fourier transforms of the derivatives of a function, simple applications to Boundary value problems.

TEXT BOOK:

1. Scope and treatment as in "Higher Engineering Mathematics", by Dr. B.S.Grewal, **43rd Edition**, Khanna Publishers.

REFERENCE BOOKS:

1. Graduate Engineering Mathematics by V B Kumar Vatti, I.K.International publications

2. Advanced Engineering Mathematics by Erwin Kreyszig.
3. A text book of Engineering Mathematics by N.P. Bali and Dr. Manish Goyal, Lakshmi Publications.
4. Mathematical Methods of Science & Engineering aided with MATLAB by KantiB.Dutta, Cengage Learning India Pvt. Ltd.
5. Higher Engineering Mathematics by B. V. Ramana, Tata McGraw Hill Company.
6. Advanced Engineering Mathematics by H.K.Dass. S.Chand Company.

BT-2101 BIOCHEMISTRY

Course Objectives:

- To study about the principles and significance of biochemistry.
- To study about the structure and function of Carbohydrates, Proteins and Aminoacids and Lipids.
- To study about the Nucleic acids like DNA and RNA and also to study about the structure and function of enzymes.
- To study about haemoglobin and chlorophyll molecules and their functions.
- To study about the fat soluble and water soluble vitamins also to study about the structure and function of hormones.

Course Outcomes:

At the end of the course, the students would be able to

- Define Biochemistry- study of chemical reactions and processes in living systems
- Understand Carbohydrates, Proteins and Amino acids and Lipids.
- Differentiate quantitative and qualitative analysis of the biomolecules.
- Demonstrate nucleic acids-DNA and RNA hereditary materials and enzyme structure and functions.
- Explain the basic structure of porphyrins and the detailed structure of haemoglobin and chlorophyll molecules.
- Describe the structure and function of vitamins and endocrinal glands.

SYLLABUS

Scope and importance of Biochemistry.

Carbohydrates: Classification, chemistry and properties of monosaccharides (Ribose, Glucose, and Fructose), disaccharides (maltose, lactose, sucrose) and polysaccharides (homopolysaccharides and heteropolysaccharides), metabolism of carbohydrates - glycolysis,

TCA cycle, electron transport and oxidative phosphorylation, HMP shunt pathway, glycogenesis and glycogenolysis,

Proteins and amino acids: Classification and properties of amino acids and proteins, peptide bond, chemical synthesis of peptides and solid-phase peptide synthesis, structural organization of proteins- primary, secondary, tertiary and quaternary structure of proteins, denaturation of proteins,

Lipids: Classification, structure and physiological functions of triglycerides, fatty acids, phospholipids, cerebroside, gangliosides and cholesterol, digestion and absorption of fats, biosynthesis and degradation of fatty acids and triglycerides,

Nucleic acids: Structure and properties of purines and pyrimidine bases, nucleosides, nucleotides, cellular localization, isolation and estimation of nucleic acids, types of nucleic acids, double helical structure of DNA, types of RNA, biosynthesis and catabolism of purines and pyrimidines,

Enzymes: Introduction, nomenclature and classification of enzymes, kinetic properties of enzymes, factors affecting enzyme action, coenzymes, enzyme inhibition- competitive, non- competitive and uncompetitive inhibitions, Porphyrins: Chemistry of hemoglobin and chlorophyll, synthesis of heme and chlorophyll and heme catabolism, Vitamins and hormones: Definition, classification, chemistry, source, functions and deficiency of vitamins, outlines of hormones and their functions,

TEXT BOOKS:

1. "Fundamentals of Biochemistry" by J.L.Jain, S.Chand & Company Ltd, New Delhi
2. "Principles of Biochemistry" by Lehninger, Nelson and Cox, CBS Publications.

CH-2103 MANAGERIAL ECONOMICS

Course Objectives:

1. To bring about an awareness about the nature of Managerial Economics and its linkages with other disciplines.
2. To understand the Micro and Macro Environment of Business.
3. To familiarise the prospective engineers with the concepts and tools of Managerial Economics with an objective to understand the real world of business.

Course Outcomes:

Managerial Economics will help the prospective engineers, who are likely to occupy managerial positions in future to understand the various economic activities in business and industry for an effective and efficient running of the organisations.

SYLLABUS

Significance of Economics and Managerial Economics:

Economics: Definitions of Economics- Wealth, Welfare and Scarcity definition Classification of Economics- Micro and Macro Economics.

Managerial Economics: Definition, Nature and Scope of Managerial Economics, Differences between Economics and Managerial Economics, Main areas of Managerial Economics, Managerial Economics with other disciplines.

Demand Analysis :Demand - Definition, Meaning, Nature and types of demand, Demand function, Law of demand - Assumptions and limitations. Exceptional demand curve.

Elasticity of demand - Definition, Measurement of elasticity, Types of Elasticity (Price, Income, Cross and Advertisement), Practical importance of Price elasticity of demand, Role of income elasticity in business decisions, Factors governing Price Elasticity of demand.

Demand Forecasting - Need for Demand forecasting, Factors governing demand forecasting, Methods of demand forecasting: Survey methods- Experts' opinion survey method and consumers Survey methods.

Utility Analysis: Utility- Meaning, Types of Economic Utilities, Cardinal and Ordinal Utility, Total Utility, Marginal Utility, The law of Diminishing Marginal Utility and its Limitations Theory of Production and Cost analysis:

Production - Meaning, Production function and its assumptions, use of production function in decision making; Law of Variable Proportions: three stages of the law

Cost analysis - Nature of cost, Classification of costs - Fixed vs. Variable costs, Marginal cost, Controllable vs. Non - Controllable costs, Opportunity cost, Incremental vs. Sunk costs, Explicit vs. Implicit costs, Replacement costs, Historical costs, Urgent vs. Postponable costs, Escapable vs. unavoidable costs, Economies and Diseconomies of scale

Market Structures : Definition of Market, Classification of markets; Salient features or conditions of different markets - Perfect Competition, Monopoly, Duopoly , Oligopoly, Importance of kinked demand curve ;Monopolistic Competition

Pricing Analysis : Pricing - Significance: Different Pricing methods- Cost plus pricing, Target pricing, Marginal cost pricing, Going -rate pricing, Average cost pricing, Peak load pricing , Pricing of joint Products, Pricing over the life cycle of a Product, Skimming pricing Penetration pricing, Mark-up and Mark- down pricing of retailers.

Business cycles, Inflation and Deflation: Business cycles - Definition , Characteristics , Phases, Causes and Consequences; Measures to solve problems arising from Business cycles Inflation -Meaning, Types, Demand-pull and Cost push inflation, Effects of Inflation, Anti- inflationary measures. Deflation- Meaning, Effects of Deflation, Control of Deflation, Choice between Inflation and Deflation.

TEXT BOOKS:

1. Sankaran,S., Managerial Economics,Marghan Publications, 2015, Chennai.

2. Aryasri, A.R., Managerial Economics and Financial Analysis, MC Graw Hill Education, New Delhi,2015.

BT-2102

BIO-ANALYTICAL TECHNIQUES

Course Objectives:

Bioanalysis is a sub-discipline of analytical chemistry covering the quantitative measurement of xenobiotics (drugs and their metabolites, and biological molecules in unnatural locations or concentrations) and biotics (macromolecules, proteins, DNA, large molecule drugs, metabolites) in biological systems. Many scientific endeavors are dependent upon accurate quantification of drugs and endogenous substances in biological samples; the focus of bioanalysis in the pharmaceutical industry is to provide a quantitative measure of the active drug and/or its metabolite(s) for the purpose of pharmacokinetics,toxicokinetics, bioequivalence and exposure-response (pharmacokinetics/pharmacodynamics studies). Bioanalysis also applies to drugs used for illicit purposes, forensic investigations, anti-doping testing in sports, and environmental concerns. Modern drugs are more potent, which has required more sensitive bioanalytical assays to accurately and reliably determine these drugs at lower concentrations. This has driven improvements in technology and analytical methods.

Course Outcomes:

At the end of the course, the student will be able to

- Explain general principles and theory of the Spectroscopy.
- Understand the basic instrumentation of HPLC, GLC for identification and characterization of compounds.
- Select separation techniques for biological components.
- Analyze instrumentation, separation and identification of compounds by Electrophoresis.

SYLLABUS

Chromatography- Distribution coefficient, modes of chromatography. Paper, Thin layer, Ion- Exchange and Affinity chromatography. GLC- Principle, sample preparation, apparatus, detectors types and applications. HPLC- Principle, Components and applications.

Electrophoresis- General principles, support media and applications. SDS-PAGE, Isoelectric focusing, Agarose gel electrophoresis, capillary electrophoresis. Centrifugation- Principle of

sedimentation, sedimentation coefficient, Preparative and Analytical centrifuges, Ultracentrifuge. Differential centrifugation, density gradient

centrifugation. Applications- in determination of molecular mass, purity and conformation of macromolecules.

Radioisotope techniques- Detection and measurement of radioactivity. Gas ionization, Excitation of solids and solutions, Autoradiography, Application in biological sciences- Metabolic pathways, turn over time determination, isotope dilution analysis, radiodating, clinical diagnosis and sterilization and tracer techniques. Biosensors- Principle and applications of Electrochemical, Thermometric, Optical and Piezoelectric Biosensors.

UV Visible Spectroscopy- Principle, Beer-Lamberts law, Instrumentation of Single and Double beam spectrophotometers. Bathochromic and hypsochromic shifts and applications. Turbidometry and Nephelometry- Principles and Applications. Infra red and Raman Spectroscopy- Principles and Applications. Spectrofluorimetry- Principle and Applications.

ESR Spectroscopy- Principle, Hyperfine splitting, Instrumentation and applications. NMR Spectroscopy- Principle, Theory of Proton Magnetic resonance and Instrumentation. NMR parameters- Chemical shifts, spin-spin splitting, Intensity and line width and applications- Magnetic resonance imaging. Mass spectroscopy- Principle, Instrumentation, Ionization techniques, Electron impact and chemical Ionization, Ion desorption and evaporation methods, Magnetic and electric sector analyzers, detectors (Faraday cup). X-ray crystallography- Principle, Bragg's equation, determination of crystal structure-Rotating crystal method and Powder method, and applications.

TEXT BOOK:

1. Biophysical techniques, by K. Upadhyay, A. Upadhyaya and N. Nath. Himalaya publishing house.

REFERENCE BOOK:

1. Practical Biochemistry- Principles and techniques- by Keith Wilson and John Walker.

BT-2103 DOWNSTREAM PROCESSING

Course Objectives:

The course will help to:

- Learn the fundamentals of downstream processing
- Understand the principle, working and application of major unit operations in Bioprocessing of industrially important products.
- Understand strategies for development of novel Bioprocessing protocol by applying the concise principles of downstream processing.

Course Outcomes:

At the end of the course, the student will be able to

- Apply the concepts of downstream processing for separation.
- Execute precise and efficient bioseparation process, which is cost effective and yield high degree of pure substance.
- Select the bioseparation process which gives high resolution, economical bioproducts.

SYLLABUS

Cell Disruption: Physical and Mechanical methods, Chemical and Enzymatic methods.

Separation Of Insoluble Products: Filtration, Centrifugation, Coagulation and Flocculation, Sedimentation.

Separation Of Soluble Products: Extraction, Precipitation, Adsorption, Micro filtration, Ultra-filtration, Reverse Osmosis, Dialysis, Electro Dialysis, Pervaporation. Electrophoresis, Gel Exclusion Chromatography and Ion Exchange Chromatography.

Products Purification & Polishing: Crystallization and Drying.

TEXT BOOKS:

- 1) "Bioseparations—principles & techniques" by B. Siva Sankar.
- 2) "Bioprocess Engineering" by Michael L. Shuler & Kargi, Prentice Hall of India
- 3) "Bioseparations – downstream processing for Biotechnology", by Paul A Belter and E.L. Cussler.

REFERENCE BOOKS:

- 1) "Biochemical engineering fundamentals" 2nd ed. by J E Bailey and D Ollis, McGraw- Hill (1986).
- 2) "Principles of fermentation technology" by P F Stanbury and A Whitaker, Pergamon press (1984).

BT-2104

BIOCHEMISTRY AND BIOANALYTICAL TECHNIQUES LABORATORY

Course Objectives:

• This lab is designed to train the students in basic techniques of Biochemistry and Bioanalytical techniques like estimation of total Carbohydrates, Proteins, Lipids and DNA.

Course Outcomes:

At the end of the course, the student will be able to

- Estimate the amount of Glucose, protein, lipid, DNA in the given sample solutions.

- Determine the Enzyme activity.
- Understand the fundamentals of recovery/purification of enzymes.
- Experiment with the Chromatographic techniques for the separation of biomolecules.

List of Experiments

1. Estimation of total Carbohydrates
2. Estimation of Proteins
3. Estimation of Lipids and of Cholesterol
4. Assay of Enzymes- Amylase. Determination of its K_m value
5. Estimation of DNA, Determination of T_m of DNA
6. Paper chromatography of sugar
7. Thin layer chromatography of lipids
8. Ion exchange chromatography for biomolecules separation
9. Electrophoresis of proteins and determination of their molecular weight by SDS-PAGE
10. Estimation of turbidity by Nephelometer
11. Separation of biomolecules by GLC

TEXT BOOKS:

1. 'Introduction to Practical Biochemistry', by Plummer, Tata Mc-Graw Hill
2. 'Practical Biochemistry', by Sawhney
3. 'Laboratory Manual in Biochemistry' by J.Jayaraman, New Age International

BT-2105

DOWNSTREAM PROCESSING LABORATORY

Course Objectives:

The objective of this course is to enable students to

- Acquire knowledge of different techniques for solid-liquid separation, product release and purification of Biotechnology products.
- To design and execute efficient and sustainable downstream processes to achieve a pure bioproduct.

Course Outcomes:

At the end of the course, the student will be able to

- Understand the fundamentals of recovery/ purification operations for biopharmaceutical production.

List of Experiments

1. Cell Disruption by Sonication
2. Cell Disruption by Enzymatic Reaction
3. Centrifugal Separation- Ultra Centrifugation, Gel Filtration
4. Micro filtration
5. Ultra filtration
6. Aqueous Two-phase Extraction
7. Dialysis

CH-2108 MATLAB

The student will learn to apply the knowledge of *MATLAB* for solving Chemical Engineering problems.

Course Outcomes:

At the end of the course the student will be able to

- Apply *Matlab* to create and print arrays and execute function files
- Solve linear equations using *Matlab*
- Determine the curve fit equation for the given data
- Draw 2D plots and 3D plots for the given data

SYLLABUS

Introduction, Tutorial lessons: MATLAB session, working with arrays of numbers, creating and printing simple data, saving and executing a script file, creating and executing function files, working with files and directories.

Interactive computation - Matrices and vectors, matrix and array operations, creating and using inline functions, using built in functions and online help, saving and loading data, plotting simple graphs. Script files, function files, language specific features, advanced data objects.

Applications - linear algebra, curve fitting and interpolation, data analysis and statistics, numerical integration, ordinary differential equations, nonlinear algebraic equations.

Basic 2D plots, using subplot to layout multiple graphs. 3-D plots, symbolic Math tool box: two useful tools in symbolic Math tool box, using symbolic Math tool box.

TEXT BOOK:

1. 'Getting started with MATLAB: A quick introduction for scientists and engineers' by Rudra Pratap, Oxford University press

CH-2109 ENVIRONMENTAL SCIENCE

Course Objectives:

The aim of this course is to make the students better understand the changes in the environment and be given a greater voice and planning

conservation through an interdisciplinary environmental science curriculum that is design to enhance scientific enquiry and to strengthen competence.

Course Outcomes:

At the end of the course, the student will be able to

- Understand various types of pollution regulations and their scientific bases.
- Apply knowledge for the protection and improvement of the environment.
- Recognize the major concepts in environmental science and demonstrating in-depth of the environment

SYLLABUS

Introduction: Definition, scope and importance, measuring and defining environmental development – indicators

Ecosystems: Introduction, types, characteristic features, structure and functions of ecosystems – forest, grassland, desert, aquatic (lakes, rivers and estuaries)

Environmental and natural resources management: Land resources- land as a resource, common property resources, land degradation, soil erosion and desertification, effects of modern agriculture, fertilizer-pesticide problems

Forest resources- use and over-exploitation, mining and dams –their effects on forest and tribal people

Water resources – use and over utilization of surface and ground water, floods, droughts, water logging and salinity, dams-benefits and costs, conflicts over water

Energy resources- Energy needs, renewable and non-renewable energy sources, use of alternate energy sources, impact of energy use on environment

Bio-diversity and its conservation: Value of bio-diversity- consumptive and productive use, social, ethical, aesthetic and option values, biogeographical classification of India - India as a mega diversity nation, threats to biodiversity, hot spots, habitat loss, poaching of wild life, loss of species, seeds etc., conservation of biodiversity - in-situ and ex-situ conservation

Environmental pollution- local and global issues: Causes, effects and control measures of air pollution, indoor air pollution, water pollution, soil pollution, marine pollution, noise pollution, solid waste management, composting, vermiculture, urban and industrial wastes, recycling and re-use, nature of thermal pollution and nuclear hazards, global warming, acid rain, ozone depletion

Environmental problems in India: Drinking water, sanitation and public health, effects of activities on the quality of environment, urbanization, transportation, industrialization, green revolution, water scarcity and ground water depletion, controversies on major dams – resettlement and rehabilitation of people: problems and concerns, rain water harvesting, cloud seeding and watershed management

Economy and environment: The economy and environment interaction, economics of development, preservation and conservation, sustainability: theory and practice, limits to growth, equitable use of resources for sustainable lifestyles, environmental impact assessment

Social issues and the environment: Population growth and environment, environmental education, environment movements, environment versus development

Institutions and governance: Regulation by Government, monitoring and enforcement of environmental regulation, environmental Acts, water (prevention and control of pollution) act, air (prevention and control of pollution) act, environment protection act, wild life protection act, forest conservation act, coastal zone regulations, institutions and policies relating to India, environmental governance

International conventions: Stockholm conference-1972, Earth summit-1992, World commission for environmental development (WCED)

Case studies: Chipko movement, Narmada bachaoandolan, Silent valley project, Madhura refinery and Taj mahal, Industrialization of Pattancheru, Nuclear reactor at Nagarjuna sagar, Tehri dam, Ralegaon siddhi (Anna Hazare), Kolleru lake-aquaculture, Fluorosis in Andhra Pradesh

Field work: Visit to a local area to document and mapping environmental assets – river/forest/grass land / hill/ mountain, study of local environment-common plants, insects, birds, study of simple ecosystems – pond, river hill, slopes etc, visits to industries- water treatment plants, effluent treatment plants

TEXT BOOK:

1. Environmental Studies by Anubha Kaushik & C.P. Kaushik, Second Edition, New Age International (P) Limited.

BT-2201

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

Course Objectives:

- To provide the students with knowledge of fundamental laws in electrical Engineering
- The ability to formulate and solve the differential equations describing time behavior of circuits containing energy storage elements.

- The capability to design and construct circuits, take measurements of circuit behavior and performance, compare with predicted circuit models and explain discrepancies.

- To understand the working of various D.C Machines.
- To inculcate the understanding about the AC fundamentals.
- To provide an insight into the principles of working of transformers, dc machines, alternators and induction motors.
- An understanding of how complex devices such as semiconductor diodes and field- effect transistors are modeled and how the models are used in the design and analysis of useful circuits.
- Understand the characteristics of transistors in CE, CB, CC configuration and it's usage as an amplifier and oscillator.

Course Outcomes:

At the end of the course, the students will be able to

- Understand concept source of electrical generation, transmission, distribution, protection, safety measures and power & energy measurement.
- Understand construction & working of electrical machines and evaluate their performance
- Explain the constructional details, principle of operation, Performance, starters and speed control of DC Machines, AC Machines and Transformers
- Develop and employ circuit models for elementary electronic components like semiconductor diodes and transistors

SYLLABUS

Section-A

Fundamentals Laws and Theorems: KVL, KCL, ohm's law, superposition theorem, Thevenin's theorem, Norton's theorem, reciprocity theorem,

D.C. and A.C. Circuits: Mesh analysis, nodal analysis, star-delta transformation, sinusoidal steady state analysis of 1- ϕ circuits, series and parallel circuits, 3- ϕ circuits, Star-Delta circuits,

D.C. Machines :Construction and working of D.C. generators, EMF equation, classification, characteristics, armature reaction, construction and working of D.C. motors, torque equation, characteristics, speed control methods and 3-point starter, efficiency calculation,

Single phase Transformers: Construction and working of single phase transformers, equivalent circuits, efficiency, regulation, O.C and S.C tests,

A.C. Machines: Construction and working of 3 – ϕ Induction motor, slip, torque equation, efficiency, calculation, construction and working of synchronous generator (alternator), EMF equation, regulation-synchronous

impedance method, synchronous motor, torque equation, starting methods.

Section-B

Electronics: Characteristics of semiconductor diodes, transistors, characteristics of CB, CE, CC transistor configurations, oscillators, cathode ray oscilloscope, construction, working, applications, mechanical transducers, electrical transducers, pressure gauges, LVDT.

TEXT BOOKS:

1. 'Elements of Electrical Engineering and Electronics' by V.K. Mehta, S.Chand & Co.
2. 'Fundamentals of Electrical Engineering and Electronics' by B.L. Thereja
3. 'Electronic Devices and Circuits' by Allen Mottorshad, Prentice Hall of India
4. 'Basic Electrical Engineering' by V.N. Mitthal, Tata Mc-Graw Hill

Course Objectives:

CH-2202

MATERIAL & ENERGY BALANCES

To give intensive quantitative training in the practical applications of the principles of physical chemistry to the solution of complicated industrial problems and in methods of predicting missing physicochemical data from generalized principles.

Course Outcomes:

At the end of the course, the student will be able to

- Convert physico-chemical quantities from one system of units to another
- Identify basis and degrees of freedom
- Perform material and energy balances on single units without and with chemical reactions
- Solve the material and energy balance problems on multi-unit processes with recycle, purge and bypass
- Analyze the ideal and real behavior of gases, vapors and liquids

SYLLABUS

Stoichiometry and composition relationships- the gram-mole and pound-mole, limiting reactant, excess reactant, degree of completion, basis of calculation, weight percent, volume percent and mole percent, density and specific gravity- Baume and API gravity scales, Behavior of ideal gases- application of the ideal-gas law, Dalton and Amagat laws to gaseous mixtures, composition of gases on dry basis and on wet basis, Vapor

pressures- Effect of temperature on vapor pressure, Antoine equation, reference substance vapor pressure plots, vapor pressure of immiscible liquids, ideal solutions and Raoult's law, non-volatile solutes, Humidity - Percentage saturation, relative saturation or relative humidity, dew point, vaporization, condensation, wet and dry bulb temperatures, adiabatic vaporization and adiabatic saturation temperature, Material balances- Tie substance, yield, conversion, processes involving chemical reactions, material balance- calculations involving drying, dissolution, and crystallization, processes involving recycle, bypass and purge,

Heat capacities of gases and gaseous mixtures- effect of temperature on heat capacity of gas, mean heat capacity of gas, Kopp's rule, latent heats, heat of fusion, heat of vaporization, Trouton's rule, Kistyakowsky equation for non-polar liquids, estimation of latent heat of vaporization using Classius-Clayperon equation, enthalpy of humid air and humid heat capacity,

Standard heat of reaction - Standard heat of formation, laws of thermochemistry, standard heat of combustion, calculation of heat of formation from heats of combustion, calculation standard heat of reaction from heats of formation and from heats of combustion, standard integral heat of solution, effect of temperature on heat of reaction, Kirchoff's equation, adiabatic and non- adiabatic reactions, theoretical and actual flame temperatures.

TEXT BOOK:

1. 'Chemical Process Principles, Part-I - Material and Energy balances' by Olaf A Hougen, K.M. Watson and R.A.Ragatz, CBS Publishers and Distributors (1995)

REFERENCE BOOKS:

1. 'Basic principles and Calculations in Chemical Engineering' by David M. Himmelblau, Prentice Hall of India Pvt Ltd, 1995

2. 'Stoichiometry' by B.I. Bhatt and S.M. Vora, 3rd Edition, Tata McGraw Hill Publishing Company Limited, New Delhi (1996)

3. 'Stoichiometry for Chemical Engineers' by Williams and Johnson, McGraw Hill Publishers.

BT-2202

FLUID MECHANICS AND HEAT TRANSFER

Course objectives

To provide

- Knowledge on pressure distribution in static fluids.
- Knowledge on rheological behavior of fluids, types of fluid flow, boundary layers and basic equations of fluid flow.

- Knowledge of incompressible fluid flow in pipes
- Knowledge on pipes, fittings, transportation and metering devices.
- Knowledge on conduction, convection and radiation
- Knowledge on heat flow by conduction and heat flow in fluids.
- Knowledge on heat exchange equipment.

Course Outcomes:

At the end of the course, the student will be able to

- Estimate the pressure drop.
- Calculate the pumping capacity and friction losses of flowing fluids.
- Differentiate pumps based on their performance.
- Select proper measuring device and estimate the quantity of flow.
- Solve heat transfer problems.
- Design heat transfer equipment.

SYLLABUS

Fluid statics and applications: Units and Dimensions, Dimensional Homogeneity, Nature of fluids, Hydrostatic Equilibrium, Applications of fluid statics – Manometers, continuous gravity decanter and centrifugal decanter.

Fluid Flow phenomena: Laminar flow, shear rate, shear stress. Rheological properties of fluids – Newtonian fluids, Non Newtonian fluids, time dependent flow, viscoelastic fluids. Viscosity, Reynolds number, Turbulence - nature of turbulence. Boundary layers - boundary layer formation over flat plate, flow in boundary layers, laminar and turbulent flow in boundary layers, boundary layer formation in straight tubes, boundary layer separation and wake formation.

Basic Equations of Fluid Flow: Continuity equation (Mass Balance in a flowing fluid), equation of motion (Differential Momentum Balance), Navier - stokes equations, Euler's equation, Couette flow, Macroscopic Momentum Balance, layer flow with free surface, Bernoulli equation (Energy equation), corrections for effect of solid boundaries and pump work.

Incompressible flow in pipes and channels : Shear Stress and skin friction in pipes, Relation with skin friction and wall shear, Friction factor, relations between skin friction parameters, equivalent diameter, laminar flow in pipes and channels, velocity distribution, average velocity, Kinetic energy correction factor and momentum correction factor for laminar flow, Hagen-Poiseuille equation, laminar flow of non-Newtonian liquids, laminar flow in annulus. Friction from changes in velocity or direction – sudden expansion, sudden contraction, pipe fittings, friction losses in Bernoulli equation, velocity heads, separation of boundary layer in diverging channel, minimizing losses.

Transportation of Fluids: Pipes, fittings, valves, positive displacement pumps (reciprocating, rotary and peristaltic pumps), centrifugal pumps

Metering of fluids: Full bore meters – Venturi meter, Orifice meter and Rotameters. HEAT TRANSFER

Nature of heat flow - Conduction, convection and radiation

Heat transfer by Conduction: Basic law of conduction, thermal conductivity, steady state conduction, compound resistances in series, heat flow through a cylinder and a sphere, unsteady state conduction – one dimensional heat flow with constant surface temperature.

Principles of heat flow in fluids: countercurrent and parallel flows, energy balances, heat flux and heat transfer coefficients, overall heat transfer coefficients, LMTD, individual heat transfer coefficients, fouling factor. Heat exchange equipment: condenser, heat exchanger, evaporator and boilers.

TEXT BOOK:

1. "Unit Operations of Chemical Engineering" Seventh Edition, by W.L. McCabe, J C Smith and P Harriot, Mc Graw Hill

REFERENCE BOOK:

1. "Introduction to Chemical Engineering" by W L Badger and J T Banchemo, Tata Mc Graw Hill

BT-2203 BIOCHEMICAL THERMODYNAMICS

Course Objectives:

To understand the theory and applications of classical thermodynamics, thermodynamic properties, equations of state, methods used to describe and to predict phase equilibria and chemical reaction equilibrium.

Course Outcomes:

At the end of the course, the student will be able to

- Understand the laws of thermodynamics
- Understand the degrees of freedom and phase & chemical reaction equilibria
- Calculate thermodynamic parameters involved in biochemical reactions
- Differentiate between ideal and non-ideal solutions

SYLLABUS

The first law and other basic concepts: Internal energy, the first law of thermodynamics, thermodynamics state and state functions, enthalpy, the Steady state Steady flow process, the reversible process, constant V and constant P processes.

Heat effects: Latent heats of pure substances, standard heat of reaction, standard heat of formation, standard heat of combustion. Temperature dependence of heat effects of chemical reactions.

The second law of Thermodynamics: Statement of the second law, heat engines, entropy changes of an ideal gas, mathematical statement of second law, the third law of thermodynamics.

Thermodynamic properties of fluids : Property relations for homogeneous phases, residual properties, Solution thermodynamics : partial properties, concepts of chemical potential and fugacity, ideal and non-ideal solutions, Gibbs-Duhem equation, excess properties of mixture, activity coefficients and correlations.

Criteria for phase equilibria: Vapour-liquid equilibrium calculations for binary mixtures, Liquid-liquid equilibria and solid liquid equilibria, Chemical reaction equilibria.

Biochemical thermodynamics: Energetics of metabolic pathways, Energy coupling (ATP & NADH), Energetic analysis of cell growth and product formation. Thermodynamics of microbial growth, oxygen consumption and heat evolution in aerobic cultures, energy balance equation for cell culture.

TEXT BOOKS:

1. Introduction to Chemical Engineering Thermodynamics by J.M. Smith, H.C. Van Ness and M.M. Abbott, 6th Ed. McGraw-Hill, 2000.

2. Kinetics and Energetics in Biotechnology, J.A. Roels, Elsevier, 1983.

REFERENCEBOOK:

1. Chemical Engineering Thermodynamics, Y.V.C. Rao, University Press.

CH-2205

INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP

Course Objectives:

1. To familiarise the students with the concepts of Management.
2. To relate the concepts of Management with Industrial Organisations.
3. To explain the factors affecting productivity and how productivity can be increased with effective utilization of inputs in an industrial undertaking.
4. To set forth a basic framework for understanding Entrepreneurship.

Course Outcomes:

An engineer with his/her fundamental knowledge of Industrial Management, will be in position to take appropriate decisions in the corporate environment. The concepts of Entrepreneurship acts as a motivating factor to launch new enterprises and translate one's dream into reality.

SYLLABUS

Basic Concepts of Management:

Management :- Definition, Nature and Importance ; Functions of the Management; Levels of Management; F.W Taylor's Scientific Management; Henry Fayol's Principles of Management; Forms of Business Organizations: Introduction, Types of Business organizations: Private Sector- Individual Ownership , Partnership, Joint stock companies and Co-Operative organizations; Public sector- Departmental Organizations, Public Corporations and Government Companies; The Joint sector Management.

Production and operations Management: Plant location- Factors to be considered in the selection of Plant location; Break - even analysis- Significance and managerial applications; Importance of Production Planning and Control and its Functions; Human Resource Management and Functions of Human Resource Manager (in brief); Functions of Marketing; Methods of Raising Finance

Entrepreneurship : Definition, Characteristics and Skills , Types of Entrepreneurs, Entrepreneur vs. Professional Managers, , Growth of Entrepreneurs, Nature and Importance of Entrepreneurs, Women Entrepreneurs, Problems of Entrepreneurship.

Entrepreneurial Development and Project Management: Institutions in aid of Entrepreneurship Development, Idea generation: Sources and Techniques; , Stages in Project formulation ; Steps for starting a small enterprise - Incentives for Small Scale Industries by Government.

TEXT BOOKS:

1. Sharma, S.C, and Banga, T.R., Industrial Organization & Engineering Economics, Khanna Publishers, Delhi, 2000.
2. Vasant Desai, The Dynamics of Entrepreneurial Development and Management (Planning for future Sustainable growth), Himalayan Publishing House, 2018.

REFERENCE BOOKS:

1. Aryasri , A.R., Management Science, McGraw Hill Education (India) Private Limited, New Delhi 2014.
2. Sheela, P. , and Jagadeswara Rao, K., Entrepreneurship, Shree Publishing House, Guntur, Andhra Pradesh, 2017.

BT-2204

PLANT CELL AND TISSUE CULTURE

Course Objectives:

- To know the basics of plant tissue culturing.
- To know the production of callus from carrot.

- To measure the efficacy of root and shoot.
- To develop the graduate capabilities of knowledge ability, comprehension and applications of plants in cell and tissue culture systems.
- To know how cell and tissue culture contributes to global sustainability.
- To develop the practical skills and confidence of students to successfully culture plant cells and tissues.

Course Outcomes:

At the end of the course, students will be able to:

- Explain the various components of plant tissue culture media, e.g. minerals, growth factors, hormones, and what governs the choice of components
- Describe the various steps taken to establish and optimize media for particular purposes in particular species, without the aid of texts.
- Demonstrate and perform some of the more advanced techniques, e.g. embryo rescue, and protoplasting.
- Establish and maintain plants in tissue culture and micropropagation, including morphogenesis.
- Understand the various cell lines used in tissue culture and their origins and uses.

SYLLABUS

Fundamentals of plant tissue culture: laboratory organization, sterilization methods, culture medium and growth regulators.

Totipotency, callus culture and organogenesis- Expression of totipotency in cell culture and importance; Principle of callus culture, characteristics of callus culture and importance; Principle of organogenesis, factors effecting organogenesis and applications.

Cell culture: single cell culture-isolation, methods of single cell culture and importance; Cell suspension culture, types of suspension culture, growth pattern, synchronization, assessment of growth and viability of cultured cells, significance of suspension cultures.

Somatic embryogenesis and synthetic seeds: principle, induction of embryogenesis, embryo development and maturation, factors effecting somatic embryogenesis, synchronization, large scale production and importance of Somatic embryogenesis, synthetic seeds- methods of making synthetic seeds and applications.

Germplasm conservation

Somoclonal variations – its genetic basis and application in crop improvement- cell line selection for resistance to herbicides, stress and

diseases. Haploid production and its advantages- androgenesis, principle, pollen culture, advantages of pollen culture over anther culture, homozygous diploids, importance of anther and pollen culture.

Clonal propagation –technique- multiplication by axillary and apical shoots, adventitious buds/bulbs/protocorms, by callus culture, transplantation, acclimatization Production of disease free plants- meristem tip culture- virus indexing.

Protoplast technology- isolation, culture and plant regeneration, protoplast fusion, methods, identification and characterization of somatic hybrids, cybrids and importance of somatic hybridisation.

Genetic transformation – plant vectors – Ti plasmids, Ri plasmids - indirect and direct methods, current status and limitations.

Automation and Economics of tissue culture.

TEXT BOOK:

1. Plant tissue culture – Kalyan Kumar De – New Central Book Agency

REFERENCE BOOKS:

1. An Introduction to Plant tissue culture. Razdan. M. K., Oxford & LBH.
2. Plant tissue culture- theory and practice. Bhojwani, SS & Razdan, MK. Elsevier
3. Plant tissue and Cell culture. Street, HE. Blackwell

BT-2205

FLUID MECHANICS AND HEAT TRANSFER LABORATORY

Course Objectives:

- The student will be exposed to various fluid measuring devices and pumps. The pressure drop calculation experimentally across the pipe and packed bed will also be dealt in this lab.
- To impart the practical knowledge for the students to apply the concepts of heat transfer principles and estimate the heat transfer parameters

Course Outcomes:

At the end of the course, the student will be able to

- Distinguish laminar and turbulent flows.
- Determine the characteristics of flow meters
- Determine the characteristics of packed beds and centrifugal pumps
- Calculate pressure drop across a pipe
- Calculate heat transfer coefficients in forced and natural convection
- Determine the emissivity of the given plate

List of Experiments

1. Variation of orifice coefficient with Reynolds number Friction losses for flow through pipe.
2. Calibration of Rotameter.
3. Verification of Bernoulli's Theorem.
4. Pressure drop in a packed bed for different fluid velocities
5. To study the characteristics of a centrifugal pump
6. Determination of emissivity of a given plate at various temperatures.
7. Determination of the natural convective heat transfer coefficient for a vertical tube
8. Determination of forced convective heat transfer coefficient for air flowing through a pipe.
9. Study of the temperature distribution along the length of a pin fin under natural and forced convection conditions.

BT-2206

PLANT CELL AND TISSUE CULTURE LABORATORY

Course Objectives:

- To acquaint students with the principles, technical requirement, scientific and commercial applications of Plant Tissue and Cell culture.
- To expose students to supporting methodologies of plant tissue and cell culture, micropropagation techniques and applications of Tissue and Cell culture to plant improvement.

Course Outcomes:

At the end of the course, the student will be able to

- Develop and maintain cultures of animal cells, establish cell lines with good viability, minimal contamination.
- Perform supportive tasks relevant to cell culture, including preparation and evaluation media.
- Recognize and troubleshoot problems, common to routine cell culture.

List of Experiments

1. Sterilization methods
2. Preparation of stock solutions
3. Preparation of medium
4. Establishment of callus cultures from carrot cambial explants
5. Establishment of cell culture
6. Establishment of growth and preparation of growth curve

7. Embryo culture of maize or any suitable crop, root/shoot initiation (organogenesis) from different explants
8. Micro propagation and plant regeneration
9. Isolation, culture and fusion of plant protoplasts
10. Anther and pollen culture

CH-2208

ASPEN PLUS (Process Design)

Course Objectives:

- To familiarize students with basic programming skills required for solving chemical engineering problems.
- To analyze the data obtained from simulation with theoretical concepts.
- To compare different thermodynamic property estimation methods and analysing the results.
- To familiarize students with fundamental applications of chemical engineering in ASPEN PLUS.

Course Outcomes:

At the end of the course, the student will be able to

- Carry out thermodynamic property estimations using Aspen
- Simulate Mixer, splitter, pumps, compressors and flash units
- Apply sensitivity, design specification and case study tools in Aspen
- Design heat exchangers, reactors and distillation columns
- Optimize process flowsheets using sequential modular and equation oriented approaches.

SYLLABUS

Solve the following steady state simulation exercises using Aspen:

1. Physical property estimations.
2. Simulation of individual units like, mixers, splitters, heat exchangers, flash columns and reactors
3. Design and rating of heat exchangers
4. Design and rating of distillation columns.
5. Mass and Energy balances.
6. Handling user specifications on output streams – Sensitivity and design Spec tools.
7. Simulation of a flowsheet
8. Simulation exercises using calculator block
9. Optimization Exercises

10. Simulation using equation oriented approach

TEXT BOOKS:

1. Lab manuals / Exercise sheets
2. A.K.Jana, Chemical Process Modelling and Computer Simulation, Prentice Hall India, 3rd Edition, 2018.

CH-2209 PROFESSIONAL ETHICS AND HUMAN VALUES

Course Objectives:

- To inculcate Ethics and Human Values into the young minds.
- To develop moral responsibility and mould them as best professionals.
- To create ethical vision and achieve harmony in life.

Course Outcomes:

At the end of the course, the student will be able to

- Understand the importance of ethics and moral values in life and society.

SYLLABUS

Ethics and Human Values: Ethics and Values, Ethical Vision, Ethical Decisions

Human Values – Classification of Values, Universality of Values.

Engineering Ethics: Nature of Engineering Ethics, Profession and Professionalism, Professional Ethics, Code of Ethics, Sample Codes – IEEE, ASCE, ASME and CSI.

Engineering as Social Experimentation: Engineering as social experimentation, Engineering Professionals – life skills, Engineers as Managers, Consultants and Leaders, Role of engineers in promoting ethical climate, balanced outlook on law.

Safety Social Responsibility and Rights: Safety and Risk, moral responsibility of engineers for safety, case studies – Bhopal gas tragedy, Chernobyl disaster, Fukushima Nuclear disaster, Professional rights, Gender discrimination, Sexual harassment at work place.

Global Issues: Globalization and MNCs, Environmental Ethics, Computer Ethics, Cyber Crimes, Ethical living, concept of Harmony in life.

TEXT BOOKS:

1. Govindharajan, M., Natarajan, S. and Senthil Kumar, V.S., Engineering Ethics, Prentice Hall of India, (PHI) Delhi, 2004.
2. Subramainam, R., Professional Ethics, Oxford University Press, New Delhi, 2013.

REFERENCE BOOK:

1. Charles D, Fleddermann, "Engineering Ethics", Pearson / PHI, New Jersey 2004 (Indian Reprint).

SUMMER INTERNSHIP (COMMUNITY SERVICE)(2MONTHS)

All the students have to undergo Summer Internship / Community Service for two months in the industries / nearby villages and report the same in the Department.

BT-3101 MASS TRANSFER

Course Objectives:

- To explain the students with the basic principles of mass transfer operations and other separation processes with examples.
- To impart knowledge on how certain substances undergo the physical change with diffusion/mass transfer components from one phase to other phases.
- To describe the students with equipment used in operations involving mass transfer and other separation processes and their advantages and disadvantages.
- To focus on distillation operations and the process design aspects of the same operations.

Course Outcomes:

At the end of the course, the student will be able to

- Define the basic principles of mass transfer operations and other separation processes.
- Identify the basic techniques for measurement of diffusivity, mass transfer coefficient, evaporation rate.
- Understand the importance of mass transfer phenomena in the design of process equipment in distillation operation.
- Understand the VLE concepts and its application to various types of distillation.
- Identify the major parts of various mass transferequipments.

SYLLABUS

Introduction: Mass transfer Operations.

Molecular diffusion in fluids: Binary solutions, Fick's law, equation of continuity, Steady state equimolar counter current diffusion, Stefan's diffusion, estimation of diffusivity of gases and liquids, application of molecular diffusion.

Mass transfer coefficients: Mass transfer coefficients in turbulent flow, theories of mass transfer, analogy between momentum, heat and mass transfer in laminar and turbulent flow, correlations for mass transfer coefficients in simple situations.

Interphase mass transfer: Concept of equilibrium, diffusion between phases, two resistance theory, material balances in steady state co-current and counter-current stage processes, Murphy stage efficiency.

Equipment for gas-liquid operations: Sparged vessels, mechanically agitated vessels for single phase liquids and gas-liquid mixtures, tray towers, sieve tray for absorption and distillation, venturi scrubbers, spray towers and spray chambers, packed towers for absorption and distillation, tray towers versus packed towers.

Absorption: Solubility's of gases in liquids, two component systems, multi-component systems, ideal and non-ideal solutions, choice of solvent for absorption, single component absorption material balances, counter current multistage operations, dilute gas mixtures, tray efficiency.

Distillation: Principles of VLE for binary systems, phase diagrams, relative volatility, ideal solutions, azeotropes, enthalpy concentration diagrams, flash vaporization, partial condensation, differential distillation, steam distillation, continuous distillation, McCabe- Thiele method.

TEXT BOOK:

1. Mass transfer Operations, Robert E. Treybal, 3rd edition, McGraw-Hill Book Co.,

REFERENCE BOOKS:

1. "Unit Operations in Chemical Engineering" by McCabe,W.L., Smith,J.C.andHarriot,P., 5th Edition, McGraw-Hill Book Co.,
2. "Chemical Engineering Hand Book" by J.H. Perry.

BT-3102

ENZYME ENGINEERING

Course Objectives:

- To understand the IUBMB system of enzyme classification and to know the catalytic activity and its regulation.
- To identify the sources and produce the enzymes with greater concentration.
- To learn the kinetics of single enzyme substrate catalyzed reactions, enzyme inhibition kinetics and the factors affecting the enzyme activity.
- To gain knowledge in the enzyme immobilization methods and their kinetics.
- To design the reactors.
- To use the enzymes in various industries.

Course Outcomes:

At the end of the course, the student will be able to

- Understand the enzyme structure and classify them.
- Produce the enzyme with high purity.
- Identify the kinetics and optimize the factors that affect the enzyme activity for maximum production.
- Describe the immobilization of the enzymes to produce an enzyme for industrial and other applications.

SYLLABUS

Introduction: Catalysis and biocatalysis, enzyme structure functionality and relationship, enzyme activity, classification of enzymes, enzymes as process catalysts.

Enzyme Production: Enzyme sources, synthesis, recovery, purification, and formulation of enzymes,

Homogeneous Enzyme Kinetics: Hypothesis of enzyme kinetics, rapid equilibrium and steady-state hypothesis, determination of kinetic parameters, various types of enzyme inhibitions, effect of pH and temperature.

Heterogeneous Enzyme Kinetics: Various methods of enzyme immobilization, mass transfer effects in heterogeneous biocatalysis, partition effects, external (film) diffusion, internal (pore) diffusion.

Enzyme Reactors: Design of ideal reactors with enzymes (Batch, CSTR, PFR), effect of diffusion on enzyme reactor design, effectiveness factor, thermal inactivation.

Application of Enzymes: Application in biosensors, Food processing applications, Medical and pharmaceutical applications, application of immobilized enzymes.

TEXT BOOKS:

1. "Enzyme Technology" by M.F.Chaplin and C.Bucke, Cambridge University press, 1990.
2. Bioprocess Engineering 2nd edition, M. L. Shuler and F. Kargi, Prantice Hall India, New Delhi, 2002.

REFERENCE BOOKS:

1. "Biocatalysts and Enzyme Technology" by K. Buchholz,V.Kasche and U.T. Bornscheur, Wiley,2005
2. "Enzyme Technology", by Shanmugam,S. and Satish Kumar,T.,IK International Pvt. Ltd, New Delhi, 2008
3. "Biochemical Engineering Fundamentals' by Bailey,J.E., and Ollis,D.F., McGraw- Hill,1986.
4. "Enzyme Biocatalysis: Principles and Applications' by A.Illanes, Springer.

BT-3103

CELL AND MOLECULAR BIOLOGY

Course Objectives:

- The main objective is to prepare the students for career in fields that require advance knowledge of cell and molecular biology.
- With the application of study in cell and molecular biology, the student can also provide services and economic opportunities to the communities.

Course Outcomes:

At the end of the course, the student will be able to

- Understand and utilize the scientific vocabulary used in communicating information in Cell & Molecular Biology.
- Represent and illustrate the structural organization of genes and the control of gene expression.
- Develop basic knowledge and skills in Cell & Molecular Biology
- Outline the processes that control eukaryotic cell cycle and cell death.
- Conduct research in the frontier and multi disciplinary areas of modern biology.

SYLLABUS

The nucleus, chromatin and the chromosome: structure and function of nucleus; organization of genetic material – Packing of DNA into chromatin, Nucleosome organization; Chromosome structure; Cell cycle – Check points, Cdks and regulation.

The biochemical basis of Inheritance: DNA as the genetic material, DNA structure and replication in prokaryotes and eukaryotes – Enzymes involved and mechanism, including replication at telomere.

Genetic code: properties of genetic code, Wobble hypothesis.

Gene Expression:Transcription in prokaryotic and eukaryotic systems – enzymes and factors involved and mechanism; RNA processing in eukaryotes – capping, addition of poly(A) and removal of introns; Translation in prokaryotes and eukaryotes – machinery involved and mechanism;

Regulation of gene expression in prokaryotes – Lac operon concept in E.coli ; regulation of gene expression in eukaryotes by promoters, enhancers, silencers and transcription factors.

Mutations – Terminology, types of mutations, Biochemical basis of mutants, Mutagenesis, Chemical mutagens - base analogues - Intercalating substances, Physical mutagens- U.V radiation and ionization radiation, AMES test - Repair of DNA damage.

TEXT BOOK:

1. "The world of the cell" Becker, Klein smith & Hordin, Pearson education

REFERENCE BOOKS:

1. Molecular cell biology by Lodish et al. Freeman Publications
2. "Cell & Molecular Biology", De Robertis. E.D.P., International Edition
3. "Molecular Biology", Friefelder, D., Narosa publications
4. "Molecular Biology of the Gene", J.D. Watson et al, Banzamin

BT-3104 OPEN ELECTIVE-I

(To be notified by BOS at the beginning of the semester)

BT-3105 (A)

FOOD TECHNOLOGY (CORE ELECTIVE - I)

Course Objectives:

To identify Pathogenic and spoilage microorganisms in foods, the important pathogens and spoilage microorganisms in foods and the conditions under which they will grow, the conditions under which the important pathogens are commonly inactivated, killed or made harmless in foods, laboratory techniques to identify microorganisms in foods, beneficial microorganisms in food systems, understand the principles involving food preservation via fermentation processes, influence of the food system on the growth and survival of microorganisms, understand the role and significance of microbial inactivation, adaptation and environmental factors (i.e., pH, temperature) on growth and response of microorganisms in various environments, Understand the principles involving food preservation via fermentation processes.

Course Outcomes:

At the end of the course, the students will be able to

- Identify the good manufacturing conditions, including sanitation practices, under which the important pathogens and spoilage microorganisms are commonly inactivated, killed or made harmless in foods.
- Understand the elements of food processing and preservation
- Explain the techniques of food processing operations.

SYLLABUS

Food processing and preservation: Biotechnology in relation to the food industry, nutritive value of the food, types of microorganisms associated with the food, food colors and flavors, enzymes and chemicals used in food processing, food preservation.

Fermented food products: Microbial culture used in food industry, fermentation technology for food industry & waste utilization. Bioprocessing and fermentation of meat, vegetables, fruits, dairy products, non-beverage plant products, beverages and related products of baking,

Food spoilage and Food Microbiology: Food spoilage, food borne illness, food quality and quality control, HFCS (High Fructose Corn Syrup), single cell protein production,

Food processing operations: Food engineering operations: characteristics, cleaning, sorting and grading of food raw materials, food conversion operations, size reduction, mixing, emulsification, filtration, membrane separation, centrifugation, extraction, and crystallization, microwave heating, thermal inactivation of microorganisms, freezing and thawing of foods,

TEXT BOOKS:

1. "Biotechnology: Food fermentation", by V.K. Joshi & Ashok Pandey.
2. "Food processing and preservation", by B. Sivasankar

REFERENCE BOOKS:

1. "Food Biotechnology", by Roger Angold, Gordon Beech & Taggart
2. "Basic Food Microbiology", by George J. Banward, CBS publishers
2. "Modern Food Microbiology", by James M. Jay, CBS publishers.

BT-3105 (B)

PROCESS OPTIMIZATION (CORE ELECTIVE I)

Course Objectives:

Optimization of Chemical Process is an important subject for Chemical Engineers. It deals with various optimization techniques in reducing cost of production, energy consumption, maximum throughput and minimum labour cost etc. On studying the course one can understand how to write a model of the process, optimize the process using the model.

Course Outcomes:

At the end of the course, the student will be able to

- Understand the definition of Optimization and how to write an Objective function
- Understand various types of Objective functions like Concave and Convex functions and its properties
- Study the Optimization of uni- & multi dimensional search problems
- Solve the Optimization problems by Linear and Non-Linear Programming methods.

SYLLABUS

Basic Concepts of Optimization: Introduction to process optimization; continuity of functions, unimodal versus multimodal functions, convex and concave functions, convex region, necessary and sufficient conditions for an extremum of unconstrained function, interpretation of the objective function in terms of its quadratic approximation,

Optimization of unconstrained Functions - One-dimensional Search: Numerical methods for optimizing a function of one variable, scanning and bracketing procedures; Newton, quasi-Newton and secant methods of uni-dimensional search, Newton's method, quasi-Newton method, secant method,

Region Elimination Methods, polynomial approximation methods - quadratic interpolation, cubic interpolation, how the one-dimensional search is applied in a multidimensional problem, evaluation of uni-dimensional search methods,

Unconstrained Multivariable Optimization: Direct methods- random search, grid search, uni-variate search, simplex method, conjugate search directions, Powell's method, indirect methods first order - gradient method and conjugate gradient method, indirect method second order - Newton's method,

Linear Programming and its Applications: Basic concepts in linear programming, degenerate LP's - graphical solution, natural occurrence of linear constraints; the Simplex method of solving linear programming problems,

Nonlinear Programming with Constraints: Lagrange multiplier method, necessary and sufficient conditions for a local minimum, generalized reduced-gradient method, random search methods, and comparative evaluation of different methods,

Global Optimization: Overview of genetic algorithm, simulated annealing and other global optimization methods, heuristic search methods.

TEXT BOOK:

1. "Optimization of Chemical Processes", 2nd Edition, by T.F. Edgar, D.M. Himmelblau and L.S. Lasdon McGraw-Hill, 2001.

REFERENCE BOOKS:

1. "Applied Optimization with MATLAB" by .P. Venkataraman, John Wiley
2. 'Optimization for Engineering Design' by K. Deb, Prentice Hall of India Private Limited, New Delhi, 2003
3. 'Engineering Optimization', 3rd Edition, by S.S. Rao Wiley, 1996.

BT-3105 (C)

ENERGY ENGINEERING (CORE ELECTIVE-I)

Course Objectives:

- To learn overview of energy sources.
- To know the production of various fuels from petroleum.
- To learn various nonconventional energy sources like solar energy, bio-energy, wind energy, water energy etc.
- To learn storage of energy.

Course Outcomes:

At the end of the course, the student will be able to

- Classify energy sources
- Demonstrate the production of fuels from petroleum
- Discuss the principles and practice of Photo voltaic cells
- Describe biogas generation
- Explain storage of energy

SYLLABUS

Conventional energy sources: The present and scope for future development, utilization of coal, formation, analysis, classification, storage and carbonization, byproduct recovery

Petroleum: Origin, classification, single and multi-stage fractionation, reforming, catalytic cracking, specification of kerosene, motor gasoline and fuel oils, liquified petroleum gas and nature gas, composition, properties and uses

Non-conventional energy sources: Solar radiation, principles of heating, cooling and photo-voltaic cells

Biogas production: Biomass, wind energy, tidal and wave energy, geothermal energy, nuclear energy, ocean thermal energy, hydrogen energy

Fuel cells: Storage of energy, types - water storage, packed bed storage, solar storage, chemical storage, phase change storage, mechanical energy storage and windmill storage

TEXT BOOKS:

1. "Fuels and Combustion", by S. Sirkar, Orient Longmans, 2nd Ed.
2. "Solar Energy, Thermal Storage", by S.P. Sukhatme, TMH
3. "Non-conventional Energy Sources", by G. D. Rai, Khanna Publications.

BT-3105 (D)

SYSTEMS BIOLOGY (CORE ELECTIVE- I)

The purpose of this course is to provide insight into quantitative modeling of biological systems at the molecular and cellular level as well as, how they are used, analyzed and developed.

Course Outcomes:

The student will be able to

- Explain the principles of system biology and experimental techniques.
- Apply achieved methodological knowledge to biologically relevant problems.
- Interpret the results from commonly used systems biology methods.

SYLLABUS

Introduction: Basic principles of systems biology, experimental techniques,

Standard models and approaches: Metabolism- enzyme kinetics and thermodynamics, metabolic networks, metabolic control analysis,

Biological processes: Signal transduction- introduction, function and structures, interactions, structural components, signaling selected biological processes, Evolution: Introduction, mathematical models, prediction of biological systems, data integration,

Applications: Systems biology in various fields, databases and tools, modeling tools.

TEXT BOOKS:

1. "Systems Biology in Practice-Concepts, Implementation and Application" by Edda Klipp and Ralf Herwig, Wiley VCH, I Edition
2. "Systems Biology: Definitions and Perspectives" by Lilia Alberghina and Hans V. Westerhoff, Springer, 2005.

REFERENCE BOOKS:

1. "Systems Biology: Principles, Methods, and Concepts" by Andrzej K. Konopka, CRC Press, 2006
2. "Stochastic Modelling for Systems Biology" by Darren James Wilkinson, CRC Press, 2006.

BT-3106

MASS TRANSFER LABORATORY

The student will be made familiarised with distillation process and will be able to determine hydrodynamics of sieve tray tower. The student will be given practical exposure to liquid- liquid extraction and to obtain Ternary – Liquid Equilibrium.

Course Outcomes:

At the end of the course, the student will be able to

- Determine ternary LLE
- Evaluate solid-liquid equilibrium
- Determine separation performance and mass transfer coefficients of sieve plate

- Identify the axial mixing characteristics in packed bed
- Evaluate the dynamics of liquid drops

List of experiments:

1. Liquid-Liquid Extraction
2. Solid –Liquid Equilibrium
3. Hydrodynamic Studies in Sieve tray tower
4. Ternary – Liquid Equilibrium
5. Single drop Liquid – Liquid equilibrium

BT-3107

CELL AND MOLECULAR BIOLOGY LABORATORY

Course Objectives:

The students will learn the fundamental aspects of experimental cell and molecular biology

Course Outcomes:

At the end of the course, the student will be able to

- Understand the basics of techniques to study molecular biology.
- Comprehend the structures of the major classes of macromolecules.
- Handle PCR

List of Experiments:

Cell biology: Study of mitosis, meiosis, differential staining of euchromatin and heterochromatin, fluorescent *in situ* hybridisation - FISH (principle & photographs), Molecular biology:

Isolation of genomic DNA, quantification of DNA, Agarose gel electrophoresis, isolation of plasmid DNA, restriction digestion, ligation, transformation, southern blotting, isolation and analysis of RNA.

TEXT BOOKS:

1. "A Guide to Molecular Cloning", Vol. 1,2 & 3, Sambrook, J. et al., Cold Spring Harbor Laboratory Publications
2. 'Chromosome Techniques' by Sharma & Sharma

BT-3108 SEMINAR/MINOR PROJECT

Course Objectives:

- To make the student to think about the new methodologies for the Chemical Engineering problems and implement them either experimentally or theoretically.
- To enhance communication skills of the student to present his/her work and to interact with the students/ faculty/ industry people.

Course Outcomes:

At the end of the seminar/ Minor project, the student will be able to

- Conduct an independent research project involving experimentation/modelling/simulation/optimization in chemical engineering
- Analyze the results
- Communicate the research results orally to an audience
- Present a detailed written report

CH-3109 INDIAN CONSTITUTION

Course Objectives:

- The student learns about the scope and scheme of fundamental duties and fundamental rights.
- The student understands federal structure and distribution of legislative and financial powers and the parliamentary form of government of India.

Course Outcomes:

At the end of the course, the student will be able to

- Identify the scope and scheme of fundamental rights and fundamental duties
- Understand the features and characteristics of the Constitution of India
- Explain the Federal structure and distribution of legislative and financial powers between the Union and the States
- Explain Parliamentary Form of Government in India
- Describe Emergency Provisions

SYLLABUS

1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India
3. Salient features and characteristics of the Constitution of India
4. Scheme of the fundamental rights
5. The scheme of the Fundamental Duties and its legal status

6. The Directive Principles of State Policy – Its importance and implementation

7. Federal structure and distribution of legislative and financial powers between the Union and the States

8. Parliamentary Form of Government in India – The constitution powers and status of the President of India

9. Amendment of the Constitutional Powers and Procedure

10. The historical perspectives of the constitutional amendments in India

11. Emergency Provisions : National Emergency, President Rule, Financial Emergency

12. Local Self Government – Constitutional Scheme in India

13. Scheme of the Fundamental Right to Equality

14. Scheme of the Fundamental Right to certain Freedom under Article 19

15. Scope of the Right to Life and Personal Liberty under Article 21.

BT-3109

SUMMER INTERNSHIP EVALUATION

All the students have to undergo Summer Internship for two months in the industries at the end of the second year second semester. Evaluation of the same will be conducted in this semester by the Department.

BT-3201 IMMUNOLOGY

To study about the process of immunity and organs and cells of lymphoid system.

- To study about the properties of antigens and structure and function of antibodies and various reactions of antigen and antibody.

- To study about complement system, major histocompatibility and various immune responses.

- To study about the hypersensitive reactions and their role in graft rejection and to study transplantation and various autoimmune diseases.

- To study the hybridoma technology and to study the various vaccines and vaccination process.

Course Outcomes:

At the end of the course, the student will be able to

- Understand immunology, the structure and function of lymphoid organs and cells.

- Explain the process of antigenicity, and in the production of antibodies

- Describe precipitation, agglutination, and other antigen-antibody reactions so that student will become a good immunologist.
- Explain complement system and immune response –humoral and cell mediated and MHC (Major histocompatibility).
- Understand hypersensitive reactions, organ transplantations and various auto immune diseases.
- Demonstrate fusion of cells to produce hybrid cells (Hybridoma technology), Understand the method of vaccination.

SYLLABUS

Immunity, Lymphoid organs and cells: Introduction to Immunology and its origin in vertebrates and invertebrates, immunity-innate immunity and acquired immunity and the various lines of defence, organs of immune system, Thymus, bone marrow, bursa of fabricius, spleen, lymphnode and MALT, cells of immune system- B-cells, T-cells, antigen presenting cells, monocytes, NK cells and langerhan cells,

Antigens, Antibodies and Ag-Ab reactions: Antigens- properties of antigens, haptens, epitopes, T-dependent and T-independent antigens, adjuvants and their clinical importance, immunoglobulins- classification, structure and functions of immunoglobulins, antigenic determinants on antibodies, antigen – antibody reactions, and tests involving them - precipitation tests, agglutination tests, complement fixation tests, immunofluorescence, RIA, ELISA, Western blotting and ELISPOT,

Complement, MHC and Immune response: Complement system- its components, complement fixation pathways and consequences, MHC- In mice and human, structure of MHC molecules and their role in antigen presentation, immune response- humoral and cell, mediated immune response, IR curve, role of cytokines in immunity, interferons and interleukins, immune suppression, immune tolerance,

Hypersensitivity, Transplantation, Autoimmune disease: Hypersensitive reactions- Type I, II, III and IV reactions and their role in graft rejection, transplantation immunology- classification of grafts and immunology of graft rejection, agents used for preventing graft rejection, autoimmune diseases- definition and few examples,

Hybridoma and Vaccination: Hybridoma technology- production of monoclonal antibodies and their applications, vaccines and vaccination, methods of attenuation of live forms, types of vaccines- whole organisms as vaccines, attenuated forms, purified molecules as vaccines, recombinant organisms, DNA vaccines and synthetic peptides.

TEXT BOOK:

1. 'Immunology' by A.Goldsby, Thomas J.Kindt, Barbara A.Osborne and Janis Kuby

2. 'A Text book of Microbiology' by R.Ananthanarayan and C.K.J.Pandey.

BT-3202 BIOINFORMATICS

Course Objectives:

The course essentially focuses on the development of skills of students for a successful career in industry or research. The course emphasizes on the delivery of the state of the art technologies in Genomics, Proteomics and Drug discovery.

Course Outcomes:

At the end of the course, the student will be able to

- Identify the major bioinformatics resources available so far
- Understand sequencing alignments and its data bases
- Explain taxonomy and phylogenetics neural networks leading to the role idea of the DNA in computer applications.
- Describe Genome mapping and its applications

SYLLABUS

Major Bioinformatics Resources:

Knowledge of the following databases with respect to: organization of data, retrieval of data using text-based search tools, sources of data method for deposition of data to databases.

Introduction, Primary & Secondary database, Nucleic acid sequence databases: GenBank, EMBL, DDBJ Protein sequence databases: SWISS-PROT, TrEMBL, PIR_PSD Genome Databases at NCBI, EBI, ExPASy, TIGR, SANGER Prosite, PRODOM, Pfam, PRINTS, CATH, SCOP, DSSP, FSSP, DALI

Sequence and Structure Databases: PDB, MMDB Metabolic pathways databases such as KEGG, EMP.

Sequence Alignment and Database Searching:

Introduction- Collection, annotation and alignment of sequences. Basic concepts of sequence similarity, identity and homology. Scoring matrices – PAM and BLOSUM, gap penalties, Database similarity searching, FASTA, BLAST.

Pairwise sequence alignments: basic concepts of sequence alignment, Dynamic programming- Needleman &Wuncsh, Smith & Waterman algorithms for pairwise alignments

Multiple sequence alignments (MSA): the need for MSA, basic concepts of MSA (e.g. progressive, hierarchical etc.). Algorithm of CLUSTALW. Use of HMM method, concept of dendograms and its interpretation.

Taxonomy and phylogenetic analysis:

Basic concepts in taxonomy and phylogeny; molecular evolution; nature of data used, Definition and description of phylogenetic trees and various types of trees, tree building and tree evaluation methods, Phylogenetic analysis algorithms such as Maximum Parsimony, UPGMA, Neighbor-Joining; Maximum likelihood algorithm.

Secondary structure prediction methods- ChouFASMAN/GOR, Nearest neighbor, Neural network

Genome Mapping and Applications:

Human genome project, application of genome mapping, DNA microarrays.

TEXT BOOKS:

1. Introduction to Bioinformatics. T.K. Attwood and P.J. Parry – Smith. Pearson Bioinformatics.
2. Bioinformatics: Sequence and Genome Analysis by D.W. Mount, 2001, Cold Spring Harbor Laboratory Press.

REFERENCE BOOKS:

1. Bioinformatics: A practical guide to the analysis of genes and proteins A.D. Baxevanis and B.F.F. Ouellette (Eds). 2002 John Wiley and Sons.
2. Evens, W.J. and Grant, G.R., Statistical Methods in Bioinformatics: An Introduction.
3. Bioinformatics Basics. Applications in Biological Science and Medicine by Hooman H. Rashidi and Lukas K. Buehler CAC Press 2000.
4. Algorithms on Strings Trees and Sequences Dan Gusfield. Cambridge University Press

BT-3203 GENETIC ENGINEERING

Course Objectives:

- The objective of this course is to discipline to students knowledge of main engines of implementation and transmission of a genetic material at molecular and cellular levels, and also methods of change of a genetic material and construction of transgene organisms with the given properties.
- Genetic engineering: refers to the process of manipulating the characteristics and functions of the original genes of an organism. The

objective of this process is to introduce new physiological and physical features or characteristics.

- A gene is a basic constituent unit of any organism. It is a locatable region of a genome which contains the whole hereditary information of the organism. A gene corresponds to a unit of inheritance. It is a segment of the DNA which determines the special features or functions of the organism.
- Genetic engineering meddles with the organism's natural reproductive process, whether sexual or asexual. It gives it a new direction which is different from its natural disposition and development. The process involves the isolation and manipulation of the genes by introducing the new DNA into the cells. DNA is a blue print of the individual characteristics of an organism. The information stored in the DNA controls the management of biochemical process of each organism. The life, development and unique characteristics of the organism depend upon on its own DNA.

Course Outcomes:

At the end of the course, the student will be able to

- Apply genetic engineering for the benefit of mankind.
- Explain the purification and manipulation of DNA
- Describe cloning vectors and libraries
- Understand PCR, Blotting and Fingerprinting techniques
- Indicate gene transfer methods and mutagenesis

The domain of genetic engineering can extend from plants to cover both the animal and human life. It can, for example, hybridize the production of the animals and promote the growth of

healthy species of milk producing animals, stronger and healthier horses, cows and bullocks which can better withstand the wear and tear of life.

SYLLABUS

Introduction, Purification and manipulation of DNA: History and scope of gene manipulation, isolation and purification of total cell DNA and plasmid DNA, DNA manipulative enzymes, restriction endonucleases- types, nomenclature, recognition sequence, cleavage pattern, restriction digestion and its analysis, Ligases – mode of action, strategies of ligation, linkers, adaptors and homopolymer tailing, DNA modifying enzymes,

Cloning Vectors and Libraries: E. coli vectors – construction and features of plasmids – p^{BR322}, p^{UC8}, p^{UC18}, p^{GEM3Z}, bacteriophage vectors – Lambda phage & M-13 phage vectors, cosmids, phasmids, shuttle vectors, yeast vectors - 2µm plasmid, yeast episomal plasmid and YACs, transfer and cloning of recombinant vectors, construction of genomic DNA libraries, cDNA libraries and their screening, gene cloning strategies,

PCR, Blotting and Fingerprinting techniques: Preparation of labeled probes and primers, DNA sequencing methods – Maxam & Gilbert method, Sangers and Automated sequencing method, PCR and its applications, southern blotting, northern blotting, DNA finger printing technique- RFLP and RAPD and its applications,

Gene transfer methods and mutagenesis: Gene transfer techniques – transformation, transfection, electroporation, lipofection and gene gun methods, cause of the mutagenesis, site specific mutagenesis, transposon mutagenesis, gene knockout technologies,

Applications, achievements and limitations: Application of genetic engineering in agriculture, animal husbandry, medicine, environmental management and in industry, achievements, limitations and negative aspects of genetic engineering.

TEXT BOOKS:

1. "Gene cloning and DNA analysis" – An Introduction, T. A. Brown, Blackwell Publishing, 2006.
2. "Biotechnology" – B.D.Singh, Kalyani Publishers, New Delhi, 2006.

REFERENCE BOOKS:

1. "Principles of Gene Manipulation and Genomics", S. B. Primrose and R. M. Twyman, Blackwell Publishing, 2006.
2. "From Genes to Clones- Introduction to Gene Technology", Winnacker, Panima Publishing Corporation, New Delhi.

BT-3204 PROCESS CONTROL

Course Objectives:

In this course, the students will learn

- To represent the processes in terms of mathematical equations
- The concept of stability and know how to operate a control system in a stable way.
- To deal with various controllers and their functions and applications.

Course Outcomes:

At the end of the course, the student will be able to

- Develop transfer functions for the processes
- Examine the stability of various control systems
- Apply advanced control schemes for processes and identify the characteristics of control valves

SYLLABUS

Introduction to process dynamics and control, Response of First Order Systems - Physical examples of first order systems.

Response of first order systems in series, higher order systems: Second order and transportation lag.

Control systems Controllers and final control elements, Block diagram of a chemical reactor control system. Closed loop transfer functions, Transient response of simple control systems.

Stability Criterion, Routh Test, Root locus. Transient response from root locus, Application of root locus to control systems Introduction to frequency response, Control systems design by frequency response.

Advanced control strategies, Cascade control, Feed forward control, ratio control, Smith predictor, dead time compensation, internal model control. Controller tuning and process identification. Control valves.

TEXT BOOK:

1. D.R. Coughanowr. Process Systems Analysis and Control, Mc Graw Hill, 1991

REFERENCE BOOK:

1. Chemical Process Control, G. Stephanopolous, Prentice Hall, 1984.

BT-3205 (A)

PHARMACEUTICAL BIOTECHNOLOGY (CORE ELECTIVE –II)

Course Objectives: The main objective of this course is to contribute to improve human health by exploiting the potential biopharmaceutical research by

- Promoting research and development in the field of pharmaceutical biotechnology.
- Promoting interactions between academia, biotechnology and pharma companies within the field of pharmaceutical biotechnology to support creativity, innovations and facilitate the commercialization of scientific finding.

Course Outcomes:

At the end of course, the students will be able to

- Understand application of therapeutic agents and regulatory aspects
- Explain drug metabolism and pharmacokinetics
- Describe important unit processes and their applications in bulk drug manufacturing, tablets and capsules manufacturing
- Summarize the manufacturing principles and quality management
- Categorize pharmaceutical products and indicate their control

SYLLABUS

Introduction- Development of Drug and Pharmaceutical Industry, Therapeutic agents – their uses and economics, Regulatory aspects.

Drug metabolism and Pharmacokinetics- Metabolism, Physico-chemical principles, radioactivity, Pharmacokinetics action of drugs on human bodies.

Important Unit Processes and their applications: Bulk drug manufacturing, Types of reactions in bulk drug manufacturing and processes, Special requirements for Bulk Drug manufacture.

Manufacturing Principles: Wet granulation, Dry granulation or slugging, Direct compression, Tablet presses. Coating of tablets, capsules. Sustained action dosage. Forms- Parental solutions, oral liquids, injections, ointments. Various topical drugs and pharmaceuticals, Packaging- Packaging techniques, Quality management and GMP.

Pharmaceutical products and their control- Therapeutic categories such as laxatives, vitamins, analgesics, non-steroid contraceptives, antibodies and Biologicals- Hormones.

TEXT BOOKS:

1. Leon and Lachman et al- Theory and Practice of Industrial pharmacy.
2. Cooper and Gunn's – Dispensing Pharmacy.

REFERENCE BOOK:

1. Remington's Pharmaceutical Sciences, Mark publishing and Co.

BT-3205(B)

**ANIMAL CELL CULTURE AND HYBRIDOMA TECHNOLOGY
(CORE ELECTIVE II)**

Course Objectives:

The main objective of this course is to contribute for the improvement of human health by exploiting the potential biotechnological research by promoting research and advanced development in the field of biotechnology.

Course Outcomes:

At the end of the course the student will be able to

- Understand the laboratory design and equipments for cell culture
- Identify the media and reagents for cell culture, purification and preservation
- Differentiate the types of cell culture
- Describe the scale up of the cell culture reactors
- Apply animal cell culture in pharmaceuticals, production of vaccines, growth hormones and interferons
- Apply monoclonal antibodies in various fields.

SYLLABUS

Cell culture: Laboratory design and equipments planning, construction and services and equipment, cryopreservation equipment and principle, water purification system, washing, packing and sterilization of different materials used in animal cell culture, aseptic concepts, maintenance of sterility in cell culture vessels,

Media and Reagents: Types of cell culture media, ingredients of media; physiochemical properties, CO₂ and bicarbonates, buffering, oxygen, osmolarity, temperature, surface tension and foaming, balance salt solutions, antibiotics and growth supplements, foetal bovine serum, serum free media, selection of medium and serum, conditioned media, other cell culture reagents, preparation and sterilization of cell culture media, serum and other reagents.

Different types of cell cultures: Primary culture and its preparation, establishment of primary culture, subculture –passage number, split ratio, seeding efficiency and criteria for subculture, continuous cell lines, suspension culture, behavior of cells in culture conditions: division, growth pattern, estimation of cell number, development of cell lines, characterization and maintenance of cell lines, common cell culture contaminants, cell transformation, normal Vs transformed cell and agents that cause transformation.

Scale-up: Cell culture reactors, scale-up in suspension, scale and complexity, mixing and aeration, rotating chambers, perfused suspension cultures, fluidized bed reactors for suspension culture, scale-up in monolayers, multisurface propagators, multiarray disks, spirals and tubes, roller culture, microcarriers, perfused monolayer cultures, membrane perfusion, hollow fiber perfusion, matrix perfusion, microencapsulation, growth monitoring,

Applications: Cell cloning and selection, transfection and transformation of cells, commercial scale production of animal cells, stem cells and their application, application of animal cell culture in pharmaceuticals, production of vaccines, growth hormones and interferons, hybridoma technology, production of hybridoma, screening and applications of monoclonal antibodies in various fields.

TEXT BOOKS:

1. "Culture of Animal Cells", (3rd Edition) by F1. Ian Freshney, Wiley-Liss,
2. "Animal Biotechnology" by M.M.Ranga, 2002 Edition.

BT-3205(C)

CANCER BIOLOGY (CORE ELECTIVE II)

Course Objectives:

To understand basic nature as well as advanced aspects of cancer. The cause & regulation of cancer cell cycle, Molecular approach of cancer study, Detection and prediction studies of cancer cell growth.

Course Outcomes:

At the end of the course, the student will be able to

- Understand fundamentals of cancer biology and cancer metastasis
- Explain the causes of cancer and cancer detection
- Identify oncogenes and retroviruses
- Differentiate cancer therapies, their advantages and limitations

SYLLABUS

Fundamentals of Cancer Biology: Introduction, regulation of cell cycle, mutations that cause changes in signal molecules, effects on receptor, signal switches, classification of cancer, modulation of cell cycle in cancer. Carcinogenesis, cancer initiation, promotion and progression,

Causes for Carcinogenesis: Chemical carcinogenesis, metabolism of carcinogenesis, natural history of carcinogenesis, targets of chemical carcinogenesis, principles of physical carcinogenesis, X - ray radiation, mechanism of radiation carcinogenesis,

Molecular Cell Biology of Cancer: Oncogenes, identification of oncogenes, retroviruses and oncogenes, detection of oncogenes, growth factor and growth factor receptors that are oncogenes, oncogenes / proto oncogene activity, growth factors related to transformations, tumor suppression, tumor suppressor genes,

Principles of Cancer Metastasis: Clinical significances of invasion, heterogeneity of metastatic phenotype, metastatic cascade, basement membrane disruption, three-step theory of invasion, proteinases and tumor cell invasion,

Detection of Cancer; Detection of cancers, prediction of aggressiveness of cancer, advances in cancer detection, different forms of therapy, chemotherapy, radiation therapy and immuno therapy, advantages and limitations.

TEXT BOOKS:

1. "Cancer Biology" by Raymond W. Ruddon, Oxford University Press Inc., 2007 Ed., NY.
2. "The Basic Science of Oncology" by Ian F. Tannock et al, 4th edition, 2007. Mc Graw Hill Company.

BT-3205(D) STEM CELLS IN HEALTH CARE (CORE ELECTIVE II)

Course Objectives:

Aim of this course is to know the nature of embryonic cells which develop into specific tissues and organs.

Course outcomes:

At the end of the course, the student will be able to

- Understand the stem cell basics
- Classify stem cells and identify their applications
- Apply stem cell in drug delivery and tissue engineering
- Apply stem cells in therapeutic applications in Parkinson's disease, neurological disorder, limb amputation, heart disease, spinal cord injuries, Alzheimer's disease etc
- Describe the applications of stem cells in tissue engineering application and production of complete organs – kidney, eyes, heart, brain.

SYLLABUS

Stem cell basics: Unique properties of stem cells, embryonic stem cells, adult stem cells, umbilical cord stem cells, similarities and differences between embryonic and adult stem cells, properties of stem cells – pluripotency, totipotency, multipotency,

Embryonic stem cells: In vitro fertilization, human embryonic stem cells, blastocyst, inner cell mass, growing ES cells in laboratory, laboratory tests to identify ES cells, stimulating ES cells for differentiation, properties of ES cells, human ES cells, monkey and mouse ES cells,

Adult stem cells: Somatic stem cells, test for identification of adult stem cells, adult stem cell differentiation, trans-differentiation, plasticity, different types of adult stem cells,

Stem cell in drug discovery and tissue engineering: Target identification, manipulating differentiation pathways, stem cell therapy Vs cell protection, stem cell in cellular assays for screening, stem cell based drug discovery platforms, drug screening and toxicology,

Genetic engineering and therapeutic application of stem cells: Gene therapy, genetically engineered stem cells and animal cloning (transgenic animals), biomarkers in cancer, therapeutic applications in Parkinson's disease, neurological disorder, limb amputation, heart disease, spinal cord injuries, diabetes, matching the stem cell with transplant recipient, HLA typing, Alzheimer's disease, spinal cord injuries, tissue engineering application, production of complete organs – kidney, eyes, heart, brain.

TEXT BOOKS:

1. "Stem Cells, Human Embryos and Ethics: Interdisciplinary Perspectives" by Larstnor, Springer, 2008
2. 'Handbook of Stem Cells', Volume-1, by Robert Paul Lanza, Gulf Professional Publishing, 2004

REFERENCE BOOKS:

1. "Embryonic Stem cells" by Kursad and Turksen. 2002, Humana Press.
2. "Stem Cell and Future of Regenerative medicine by Committee on the Biological and Biomedical Applications of Stem cell Research", 2002, National Academic Press.

BT-3206 OPEN ELECTIVE-II

(To be notified by BOS at the beginning of the semester)

BT-3207

PROCESS CONTROL LABORATORY

Course Objectives:

- To understand the dynamic behaviour of the systems
- To evaluate response of first and higher order characteristics.
- To calibrate the given thermocouple and resistance thermometer.

Course Outcomes:

At the end of the course, the student will be able to

- Identify the dynamics of first order, second order, interacting and non-interacting processes
- Explain the calibration of thermocouple

List of Experiments:

1. Response of Bare Thermometer for a step input
2. Response of Thermometer with thermal well for step input
3. Response of single tank for a step input
4. Response of Non – Interacting system for a step change
5. Response of a Interacting system for a step change
6. Response of resistance thermometer
7. Calibration of thermocouple
8. Response of manometer

CH-3209 INTELLECTUAL PROPERTY RIGHTS

Course Objectives:

- To introduce fundamental aspects of intellectual property rights.
- To disseminate knowledge on copyrights and its related rights and registration
- To provide comprehensive knowledge to the students regarding Indian position of patent law, procedure for granting patent, Infringement
- To provide knowledge to the students regarding registration of trade mark, Infringement of trade mark

Course Outcomes:

At the end of the course, the student will be able to

- Identify the types of IP and the importance of protection of IP
- Differentiate the foundation and patent laws in India and developed countries
- Explain how to obtain copy right and law of copy rights
- Learn the purpose and function of trade marks and registration of trade mark
- Describe risks involved and legal aspects of Trade Secret Protection
- Understand IP Infringement issue and enforcement

SYLLABUS

Introduction to Intellectual Property: Historical Perspective, Different Types of IP, agencies and treaties, Importance of protecting IP, international organizations Innovations in products, processes, services and procedures - product life cycles, favorable and unfavorable aspects in innovation; Inventions as intellectual property.

Patents: Historical Perspective, Basic and associated right, WIPO, PCT system, Traditional Knowledge, Patents and Healthcare – balancing promoting innovation with public health, Software patents and their importance for India, Foundation of patents and patent laws, procedures in India and developed countries; study of patents in different fields and their innovative content; patent searching process, ownership rights and transfer.

Copyrights: Introduction, How to obtain a copy right and Law of copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law, Differences of copyrights from Patents.

Geographical Indications: Definition, rules for registration, prevention of illegal exploitation, importance to India.

Trade Marks: Introduction to trademarks, Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting, and evaluating trade mark, trade mark registration processes.

Trade Secrets: Introduction and Historical Perspectives, Scope of Protection, Trade secret law, Risks involved and legal aspects of Trade Secret Protection, Determination of trade secret status, liability for misappropriations of trade secrets, protection for submission, trade secret litigation, Unfair competition: Misappropriation right of publicity, false advertising.

New developments and Infringement Issues of IP:

New development of intellectual property: new developments in trade mark law; copy right law, patent law, intellectual property audits.

International overview on intellectual property, international – trade mark law, copy right law, international patent law, and international development in trade secrets law, motivating and encouraging innovative attitude in individuals and organizations; entrepreneurial qualities and skills, learning and training.

IP Infringement issue and enforcement– Role of Judiciary, Role of law enforcement agencies – Police, Customs etc. Economic Value of Intellectual Property – Intangible assets and their valuation, Human attitudes, risks, hardships, examples of failure, case studies of inventors; Intellectual Property in the Indian Context – Various laws in India Licensing and technology transfer.

REFERENCE BOOKS:

1. Ganguli, P. Intellectual Property Rights: Unleashing the Knowledge Economy, Tata McGraw-Hill (2001).
2. Intellectual property right, Deborah. E. Bouchoux, Cengage learning.
3. Acharya, N.K. Textbook on intellectual property rights, Asia Law House (2001).
4. Miller, A.R. & Davis, M.H. Intellectual Property: Patents, Trademarks and Copyright in a Nutshell, West Group Publishers (2000).
5. Watal, J. Intellectual property rights in the WTO and developing countries, Oxford University Press, New Delhi.

CH -3210

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

Course Objectives:

- To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.
- To make the students understand the traditional knowledge and analyse it and apply it to their day to day life

Course Outcomes:

At the end of the Course, Student will be able to:

CO 1:Identify the concept of Traditional knowledge and its importance. CO 2:Explain the need and importance of protecting traditional knowledge.

CO 3:Illustrate the various enactments related to the protection of traditional knowledge. CO 4:Interpret the concepts of Intellectual property to protect the traditional knowledge. CO 5:Explain the importance of Traditional knowledge in Agriculture and Medicine.

SYLLABUS

Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, Indigenous Knowledge (IK), characteristics, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge

Protection of traditional knowledge:The need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.

Legal framework and TK: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act); The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016.

Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge

Traditional Knowledge in Different Sectors: Traditional knowledge and engineering, Traditional medicine system, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK

TEXT BOOKS:

1. Traditional Knowledge System in India, by Amit Jha, 2009.

REFERENCE BOOKS:

1. Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002.
2. "Knowledge Traditions and Practices of India" Kapil Kapoor, Michel Danino.

SUMMER INTERNSHIP PROGRAM (2 MONTHS)

All the students have to undergo Summer Internship for two months in the industries and report the same in the Department.

BT-4101 ENGINEERING ECONOMICS & BIOPROCESS DESIGN

Course Objectives:

- To introduce bioprocess design with its basic function of a bioreactor.
- To study the construction of bioreactor.
- To introduce the basic fundamentals such as aeration and agitation used in fermentation industrial.

- Designing of fermentation vessels and problems related to scale up of microbial processes.

- Engineering economics deals with value of money equivalence and depreciation.

Course Outcomes:

At the end of the course, the student will be able to

- Understand fundamentals concepts of bioprocessing
- Design and operate a Bioprocess/fermentation vessels..
- Understand the value of money equivalence and depreciation.

SYLLABUS

Engineering Economics:

Value of money equivalence: Value of money, equations for economic studies, equivalence, types of interest, discrete, continuous, annuities: relation between ordinary annuity and the periodic payments, continuous cash flow and interest compounding, present worth of an annuity, perpetuities and capitalised costs, bonds and debentures: value of a bond and yield rate,

Depreciation: Types and various methods of calculating depreciations, depreciation accounting, cost accounting- basic relationship in accounting, balance sheet and income statements.

Bioprocess Design:

Basic function of a Bioreactor for plant and microbial or animal cell culture, factors involved in bioreactor design and principal operating characteristics of bioreactors.

Body construction: construction material, temperature control, Aeration and agitation: Agitators (impellers), stirrer glands and bearings, baffles, aeration system (spargers), valves and steam traps used in fermentation industries,

Scale up: Basic concepts, problems related to the scale up of the microbial processes, designing of other fermentation vessels,

TEXT BOOKS:

1. 'Plant Design and Economics for Chemical Engineers' fourth edition, by Max S Peters and Klaus D Timmerhans, Mc Graw Hill Book Company

2. 'Fermentation and Biochemical Engineering Handbook' 2nd Edition by Henry C. Vogel and Celeste L. Todaro, Noyes Publications, 1997.

REFERENCE BOOKS:

1. 'Biochemical Engineering Fundamentals', 2nd edition, E.Bailey and D.F.Ollis, McGraw Hill, 1986

2. 'Bioprocess Engineering' 2nd edition, M.L.Shuler and F.Kargi, Prentice Hall India, New Delhi

3. 'Principles of Fermentation Technology' by Stanbury, Pergamon

4. 'Text Book of Biochemical Engineering', by D.G. Rao, Tata McGraw Hill

BT-4102 BIOCHEMICAL REACTION ENGINEERING

Course Objectives:

- To understand the importance of bioprocess engineering and the role of bioprocess engineer and the importance of regulatory constraints.

- To understand the mechanism of enzyme action, their kinetics and about stoichiometry of microbial growth.

- To know the configuration of various bioreactors for cell growth and their operations.

- To understand the instrumentation and control of bioreactors and scale up aspects.

Course Outcomes:

At the end of the course, the student will be able to

- Understand the importance of bioprocess aspects and the role of bioprocess engineer.

- Analyze the enzyme kinetics and mechanism of their action.

- Design of various bioreactors.

- Explain the instrumentation used in bioreactors and their control.

SYLLABUS

Introduction to biotechnology and biochemical engineering, role of bioprocess engineer, regulatory constraints in bioprocesses, FDA, GMP, GLP and SOPs.

Fundamentals of biochemical reaction engineering: Kinetics of homogeneous reactions, elementary and non elementary reactions, reaction mechanism, temperature dependency from Arrhenius law.

Analysis of batch reactor data: Various methods of analysis of batch reactor data obtained for various types of reactions (excluding variable volume and variable pressure reactions).

Enzyme kinetics: Mechanism of enzyme action, Michaelis-Menten equation and determination of kinetic parameters, effect of pH and temperature.

Stoichiometry of microbial growth and product formation: Elemental balances, degree of reduction, yield co-efficients, maintenance co-efficients.

Cell kinetics and fermentor design: Batch growth cultivation, batch, continuous and plug flow fermentors, Monod growth kinetics in continuous culture and evaluation of kinetic parameters, Fed batch operation, chemostat with cell recycle, multistage chemostat systems.

Non-conventional bioreactors Air lift reactor, Bubble column reactor, Trickle bed reactor, scale up of bioreactors, bioreactor instrumentation and control.

Principles and mechanism of media and air sterilization: Batch and continuous sterilization of media, air sterilization, air filter design (thickness).

TEXT BOOKS:

1. Bioprocess Engineering 2nd edition, M. L. Shuler and F. Kargi, Prantice Hall India, New Delhi, 2002.
2. Biochemical Engineering fundamentals, 2nd Edition, E.Bailey and D.F.Ollis, McGraw Hill, 1986.

REFERENCE BOOKS:

1. Textbook of biochemical engineering, D.G. Rao, Tata McGraw Hill, New Delhi, 2004.
2. Biochemical Engineering, J. M. Lee, Prantice Hall 1992.

BT-4103 INDUSTRIAL BIOTECH PRODUCTS

Course Objectives:

- To study about fermentation process and to study the culturing of micro organisms and maintenance of cultures.
- To study about the preparation of alcohol using yeast cells and sugars by fermentation process.
- To study about the production of Acetic acid, Citric acid and lactic acid using fermentation technology.
- To study about the production of fungal foods- mushroom and other foods like cheese. And also studies the production of bakers yeast, amino acids and vitamins(Microbial origin)
- To study about the antibiotics production, industrial enzymes- amylase, protease, lipase, and the production of biopolymers- Xanthan gum.

Course Outcomes:

At the end of the course, the student will be able to

- Explain the preparation of microbial slants, maintenance of stock cultures and other microbial techniques
- Describe the production of alcohols using fermentation technology.
- Demonstrate the production of acetic acid, citric acid, lactic acid using micro organisms and biological substrates by fermentation technology.
- Explain the production of foods using microorganisms and the production of mushrooms, cheese and vitamins, etc.
- Demonstrate the production of antibiotics and enzymes used in large scale and production of vaccines and biopolymers

SYLLABUS

Microbial Processes: Introduction, types of fermentations, components of industrial microbial process, source of industrial cultures, maintenance and improvement of culture for better production,

Alcohol fermentation: Production of industrial alcohol, biosynthetic mechanism, recovery of latest developments, wine manufacture, glycerol fermentation, production of acetone and butanol,

Organic acid production- Biochemistry of acetic acid production, vinegar manufacture, production of citric acid and lactic acid,

Microbial foods: Mushrooms, cheese, Baker's yeast Amino acids – L- Glutamic acid, Lysine Vitamins – Vitamin B12 Antibiotics – Penicilin and streptomycin. Industrial enzymes: production of amylase, protease and lipase Miscellaneous-Biopolymers (Xanthan gum, dextran etc), vaccines.

TEXT BOOKS:

1. "Industrial Microbiology" by Cruger&cruger
2. "Industrial Microbiology" by Cassida
3. "Industrial Microbiology" by A.H.Patel

REFERENCE BOOKS:

- 1 'Industrial Microbiology' by Prescott & Dunn
- 2 "Biotechnology" by U. Satyanarayana.

BT-4104 OPEN ELECTIVE –III

BT-4105 OPEN ELECTIVE-IV

Open Elective –III & Open Elective-IV are MOOCS courses (To be specified/ approved by BOS)

BT-4106

BIOCHEMICAL REACTION ENGINEERING LABORATORY

Course Objectives:

To evaluate the reaction rate constant and to determine the conversion in the Batch and Continuous reactors

Course Outcomes:

At the end of the course, the student will be able to

- Explain the kinetics of enzyme catalyzed reaction in free and immobilized states.
- Develop microbial enzymes.
- Evaluate the variables affecting the production process.
- Design of optimal Batch and Continuous reactors

List of Experiments:

Bioprocess Engineering

1. Isolation and characterization of industrial cultures for use as biocatalysts in bioprocesses and Analysis of raw materials used in common industrial bioprocesses
2. Production Ethanol & Protease
3. Parameter optimization studies in bioprocesses eg.Ethylalcohol, aminoacid production etc.
4. Product purification in bioprocess studies. Eg. Enzyme production (amylase, proteaseetc).
5. Measurement of Volumetric Oxygen transfer coefficient
6. Cell immobilization protocols
7. Immobilized bioprocess with cells and enzymes
8. Filter efficiency of common air filters
9. Heat inactivation of microbial cells, thermal death rate

Reaction Engineering :

1. Determination of order of reaction using a Batch Reactor
2. Determination of rate constant using a Batch Reactor
3. Determination of rate constant using a CSTR
4. Determination of rate constant using a PFR
5. Determination of rate constant using a CFR (CSTR to PFR)
6. Determination of rate constant using a CFR (PFR to CSTR)
7. RTD studies in a packed bed Reactor
8. RTD studies in a Plug flow reactor

BT-4107 BIostatistics

Course Objectives:

To make them understand about the Introduction of bioinformatics, Moments like skewness and kurtosis, correlation, Probability distribution and sampling theory, Sampling Theory: sampling, random sampling, parameters and statistic, objectives of sampling and Numerical solutions of PDEs.

Course Outcomes:

At the end of the course, the student will be able to

- Classify data and understand relation between mean, median and mode, geometric mean and harmonic mean, measures of dispersion.
- Understand coefficient of correlation both for ungrouped and grouped data, lines of regression, standard error of estimate, rank correlation.

- Solve PDE's numerically
- Explain probability distribution and sampling theory

SYLLABUS

Introduction, collection and classification of data, graphical representation, histogram, frequency polygon and cumulative frequency curve, comparison of frequency distributions, measures of central tendency, mean, median and mode, an empirical relation between mean, median and mode, geometric mean and harmonic mean, measures of dispersion – range, quartile deviation or semi-inter quartile range, mean deviation, root mean square deviation, standard deviation, variance, coefficient of variation, empirical relation between measures of dispersion, standard deviation of combined samples

Moments, skewness and kurtosis, correlation, scatter diagram, coefficient of correlation both for ungrouped and grouped data, lines of regression, standard error of estimate, rank correlation

Probability distribution and sampling theory: Random variable both discrete and continuous, probability distribution both discrete and continuous, cumulative distribution, expectation, variance, standard deviation, moment generating function, binomial distribution, constants of binomial distribution, mean, standard deviation, skewness and kurtosis, fitness of a binomial distribution, Poisson distribution, constant of poisson distribution, mean, standard deviation, skewness and kurtosis – fitting of a poisson distribution, normal distribution, standard normal distribution, propertive normal distribution, probability error, fitting of normal distribution, Sampling Theory: sampling, random sampling, parameters and statistic, objectives of sampling, sampling distribution, standard error, testing of hypothesis, errors, null hypothesis, level of significance, testing significance, confidence limits, simple sampling of attributes, test of significance for large samples, comparison of large samples, test of significance for means of two large samples, sampling of variables, small samples, number of degrees of student t-distribution, significance test of difference between sample means, f- distribution, Fisher's z-distribution, Chi-square distribution

Numerical solutions of PDEs – Elliptic (Liebmann iteration process), Parabolic (Schmidt explicit formula), Hyperbolic and Poisson's equations (Gauss – sieidel method)

TEXT BOOK:

1. Higher engineering mathematics by B.S.Grewal

REFERENCES:

1. Numerical methods for Scientific and Engineering Computation by M.K.Jain, S.R.K.Iyengar, R.K.Jain, and Publishers New age international (P) Ltd. New Delhi

2. Probability, Statistics and random process by T. Veerarajan, Tata McGraw Hill.

3. Probability, Statistics with Reliability, Queing and Computer Science Application by Kishore S. Trivedi

BT-4108 SUMMER INTERNSHIP EVALUATION

All the students have to undergo Summer Internship for two months in the industries at the end of the third year second semester. Evaluation of the same will be conducted in this semester by the Department.

BT-4201 PROJECT WORK

(6 months Project Work/ Internship shall be carried out in the Industry)

Course Outcomes:

At the end of the course, the student will be able to

- Carry out literature review
- Formulate the problem involving manufacture of a chemical product/ experimentation/modelling/simulation/optimization/design
- Carry out the project involving manufacture of a chemical product/ experimentation/ modelling/simulation/optimization/design/industrial problem
- Discuss the results
- Communicate results orally to audience
- Present the detailed written report

B.Tech. (Honors) BTH-1001

ADVANCED MICROBIOLOGY

Course Objectives:

- To make the student learn about origin and evolution of microbes.
- To make the student understand structure and functioning of different microbial groups.
- To make them to acquaint the cultivation of microbes in artificial medium.
- To understand basic as well as advanced aspects of microbiology like Epidemiology and infectious diseases and immunology.

Course Outcomes:

At the end of the course, the student will be able to

- Demonstrate the occurrence and development of microbiology, and evolution of microbes
- Understand structure and functioning of different microbial groups, isolation and culturing techniques, reproduction, metabolism of micro organisms

- Explain the importance of microbes in energy production
- Interpret Epidemiology and infectious diseases
- Classify defence mechanisms and immunity
- Explain the production of vaccines and antibiotics

SYLLABUS

Introduction to Microbiology: Origin and evolution of microorganisms, history of Microbiology, nature and scope of microbiology, major characteristics of prokaryotes and Eukaryotes, structure and functioning of bacterial cell, staining reactions.

Classification of microorganisms: Major characteristics of microorganisms, concepts of Classification, classification methods, principles of nomenclature and identification, Modern trends in classification.

General features and classification of some groups of microorganisms - Algae, Fungi, Chlamydiae, Rickettsiae, Mycoplasmas, Viruses and Protozoa, economic importance of Micro-organisms Methods in microbiology: Nutritional requirements, nutritional types of bacteria, Characteristics of culture medium, type of culture media and preparation of culture media, isolation of microorganisms - general and selective methods, isolation of bacteria in pure culture, enrichment - enrichment methods, staining techniques, culture characteristics, maintenance and preservation of cultures, culture collections.

Reproduction and growth: Reproduction in bacteria, genetic transfer in bacteria, Bacterial growth, bacterial growth curve, growth measurement techniques, factors affecting growth, control of microorganisms by physical and chemical methods.

Metabolism and energy production: Respiratory chain, energy production by aerobic and anaerobic process, energy production by photosynthesis. Microbiology of air, water, soil, milk and food.

Epidemiology and infectious diseases: Epidemiological markers, role of host in infectious diseases - Air borne, water borne and food borne diseases.

Immunology: Natural resistance, internal defense mechanisms, non-specific defense mechanisms, immunity, types of immunity, immune systems, antibody and its diversity, Hypersensitivity, transplantation, autoimmunity, AIDS and other immune deficiencies, vaccines, types of vaccines, production of vaccines and synthetic vaccines, monoclonal antibodies and their use, antibiotics, history of antibiotics, classification and

production of antibiotics, microbial toxins, types of microbial toxins, effects of microbial toxins and their control.

TEXT BOOKS:

1. Microbiology by M. J. Pelczar, E. C. S. Chan, N. R. Kries. Tata McGraw Hill publications
2. Microbiology fundamentals and applications by S. S. Purohit. Agro botanical. Publications.

REFERENCE BOOKS:

1. Microbiology by Prescott, Harley, Klein. Mc Graw-Hill publications
2. General Microbiology by Roger Y. Stainer, Edward A. Adebey, John L. Ingraham. Published by Macmillan Press LTD.

BTH-1002 ADVANCED BIOCHEMISTRY

Course Objectives:

- To study about the biomolecules and importance of biochemistry in the advanced level.
- To study the detailed structure and function of biomolecules like carbohydrates, amino acids, proteins, lipids and nucleic acids.
- To study the detailed structure and function of biocatalysts, enzymes. To study various types of enzyme inhibitions.
- To study in detailed vitamins, membrane assembling, bioenergetic principles and ATP cycle.
- To study the metabolism in advanced level and biosynthesis of fatty acids, DNA, RNA, and proteins.
- The student obtains advanced level knowledge in biomolecules and metabolic process as a base for the higher research activity.

Course Outcomes:

At the end of the course, the student will be able to

- Understand the advanced structure of biomolecules.
- Explain biosynthesis and degradation of biomolecules.
- Describe metabolism and bioenergetic principles.
- Create new biomolecules and understand new metabolic processes.
- Summarize biosynthesis of fatty acids- palmitic acid, α -oxidation of fatty acids, DNA (replication), RNA (transcription), proteins (translation).

SYLLABUS

Scope and importance of biochemistry, molecular logic of living matter, origin of biomolecules.

Molecular structure of Water, macromolecular structure of water, hydrogen bonds, dissociation of water.

Carbohydrates: classification of carbohydrates, structure and properties of monosaccharides (ribose, glucose, fructose), disaccharides (maltose, lactose, sucrose) and polysaccharides (Starch, glycogen and cellulose).

Amino acids and proteins: Classification and properties of amino acids and proteins, peptide bond, structural organization of proteins: primary, secondary, tertiary and quaternary structure of proteins. Biochemical function of proteins, denaturation of proteins.

Lipids: classification, structure and physiological functions of triglycerides, fatty acids, phospholipids, cerebrosides, gangliosides and cholesterol.

Nucleic Acids: Structure and properties of purines and pyrimidine bases, nucleosides, nucleotides. Structure of nucleic acids-DNA and RNA.

Enzymes: Classification of Enzymes, Mechanism of Enzyme action, factors affecting enzyme action, co-enzymes and regulatory enzymes. Enzyme inhibition-competitive, non-competitive and uncompetitive inhibitions. Structure and functions of vitamins. Membrane assembly and transport across the membranes. Bioenergetic principles and ATP cycle.

Mechanism of photosynthesis, Embden-Meyerhof pathway of glucose metabolism (glycolysis), citric acid cycle (Krebs cycle), electron transport and oxidative phosphorylation.

Biosynthesis of fatty acids- palmitic acid biosynthesis, α -oxidation of fatty acids. Biosynthesis of DNA (replication). Biosynthesis of RNA (transcription). Biosynthesis of proteins (translation).

TEXT BOOKS:

1. Textbook of Biochemistry by Albert-Lehninger, Kalyani Publishers, Ludhiana, New Delhi.
2. Principles of Biochemistry- Lehninger, Nelson and Cox-CBS Publishers and distributors, Delhi.
3. A text book of Biochemistry by A.V.S.S. Rama Rao, UBS Publishers and Distributors Ltd, New Delhi, Chennai.
4. Fundamentals of Biochemistry-J.L. Jain, S. Chand and company Ltd. New Delhi.

BTH-1003 : ADVANCED BIOCHEMICAL ENGINEERING

Course Objectives:

- To introduce enzymes, enzymatic and microbial growth kinetics
- To introduce transport of materials in biological systems with respect to mass transfer and heat transfer

- To introduce different types of bio-reactors and special reactors like animal and plant cell reactors

- To introduce immobilization and sterilization techniques

Course Outcomes:

At the end of the course, the student will be able to

- Determine the enzyme activity, parameters affecting activity and enzyme immobilization

- Understand gas liquid mass transfer
- Evaluate the KLa and to know inter particle and intra particle diffusion
- Explain working and analysis of all types of reactors
- Describe thermal death kinetics and sterilization of air and medium

SYLLABUS

Enzyme Kinetics: effects on enzyme activity, deactivation, immobilized enzymes.

Microbial growth kinetics: Batch growth, unstructured models, growth in continuous culture, structured models, product formation kinetics, cell immobilization.

Transport Phenomena: Gas-liquid Mass transfer; Theoretical models for KLa, interfacial area and bubble oxygen transfer, gas-liquid mass transfer of components other than oxygen. Mass transfer into solid particles: External transfer, intraparticle diffusion. Heat transfer correlations.

Bioreactors: Review of various types of bioreactors used in the fermentation industry. Multiphase bioreactors: packed bed, bubble-column, fluidized bed and trickle-bed reactors.

Alternate Fermenters: New bioreactor configurations used in the fermentation technology. Animal and plant cell reactor technology.

Sterilization: Sterilization methods, thermal death kinetics, design criterion, batch and continuous sterilization, air sterilization.

TEXT BOOK:

1. Shuler, M. L and F. Kargi, Bioprocess Engineering: Basic concepts, 2nd ed., Prentice Hall India, New Delhi, 2003.

REFERENCE BOOKS:

1. Lee, J. M., Biochemical Engineering (e Book), Prentice Hall, Englewood Cliffs, 2001.

2. Bailey, J. E., and D. F. Ollis, Biochemical Engineering Fundamentals, 2nd edition, McGraw-Hill, New York, 1986.

3. Blanch, H. W., and D. S. Clark, Biochemical Engineering, Marcel Dekker, New York, 1996.

4. Swamy, A.V.N., 'Fundamentals of Biochemical Engineering', BS publications, 2007

BTH-1004 : ADVANCED DOWNSTREAM PROCESSING

Course Objectives:

- To learn and understand the applied concepts of downstream processing.

- To enable the students to obtain pure proteins, enzymes and in general about product development and hands on experience in Downstream processes.

Course Outcomes:

At the end of the course, the student will be able to

- Understand methods to purify various types of compounds
- Explain purification and characterization of various types of bioproducts in large scale level.
- Summarize precise and efficient bioseparations, which is cost effective and yield high degree of pure substances.

SYLLABUS

Introduction - An Overview of Bioseparations: Bioprocesses, Range and characteristics of bioproducts, Need for down stream processing, Characteristics of Fermentation broths, An overview of bioseparations; A few case studies.

Cell Disruption: Intracellular products, Cell wall, Cell disruption, Proteins of inclusion bodies.

Reverse Phase and Hydrophobic Interaction Chromatography: hydrophobic interaction chromatography; Reverse phase chromatography. Basic theory of retention in RPC and HIC; Hydrophobic Interaction Chromatography. Electrokinetic Methods of Separation: the various Method; Electrophoresis; Capillary Electrophoresis; Isoelectric Focusing; Isotachopheresis.

Liquid- Liquid Extraction with Ternary Systems-Instructional objectives: industrial example; Equipment: mixer- settlers, spray columns, packed columns, plate columns, columns with mechanically agitated agitation; General design considerations; Hunter- Nash graphical equilibrium- stage method: number of equilibrium stages, minimum and maximum solvent- to-feed flow rate- ratios, use of right- triangle diagrams, use of an auxiliary distribution curve with McCabe- Thiele diagram, extract and raffinate reflux; Maloney- Schubert graphical equilibrium- stage method; Theory and scale-up

of extractor performance: mixer- settler units, multi-compartment columns, axial dispersion.

Membrane Separations: Instructional objectives: industrial example; Membrane materials; Membrane modules; Transport in membranes: porous membranes, bulk flow, liquid diffusion in pores, gas diffusion, nonporous membranes, solution- diffusion for liquid mixtures, solution- diffusion for gas mixtures, module flow patterns, cascades, external mass transfer resistances, concentration polarization and fouling; Dialysis and electro dialysis; Reverse osmosis; Gas permeation; Pervaporation; Ultra filtration: process configurations; Micro filtration: constant- flux operation, constant-pressure operation, combined operation. Introduction to liquid membranes, principle, its advantages and its applications.

Crystallization: Instructional objectives: industrial example; Crystal geometry: crystal- size distributions, differential screen analysis, cumulative screen analysis, surface mean diameter, mass- mean diameter, arithmetic-mean diameter, volume- mean diameter; Thermodynamic considerations: solubility and material balances, enthalpy balances; Kinetic and transport considerations: super saturation, nucleation, crystal growth; Equipment for solution crystallization: circulating, batch crystallizers, continuous, cooling crystallizers, continuous, vacuum, evaporating crystallizers; The MSMR crystallization model: crystal population balance; Precipitation.

Drying of Solids: Instructional objectives: industrial example; Drying equipment: batch operation, continuous operation; Psychrometry: wet- bulb temperature, adiabatic-saturation temperature, moisture- evaporation temperature; Equilibrium- moisture content of solids; Drying periods: constant- rate drying period, falling- rate period; Dryer models: materials and energy balances for direct- heat dryers, belt dryer with through- circulation, direct- heat rotary dryer, fluidized- bed dryer.

TEXT BOOKS:

1. 'Separation Process Principles', Seader, J.D. and Henley, E.J, 2Ed.Wiley India.
2. 'Bioseparations: Principles and Techniques' by B.Sivasankar, Prentice-Hall India.

BTH-1005 : ENVIRONMENTAL BIOTECHNOLOGY

Course Objectives:

- To make the student learn about origin and evolution of microbes.
- To make the student understand structure and functioning of different microbial groups

- To make them to acquaint the cultivation of microbes in artificial medium.

Course Outcomes:

At the end of the course, the student will be able to

- Understand environment and economy
- Differentiate the biological waste water treatment methods
- Describe the applications of biodegradation and bioremediation
- Discuss Biofertilizers and Biopesticides, Biopolymers, Bioplastics and Biofuels
- Explain Biosorption, Bioleaching, Biodiversity

Syllabus Environment:

Types and Components of Environment, Environmental Education, Ecology, Ecosystems, Ecological Pyramids, Food Chains, Food Web, Nutrient Cycling, Ecological Succession, Microbial Associations. History of Environmental Biotechnology.

Biological Waste Water Treatment:

Biological Processes for Domestic and Industrial Waste Water Treatment. Trickling filters, Activated Sludge Process, Rotating Biological Contactors (RBC), Packed Bed Reactors (PBR), Anaerobic Digestion, Fixed Film Reactors, Up Flow Anaerobic Sludge Blanket Reactor (UASBR), Waste Water Cycling.

Biodegradation and Bioremediation:

Introduction, Factors Effecting Bioremediation, Enzyme Systems for Bioremediation, Types of Bioremediation, Bioremediation of Contaminated Soils and Waste Lands, Phytoremediation, Degradation of Xenobiotic Compounds: Petroleum products, Alkanes, Aromatic Compounds.

Biofertilisers and Biopesticides, Biopolymers and Bioplastics, Biosorption, Bioleaching Biofuels, Biodiversity.

TEXTBOOKS:

1. Environmental Biotechnology: Basic concepts and applications by Indu Sekhar Thakur I.K. International Pvt. Ltd. New Delhi.
2. Biotechnology by U. Satyanarayana, Books and Allied (P) Ltd. Koldata.

REFERENCE BOOKS:

1. Biotechnology and Biodegradation. Advances in applied biotechnology, Vol-4 by Karnely, D. Chakraborty, Omen, G.S. Guild Publications co; LONDON.

2. Bioremediation Engineering: Design and Applications by John Cookson Jr; McGrawHill.INC.

BTH-1006 AGRICULTURAL BIOTECHNOLOGY

Course Objectives:

- To make the student learn about the biotechnological approach in the field of agriculture.
- To make the student understand structure and functioning of genes and gene manipulation in plants so as to enhance the quality and crop production.
- To make them to acquaint the novel techniques in the improvement of Agriculture.

Course outcomes:

At the end of the course, the student will be able to

- Understand molecular biology, biochemical concepts for the production and improvement of agricultural practices.
- Develop the theoretical approach to study and understand the importance of genetic approach in the field of agriculture.

SYLLABUS

Introduction - Definition, classical vs modern approach, demand for biological resources, achievements,

Nitrogen Fixation-Basic concepts, nif genes and their regulation, potential scope in crop improvement, Genetic engineering- aims of genetic engineering, techniques of gene manipulation, Transformation Techniques - Physical methods, Agrobacterium, mediated transformation.

Transgenics -Basic concept and essential steps of the process, some examples of transgenic plants, use of suitable promoters, gene silencing and measures to overcome it, commercial aspects of the technology.

Molecular Markers - concept, SNPs, RAPD, RFLP, role in crop improvement and genome mapping,

Molecular and biochemical basis, signalling pathways in the production of transgenic plants for fungal, bacterial and viral disease resistance; herbicide resistance, pest resistance, drought and other abiotic stress resistance, Plant as Biofactories- Concept, production of chemicals, pigments, perfume, flavors, insecticides, anticancer agents and other important compounds, molecular farming, use of plants for production of nutraceuticals, edible vaccines and other desired products, SCP - micro organisms, nutritional value, production of algal biomass, bio fertilizers and bio pesticides, mass cultivation of *Rhizobium*, *Azotobacter*, *Azospirillum*, *Mycorrhiza*, bluegreen algae and *Azolla*.

TEXT BOOKS:

1. "Agricultural Biotechnology" by Arie Altman, Marcel Dekker, Inc. (2001)
2. "Agricultural Biotechnology", by S.S.Purohit, Agro Bios (India)

REFERENCE BOOK:

1. "Molecular Biotechnology Principles and Applications of Recombinant DNA", by Bernard R. Glick and Jack J. Pasternak,. ASM Press

BTH-1007 : BIO-ANALYTICAL TECHNIQUES

Course Objectives:

The course is designed to impart the knowledge in the field of Pharmaceutical Analysis. The various modern analytical techniques like UV-Visible, IR, NMR, Mass, GC, HPLC, different chromatographic methods and other important topics will be taught to enable the students to understand and apply the principles involved in the determination of different bulk drugs and their formulation. In addition to theoretical aspects, the basic practical knowledge relevant to the analysis will also be imparted.

Course Outcomes:

At the end of the course, the students will be able to

- Explain general principles and theory of the Spectroscopy.
- Understand the basic instrumentation of HPLC, GLC for identification and characterization of compounds.
- Learn various separation techniques.
- Analyze instrumentation, separation and identification of compounds by Electrophoresis.

SYLLABUS

Chromatographic Techniques - Affinity - Adsorption - paper - Thin layer - Column - Ion Exchange - Gel Chromatography - Applications. Gas liquid chromatography - High Pressure liquid chromatography - Equipment - Applications.

Spectrophotometric Techniques - IR - UV - Visible - NMR - ESR - Optical density - Circular dichroism.

pH - pH titrations - Determination of pKa values - Buffers - Preparation - Buffer Action - Physiological buffers - potentiometric titration - centrifugal dialysis - lyophilization -

Electrophoresis - Ultra filtration - Assay techniques for proteins, lipids, sugars, amino acids and nucleic acids.

TEXT BOOKS:

1. "Instrumental methods of Chemical Analysis - Chatwal, G & Anand, S. Himalaya Publishing House, Bombay.

2. "Instrumental methods of Chemical Analysis - Sharma, B.K. Goel Publishing House, Meerut.

3. "Instrumental Methods Analysis - Willard, Merritt, Dean & Settle, CBS Publishers & Distributors, Delhi.

BTH-1008 GENETIC ENGINEERING-II

Course Objectives: A gene is a basic constituent unit of any organism. It is a locatable region of a genome which contains the whole hereditary information of the organism. A gene corresponds to a unit of inheritance. It is a segment of the DNA which determines the special features or functions of the organism. Genetic engineering or genetic modification refers to the process of manipulating the characteristics and functions of the original genes of an organism. The objective of this process is to introduce new physiological and physical features or characteristics.

Course Outcomes:

At the end of the course, the students will be able to

- State the importance of developing and practicing of genetic engineering as noble and beneficial for mankind.
- Understand the basic processes involved in manipulating genetic information used by recombinant and cloning methods, different ways that genetic engineering has used in manufacturing, agriculture, medicine.
- Identify several current issues surrounding genetic engineering.

SYLLABUS

Introduction to Gene manipulation. Enzymology of gene cloning, modification methylases, restriction endonucleases.

Reverse transcriptase and D N A cloning in *E. Coli*, Plasmids, cosmids and bacteriophages as cloning vectors. Cloning strategies and gene libraries, Recombinant selection and screening.

Expression of cloned genes cloning in bacteria other than *E. Coli*, in yeasts, in plant cells and in mammalian cells in culture, Micro injection genes into oocytes, eggs and embryo.

The genetic code and regulation of gene expression, Application of genetic engineering in the fields of biology, medicine and industries.

TEXT BOOKS:

1. Introductory Bio - Technology by R. P. Singh.
2. Principles of genetic Engineering by R.W.Old and S.B.Primarose.

BTH-1009 NANOTECHNOLOGY

Course Objectives:

Nanotechnology may be treated as **Green technology**. It is one of the most advanced technologies now-a-days. It leads to have revolutionary changes in the fields of medical, Bio- medical, and fabrication of materials. Technologists are able to prepare ageless materials with the help of nano-techniques. Main objectives of the subject nanotechnology are:

- To define green technology properly
- To expose the students with new techniques of the nanotechnology.
- To make them to learn the importance of quantum technology
- To learn the procedure ageless materials to avoid wear-tear.
- To learn the importance of nano –robots, machines
- To know about the latest microscopes such as SEM, TEM
- To know the importance of nanotechnology in the dawn of optical instruments

Course Outcomes:

At the end of the course, the students will be able to

- Apply nanotechnology in the development of energy, solar panels, Fuel cells, DVD, LEDs, pharmaceuticals, etc
- Explain the importance of atoms manipulation
- Discuss the future applications of Nanotechnology
- Demonstrate the application of Nanotechnology in Optics

SYLLABUS

Introduction to nanotechnology, molecular and atomic size, surface and dimensional spaces. Molecular nanotechnology: atoms by inference, electron microscopes, nanomanipulator, nanotweezers, atom manipulation, nanodots, nanolithography.

Nanopowders and nanomaterials: preparation, plasma arcing, chemical vapor deposition, sol- gels, electrodeposition, Ball milling, applications.

Carbon nanotubes: types, formation, assemblies, purification, properties and uses.

Molecular mimics: Catenanes and rotaxanes, various molecular switches, synthesis of rotaxanes and catenanes, molecular computers, chemical rotors, prodders, flippers, atom shuttles, actuators, contacts.

Nanobiometrics: Lipids as nano-bricks and mortar, self – assembled monolayers, proteins, 3- D structures arising from amines acids, nanoscale motors, Biological Computing, ion channels as sensors, Information in DNA structure, using DNA to build nano-cubes, hinges, smart glue, wire template.

Optics, photomicroscopy and solar energy: Properties of light and nanotechnology, Interaction of light and nanotechnology, Nanoholes and photons, Imaging, New low cost energy efficient windows and solar absorbers based on nanoparticles, Photonic crystals, surface wave guides and control of light paths.

Nanoelectronics: birth of electrons, semiconductors, transistor, integrated circuits, the tools of micro and nanofabrication, quantum electronic devices, quantum information and quantum computers, experimental implementations of quantum computers.

Future applications: microelectromechanical systems, nano-robots, ageless materials, invisible mending of atomic dislocations inside damaged materials, nanomechanics and nanoelasticity, nanoparticle coatings, nanoelectronic and magnetic devices and new computing systems, optoelectronic devices, environmental applications.

Molecular Dynamics, Simulation and Optimization of Nanosystems: Integration of Newton equation of motion, simulation of systems in contact with a heat bath, simulation methods based on accuracy and computational time, use of local and global optimization methods. (Scope: Chapters 5&6, Ali Mansoori*: Principles of Nanotechnology)

(This last section is not open for external assessment, but students are assessed internally by means of assignments and home work problems).

TEXT-BOOK:

1. M.Wilson, K.Kannangara, G. Smith, M. Simmons and B. Ragues, Nanotechnology, Overseas press (India) Private Ltd; New Delhi, 2005.

REFERENCE BOOKS:

1. G. Ali Mansoori, Principles of Nanotechnology, World Scientific Publishing Company, 2005.

2. G. Timp, Nanotechnology, Springer-Verlag, Network, 1999.

3. P. Poole and F.J. Owens, Introduction to Nanotechnology, John Wiley, 2003.

4. D.Ratner and M.Ratner, Nanotechnology: A Gentle Introduction, Pearson Education, 2003.

5. B. Bhusan, Handbook of Nanotechnology, Springer, 2004

Appendix "T" Item No. 39

INSTRUMENT TECHNOLOGY

B.Tech II Year - I Semester

Course Category	Course Title	Hours per week	Internal	External	Total
CreditsC					

code			L	T	P	Marks	Marks	Marks	
IN2101	BS	Maths III	3	0	0	30	70	100	3
IN2102	PC	Strength of materials and theory of machines	3	0	0	30	70	100	3
IN-2103	PC	Electrical machines	3	0	0	30	70	100	3
IN-2104	PC	Sensors and transducers	3	0	0	30	70	100	3
IN-2105	HSS	Managerial economics	3	0	0	30	70	100	3
IN-2106	PC	Analog electronic circuits LAB	0	0	3	50	50	100	1.5
IN-2107	PC	Transducers LAB	0	0	3	50	50	100	1.5
IN-2108	PC	Electrical machines LAB	0	0	3	50	50	100	1.5
IN-2109	SC	Object oriented programming in C++	1	0	2	50	50	100	2
IN-2110	MC	Professional ethics Human & Universal values	0	0	0	—	100	100	0
IN-2111	MC	NCC/NSS	0	0	2	—	—	—	0
Total credits									21.5

*MC-Mandatory course

B.Tech II Year - II Semester

Course Category			Course Title	Hours per week			Internal	External	Total
Credits	C								
code				L	T	P	Marks	Marks	Marks
IN-2201	ES	Maths IV		3	0	0	30	70	100
IN-2202	BS/PC	Electrical measurements and measurements instruments		3	0	0	30	70	100
IN-2203	PC	Signals and systems		3	0	0	30	70	100
IN-2204	PC	Op amps and linear ic's		3	0	0	30	70	100
IN-2205	PC	Digital logic design		3	0	0	30	70	100
IN-2206	PC	DLD lab		0	0	3	50	50	100
IN-2207	PC	Electrical measurements lab		0	0	3	50	50	100
IN-2208	SC	MATLAB skills		1	0	2	50	50	100
IN-2209	MC	Environmental Sciences		0	0	0	—	100	100
Summer Internship									
Total credits									
20									

*MC-Mandatory course

IN2102 - STRENGTH OF MATERIALS AND THEORY OF MACHINES

Course Objective: The basic objective of including this course is to bring awareness in the students about the subject Theory of machines, is that branch of Engineering science which deals with the study of relative motion between the various parts of a machine and forces which act on them. The strength of materials is a subject from which the stress, strain and

several other load factors that apply for a cantilever & beam can be inferred. It brings an insight into various topics of friction, link & element mechanisms.

Course Outcomes: Theory of machines gives an idea about several mechanisms which we come across in several industries & in our day to day life. The students could properly identify the mechanisms that run typical machines. This is important because every process industry a student joins needs the basic knowledge about the mechanisms & mechanical science.

Simple stresses and strains – Tensile, compressive and shear stresses. Elastic limit, Hooke's law, stress-strain relation, Poisson's ratio, Relationship between Modulus of Elasticity and Modulus of Rigidity. Stresses in bars of varying section, Stresses in bars of composite sections, temperature stresses.

Shear Force Bending Moments– Definitions, Cantilever with concentrated load, uniformly distributed loads, load whose intensity varies uniformly, S.F and B.M diagrams, Simply supported beams with pointed loads, uniformly distributed loads, load whose intensity varies uniformly, S.F and B.M diagrams.

Simple Mechanisms: Link and element, lower and higher pairs, kinematic pairs, types of kinematic pairs, kinematic chain, Mechanism, Inversion, degrees of freedom, joint, Grubler's criteria, Mechanisms with turning and sliding pairs : Four bar mechanism and Inversions of Four bar mechanism, Single slider crank chain and Inversions of Single slider crank chain, Double slider crank chain and Inversions of Double slider crank chain.

Mechanisms with lower pairs- pantograph, Exact straight line mechanisms: Scott-Russell mechanism, Peaucellier mechanism, Hart's mechanism, Approximate straight line mechanisms- Modified Scott Russell mechanism, Watt's mechanism, Chebicheff's mechanism, Roberts mechanism, Grasshopper mechanism.

Friction and bearings- Friction definition, types of friction, laws of Friction, limiting friction, limiting angle of Friction, angle of repose, Effort required to move a body on a rough horizontal plane, Effort required to move a body on an inclined plane: up the inclined plane and down the inclined plane, Efficiency of Inclined plane, friction between screw and nut, friction in journal bearings, friction circle.

Text books:

1. Strength of Materials- S.Ramamrutham
2. Strength of materials- J.A.Taraporebala
3. Machines of structures- S.B.Junnarkar-
4. Theory of machines- Toft.L. and Kersy A.T.J
5. Theory of machines - R.S.Kurmi and J.K.Gupta

IN2103 - ELECTRICAL MACHINES

Course Objectives:

The subject aims to provide the student with:

- Understanding of the basics of electrical machines and their construction
- Knowledge of testing and performance of electrical machines.
- Knowledge for learning advanced machines and their control.
- In-depth understanding of application based knowledge in the field of electrical drives

Course Outcome:

At the end of this course, students will demonstrate the ability to

- Analyse and apply the energy conversion principles to rotating machines.
- Evaluate the steady state parameters, basic operating characteristics and performance of DC Machine and its application.
- Evaluate the steady state parameters, basic operating characteristics and performance of transformers

POLYPHASE CIRCUITS

Star and delta connections, vector diagrams, phase sequence, voltage, current relations in two phase and three phase circuits. Analysis of balanced three phase circuits. Measurements of power in three phase circuits.

TRANSFORMERS

Single phase transformer-construction-voltage equation, transformer on no-load and full-load. Equivalent circuit – losses- efficiency-auto transformer, use of transformers with instruments-testing of transformer – Short circuit test and open circuit test.

D.C.Machines

DC Generator – construction - armature windings – principle - e.m.f equation-armature reaction (in brief) and commutation- losses - efficiency - Generator characteristics

D.C.motor – construction- back e.m.f- losses – efficiency- speed torque characteristics-starters-speed control testing.

Synchronous machines- Alternators- principle and working - synchronous impedance-armature reaction (in brief) -e.m.f.equation-synchronous motor, nature of torque, vector diagram-characteristics of a synchronous motors-starting methods.

Induction motor-construction-theory of induction motor –efficiency-equivalent circuit and speed control.

TEXT BOOKS:

1. Electrical technology by B.L.Theraja.
2. Electrical technology by H.Cotton.
3. Electrical machinery by Fitzgerald/kingsley/umans.
4. Electrical machinery by Irving L.Kosow.

IN2104 - SENSORS AND TRANSDUCERS

Course Objectives:

- * To understand about measurement systems and their classification
- * To understand about errors in measurement systems and calibration of measurement systems
- * To enable the students to select and design suitable instruments to meet the requirements of industrial applications and various transducers used for the measurement of various physical quantities
- * To understand about Various types of Sensors & Transducers and their working principle Resistive, Capacitive and Inductive, Piezo electric and Some of the miscellaneous transducers Characteristics of transducers

Course Outcomes:

- * Upon completion of this course the student shall be able to understand the working of basic sensors and transducers used in process and manufacturing industries.
- * The student will be able to select particular type of sensor/transducer in a typical application in a process Industry.

Measurements and Measurement systems- functional elements of measurement system- classification of measuring instruments- specifications of measuring instruments-

Standards of measurement-calibrations of measuring instruments-static and dynamic characteristics of measurement systems-errors in measurement systems.

Mathematical modeling of measurement systems- Modeling of mechanical systems-electrical system-thermal systems and fluidic systems-order of measurement systems –zero order,1st order, 2nd order and higher order systems – transfer function of measurement systems – system response to standard test signals – response of 1st order and second order systems for standard test signals.

Primary sensing elements-mechanical sensors springs-cantilever-torsion bars, load cells elastic sensors- diaphragms, capsules-Bellows and bourdon tube gauges- flapper-nozzle sensors – Thermal sensors - filled in systems- Bimetal sensors – Level sensors- floats and displacers – flow

sensors- Head flow sensors (Orifice, venture and pitot tubes) Area flow sensors (Rota meter and piston meters)

Transducers-Active and passive transducers – Transducers-characteristics- basic requirements resistive transducers- strain gauges-potentiometers RTD's and thermistors – Inductive transducers- self inductance and variable inductance transducers _LVDT and its applications – capacitive transducers- variable distance and variable area and dielectric type

Piezo electric transducers and their applications- magnetic strictive-thermo electric and hall effect transducers- photo electric transducers- photo emissive and photo voltaic types and their applications- advanced sensors smart transducers- intelligent transducers and MEMS sensors.

IN 2105 MANAGERIAL ECONOMICS

Course Objectives:

- To bring about an awareness about the nature of Managerial Economics and its linkages with other disciplines.
- To understand the Micro and Macro Environment of Business.
- To familiarize the prospective engineers with the concepts and tools of Managerial Economics with an objective to understand the real world of business.

Course Outcomes:

After completion of the course, student will be able to:

- Understand the various economic activities in business and industry.
- Analyse the real world business problems.
- Make optimal business decisions for the effective and efficient management of

Organisations.

Significance of Economics and Managerial Economics:

Economics: Definitions of Economics- Wealth, Welfare and Scarcity definitions Classification of Economics- Micro and Macro Economics.

Managerial Economics: Definition, Nature and Scope of Managerial Economics, Differences between Economics and Managerial Economics, Main areas of Managerial Economics, Managerial Economics with other disciplines.

Demand and Utility Analysis:

Demand - Definition, Meaning, Nature and types of demand, Demand function, Law of demand - Assumptions and limitations. Exceptional demand curve.

Elasticity of demand - Definition, Measurement of elasticity, Types of Elasticity

(Price, Income, Cross and Advertisement), Practical importance of Price elasticity of demand, Role of income elasticity in business decisions, Factors governing Price Elasticity of demand.

Utility Analysis: Utility- Meaning, Types of Economic Utilities, Cardinal and Ordinal Utility, Total Utility, Marginal Utility, The law of Diminishing Marginal Utility and its Limitations.

Theory of Production and Cost analysis:

Production - Meaning, Production function and its assumptions, use of production function in decision making;

Cost analysis - Nature of cost, Classification of costs - Fixed vs. Variable costs, Marginal cost, Controllable vs. Non - Controllable costs, Opportunity cost, Incremental vs. Sunk costs, Explicit vs. Implicit costs, Replacement costs, Historical costs, Urgent vs. Postponable costs, Escapable vs. Unavoidable costs, Economies and Diseconomies of scale.

Market Structures : Definition of Market, Classification of markets; Salient features or conditions of different markets - Perfect Competition, Monopoly, Duopoly , Oligopoly, Importance of kinked demand curve ;Monopolistic Competition.

Pricing and Business Cycles:

Pricing Analysis : Pricing – Significance; Different Pricing methods- Cost plus pricing, Target pricing, Marginal cost pricing, Going -rate pricing, Average cost pricing, Peak load pricing , Pricing of joint Products, Pricing over the life cycle of a Product, Skimming pricing Penetration pricing, Mark-up and Mark- down pricing of retailers.

Business cycles - Definition, Characteristics, Phases, Causes and Consequences; Measures to solve problems arising from Business cycles.

Text Books:

1. Sankaran,S., Managerial Economics, Marghan Publications, 2015, Chennai.
2. Aryasri, A.R., Managerial Economics and Financial Analysis, MC Graw Hill Education, New Delhi,2015.

Reference Books:

1. Dwivedi, D.N., Managerial Economics, Vikhas Publishing House Pvt. Ltd. 6th Edition, New Delhi,2004.
2. Dewett, K.K., Modern Economic Theory, S.Chand & Company Ltd., New Delhi, 2005.

IN 2106 Analog Electronics Circuits Lab

Course Educational Objective: This course gives an overview of amplifiers, power amplifiers, Feedback Amplifiers and Oscillators.

Course Outcomes: At the end of the course, the student will be able to

CO1 : Understand the operation of different types of amplifiers and oscillators.

CO2: Analyze the characteristics of different types of amplifiers.

CO3: Design an amplifier.

List of Experiments

1. Common Emitter Amplifier
2. Common Source Amplifier
3. Two Stage RC coupled CE amplifier
4. Two Stage RC coupled CS FET amplifier
5. Class A power amplifiers
6. Class B power amplifiers
7. Class C power amplifiers
8. Voltage –current series feedback amplifier
9. RC phase shift Oscillator using Transistor
10. Wein Bridge oscillator

IN 2107 Transducers Lab

Course Objective:

1. This Lab explores the Calibration of Various kinds of Transducers & Industrial Instruments

2. To make the students familiarize with several Industrial parameters.

To obtain the practical knowledge on working principle of several transducers & Sensors what they have studied in theory.

Course Outcomes:

The purpose of inclusion of this lab into the curriculum is to illustrate the Working principle, Calibration and characteristics of various types of transducers

At the completion of this lab, the student will be able to:

1. Calibrate & plot Characteristics of different kinds of transducers such as Strain Gauge, LVDT, Dead weight tester etc....
2. Visualize the working principle of various types of sensors Like RTD, Thermo couple, Orifice meter etc... which they have studied in theory.
3. Control the Industrial parameters like Pressure, Level, Flow, Temperature etc....
4. Obtain the knowledge about practical applications of several transducers, Sensors & Industrial Instruments.

IN2108: ELECTRICAL MACHINES LAB

Course Objective:

1. This Lab explores all the possible design connections of a DC machine and it also experimentally obtains the characteristics and thus observes the performance of different DC motors and generators and performs tests on DC machines to derive their efficiency.

2. To make the students familiarize the students with all necessary AC electrical machines like Single phase and three phase induction motors all of which help to enhance the technical skills of students.

3. The working of a transformer, wattmeter and dc, ac motors are apparent to the students. They could practically visualize & can correlate with what they have studied in theory and grasp the concepts well.

Course Outcomes:

The purpose of inclusion of this lab into the curriculum is to illustrate the working and characteristics of transformers & various types of dc & ac motors and generators under no-load, loaded conditions.

At the completion of this lab, the student will be able to:

1. Obtain the operating characteristics of dc machines, transformers and Induction motors.

2. Examine the relationship between torque, speed, voltage and Current for various types of motor & generator connections in no-load and loaded configurations.

3. Predict, by calculation, the performance of dc machines Motor & Generator.

4. Analyze and select appropriate dc machines & ac machines for given applications.

5. The working of a transformer, wattmeter and DC Motors, AC Motors are apparent to the students. They could practically visualize & can correlate with what they have studied in theory and grasp the concepts well.

IN 2109 Object Oriented Programming through C++(SC)

Course Objectives:

- Exposure to basics of object oriented mode, C++ programming and I/O in C++

- Acquaintance with classes, objects and member functions.

- Concentration on inheritance, types of inheritance, polymorphism, virtual functions

- Focus on constructors, destructors, variants in them

Course Outcome:

- * Expertise in object oriented principles and their implementation in C++

INTRODUCTION: Differences Between C And C++, The Object Oriented Technology, Disadvantage of Conventional Programming, Concepts of Object Oriented Programming, Advantages of OOP Structure of a C++ Program, Header Files And Libraries.

INPUT AND OUTPUT IN C++: Introduction, Streams In C++ And Stream Classes, Pre-Defined Streams, Stream Classes, Formatted And Unformatted Data, Unformatted Console I/O Operations, Member Functions Of Istream Class, Formatted Console I/O Operations, Bit Fields, Flags Without Bit Field, Manipulators, User Defined Manipulators.

FUNCTIONS IN C++: Introduction, Structure Of Function, Passing Arguments, Lvalues And Rvalues, Return By Reference, Returning More Values By Reference, Default Arguments, Constant Arguments, Inputting Default Arguments, Inline Functions, Function Overloading, Principles Of Function Overloading, Recursion.

CLASSES AND OBJECTS: Introduction, Classes In C++, Declaring Objects, Access Specifiers And Their Scope, Member Functions, Outside Member Function As Inline, Data Hiding or Encapsulation, Classes, Objects and Memory, Static Member Variables, Static Member Functions Static Object, Array Of Objects, Objects As Function Arguments, Friend Functions, The Constant Member Functions, The Volatile Member Function, Recursive Member Function, Local Classes, Empty, Static And Constant Classes, Member Function and Non- Member Function, Overloading Member Functions, Nested Class.

CONSTRUCTORS AND DESTRUCTORS :Introduction, Characteristic Of Constructors & Destructors, Applications With Constructors, Parameterized Constructor, Overloading Constructors (Multiple Constructors), Array Of Objects Using Constructors, Constructors With Default Arguments, Copy Constructors, The Constant Objects, Destructors, Calling Constructors And Destructors, Qualifier And Nested Classes, Anonymous Objects, Private Constructors And Destructors, Dynamic Initialization Using Constructors, Dynamic Operators and Constructors, Recursive Constructor, Constructor and Destructor With Static Members, Local Vs. Global Object.

INHERITANCE: Introduction, Reusability, Access Specifiers And Simple Inheritance, Protected Data With Private Inheritance, Types Of Inheritance (Single Inheritance, Multilevel Inheritance, Multiple Inheritance, Hierarchical Inheritance, Hybrid Inheritance, Multipath Inheritance), Virtual Base Classes, Constructors, Destructors, And Inheritance, Object As A Class Member, Abstract Classes, Qualifier Classes And Inheritance, Constructor In Derived Class, Pointers And Inheritance, Overloading

Member Function, Advantages Of Inheritance, Disadvantages Of Inheritance.

POLYMORPHISM: Pointer To Base And Derived Class Objects, Virtual Functions, Rules For Virtual Functions, Array Of Pointers, Pure Virtual Functions.

TEXT BOOKS

- Object Oriented Programming with C++, E. Balaguruswamy, TMH
- Programming In C++ , Ashok N Kamthane. Pearson 2nd Edition.
- Object Oriented Programming C++ , Joyce Farrell, Cengage
- Mastering C ++, Venugopal, Rajkumar, Ravi kumar TMH

REFERENCE BOOKS

- The Complete Reference, C++, 4ed, Herbert Schildt, TMH

IN 2110 Professional Ethics and Universal Human Values

(Common for all Branches)

Course Objectives:

The objective of the course is Six fold:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- This course will illuminate the students in the concepts of laws and its applicability to engineers
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection, Development of commitment and courage to act and also enable the students to imbibe and internalize the Values and Ethical Behaviour in the personal and professional lives
- To enable the students to imbibe the Values and Ethical Behavior in the personal and Professional lives
- The students will learn the rights and responsibilities Individual, employee, team member and a global citizen

Course Outcomes:

By the end of the course Student will be able to:

- Grasp the meaning of the concept – Law and also Get an overview of the laws relating to Engineers and also Apprehend the importance of being a law abiding person and They would have better critical ability
- Self-explore by using different techniques to live in harmony at various levels
- Analyze themselves and understand their position with respect to the moral and ethical

character needed for a successful and satisfactory work life

· Students are expected to become more aware of themselves and their surroundings

(family, society, nature)

· They would become more responsible in life, and in handling problems with sustainable

solutions, while keeping human relationships and human nature in mind.

· They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society

SYLLABUS

Need, Basic Guidelines, Content and Process for Value Education

· Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation - as the process for self-exploration, Continuous Happiness and Prosperity - A look at basic Human Aspirations, Right understanding, Relationship and Physical Facility - the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels. Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking, Include practice sessions and case studies.

Understanding Harmony in the Human Being - Harmony in Myself!

· Understanding human being as: a co-existence of the sentient 'I' and the material 'Body', the needs of Self ('I') and 'Body' - happiness and physical facility, the Body as an instrument of 'I' (I being the doer, seer and enjoyer), the characteristics and activities of 'I' and harmony in 'I', the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail, P to ensure Sanyam and Health, Include practice sessions and case studies.

Understanding Harmony in the Family and Society - Harmony in Human – Human Relationship

· Understanding values in human-human relationship: meaning of Justice (nine universal

values in relationships) and program for its fulfillment to ensure mutual happiness; Trust

and Respect as the foundational values of relationship, the meaning of Trust; Difference between intention and competence, the meaning of

Respect, Difference between respect and differentiation; the other salient values in relationship, the harmony in the society (society being an extension of family), Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society, Universal Order from family to world family, Include practice sessions and case studies.

Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

- Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature recyclability and self-regulation in nature, Understanding Existence as Co-existence of mutually interacting units in all – pervasive space, Holistic perception of harmony at all levels of existence, Include practice sessions and case studies.

Concept of Law and Law of Torts

- Understanding Essentials of a Valid Contract and the basics of contract law protecting rights and obligations, Introduction to the Law of Torts and the basics to protect oneself and the company Law affecting the Workplace Employers Responsibilities/Duties Hiring Practices, Introduction to Intellectual Property Law, Professional Code of Conduct for Engineers, Relationship between Law and Ethics, Include practice sessions and case studies.

Implications of the above Holistic Understanding of Harmony on Professional Ethics

- Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations, Include practice sessions and case studies.

Text Books

1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. R R Gaur, R Asthana, G P Bagaria, "Teachers' Manual for A Foundation Course in Human

Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN

978-93-87034-53-2

3. R. Subramanian, "Professional Ethics", Oxford University Press.

4. S.B. Srivastha, "Professional Ethics & Human Values", SciTech Publications (India) Pvt. Ltd. New Delhi.

5. D.R. Kiran, "Professional Ethics & Human Values", TATA Mc Graw Hill Education.

6. Saroj Kumar, "Business Law" and Avtar Singh, "Law of Contract"

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.

2. A. N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, 2004.

3. The Story of Stuff (Book), Mohandas Karamchand Gandhi "The Story of My Experiments with Truth", E. F. Schumacher. "Small is Beautiful", Slow is Beautiful –Cecile Andrews, J C Kumarappa "Economy of Permanence", Pandit Sunderlal "Bharat Mein Angreji Raj" and Dharampal, "Rediscovering India

4. G K Kapoor, "Business Law" and Sen & Mitra, "Business & Commercial Laws" and Calvin Frank Allen, "Business law for Engineers"

5. Hilgard, E. R.; Atkinson, R. C. & Atkinson, R.L. (1975). *Introduction to Psychology*. 6th Edition. New Delhi: Oxford and IBH Publishing Co. Pvt. Ltd.

6. Govindarajan, M; Natarajan, G. M. & Senthilkumar, V.S. (2013). *Professional Ethics & Human Values*. Prentice Hall: New Delhi

7. Gogate, S. B. (2011). *Human Values & Professional Ethics*. Vikas Publishing: New Delhi.

8. Charles E Harris Jr., Michael S Pritchard, Michael J Rabins, "Engineering Ethics, Concepts Cases: 4e, Cengage learning, 2015.

9. Caroline Whitbec, " Ethics in Engineering Practice & Research: 2e, Cambridge University Press 2015.

B.Tech II year - II Semester

IN2202 - ELECTRICAL MEASUREMENTS AND MEASURING INSTRUMENTS

Course Objectives:

- This course provides adequate knowledge of various instruments for measuring electrical quantities.

- understand basic laws governing the operation and working of instruments and their equivalent circuits used for the measurement of voltage, current, power, energy.

Course Outcomes:

The student will be able to:

- differentiate PMMC and MI instruments.
- determine R, L and C of the given impedances using different bridges.
- understand the functioning and errors present different type of instruments

MEASUREMENT OF RESISTANCE, CAPACITANCE AND INDUCTANCE: D.C bridges, potentiometers, A.C bridges, measurement of inductance and capacitance, errors in bridge measurements, Wagner's earthing device.

CLASSIFICATION OF INSTRUMENTS: Electrical analog instruments, classification and constructional details, galvanometers, operating principle dynamic response, measurement of galvanometer constants

MEASUREMENT OF VOLTAGE AND CURRENT: moving-iron, PMMC, Electro dynamic, electro static and inductive type instruments, range extension

MEASUREMENT OF POWER: Watt meters, dynamometer induction electrostatic watt meters, poly phase watt meters.

MEASUREMENT OF ENERGY: induction watt-hour meter-errors and compensation, polyphase induction watt-hour meter, measurement of frequency, phase angle, power factor, special purpose instruments.

TEXT BOOKS:

1. Electrical measurement and measuring Instruments by Golding and Widdis.
2. Electrical and Electronic measurements and Instruments By A.K.Sawhney.
3. Electrical measurements and Measuring instruments By Rajendra Prasad.

IN2203 - SIGNALS AND SYSTEMS

Course Educational Objectives: This course describes signals mathematically and how to perform mathematical operations on signals, represents the signals in both time and frequency domains, provides the concepts of signal approximation using orthogonal functions and Fourier Series, the Fourier Transform and its properties, Laplace Transform and their properties, analysis of systems using Laplace Transforms.

Course Outcomes (COs): At the end of this course, student will be able to

CO1 Remember the classification and properties of the signals & systems, properties of Fourier and Laplace Transforms.

CO2 Understand the fundamental characteristics of the signals, systems and their classifications

CO3 Apply mathematical tools to model and examine signals and systems in both time and frequency domains.

CO4 Analyze the concept of Fourier Series, Region of convergence and convolution in time and frequency domains

CO5 Evaluate system for linearity, causality, time variance, stability, memorability and reliability.

SIGNAL ANALYSIS: Approximation of a function by a set of mutually orthogonal functions, evaluation of mean square error. Orthogonality in complex functions. Trigonometric and exponential Fourier series. Representation of a periodic function by Fourier series. Fourier transform, properties of Fourier transform. Fourier transform of simple functions.

Convolution integral. Convolution in time domain and frequency domain. Graphical representation. Sampling theorem – statement and proof, aliasing.

CORRELATION: Cross correlation and auto correlation functions, properties of correlation function, correlation and convolution, energy and power spectral density functions. Parseval's theorem.

SIGNAL TRANSMISSION THROUGH LINEAR NETWORKS: Linear time invariant system. Transfer function. Filter characteristics of linear systems. Conditions for distortionless transmission. Causality and physical realizability. Bandwidth and rise time.

LAPLACE TRANSFORMS: Review of Laplace transforms, partial fraction expansion, inverse Laplace transforms, concept of region of convergence (ROC) for Laplace transforms. Constraints on ROC for various classes of signals, properties of Laplace transforms, relation between Laplace transform and Fourier transform of a signal. Laplace transform of a certain signals using wave form synthesis.

Z-TRANSFORMS : Fundamental difference between continuous and discrete time signals, discrete time complex exponential and sinusoidal signals, periodicity of discrete time complex exponential signals. Concept of Z – transform of a discrete sequence. Distinction between Laplace, Fourier & Z –transforms. Region of convergence in Z-transforms, constraints on ROC for various classes of signals, inverse Z – transforms, properties of Z-transforms.

TEXT BOOKS:

1. Signals, systems and communications – by B.P Lathi, BS publications.

2. Signals and systems – by A.V Oppenheim , AS Willesky & SH Nawab, PHI

REFERENCE:

1. Signals and systems – by Simon Haykins, Wiley Student Ed.

IN2204- OPAMPS AND LINEAR IC'S

TotalCourse Objective: The operational amplifier is responsible for a dramatic and continuing revolution in our approach to analog system design. The availability of high performance, inexpensive devices influences the entire spectrum of circuits and systems, ranging from simple, mass-produced circuits to highly sophisticated equipment designed for complex data collection or processing operations. At one end of this spectrum, modern operational amplifiers have lowered cost and improved performance; at the other end, they allow us to design and implement systems for various purposes.

Course Outcomes:

The final outcome of this subject is that they are used in designing many circuits like filters, multivibrators and different amplifier circuits.

INTRODUCTION TO OPERATIONAL AMPLIFIER: IC definition, advantages, Classification of ICs, Block diagram of typical op-amp, Electrical characteristics of an op-amp, Ideal op-amp characteristics, Equivalent circuit of an op-amp, Ideal voltage transfer curve, open loop operational amplifier configuration: Differential amplifier configuration, Inverting amplifier configuration and non-inverting amplifier configuration.

AN OPERATIONAL AMPLIFIER WITH NEGATIVE FEEDBACK: Block diagram representation of feedback configurations: voltage-series feedback, voltage shunt feedback, Current-series feedback, Current-shunt feedback, Voltage-series feedback amplifier analysis: closed loop voltage gain, difference input voltage ideally zero, input resistance with feedback, output resistance with feedback, Bandwidth with feedback, total output offset voltage with feedback, Voltage follower, Voltage shunt

feedback amplifier analysis: closed loop voltage gain, Inverting input terminal at virtual ground, input resistance with feedback, output resistance with feedback, Bandwidth with feedback, total output offset voltage with feedback, Current-to-voltage converter, Inverter, Differential Amplifiers: Differential Amplifier with one Op-Amp Differential Amplifier with two Op-Amps.

THE PRACTICAL OPERATIONAL AMPLIFIER: Introduction, Input offset voltage, Offset voltages, offset voltage null circuit, offset voltage compensating network, configurations of inverting and non-inverting

amplifiers with feedback and offset- voltage compensation, thermal drift, noise.

GENERAL LINEAR APPLICATIONS OF OPERATIONAL AMPLIFIER: DC and AC amplifiers, the Peaking Amplifier, Summing, Scaling and Averaging Amplifiers: Inverting configuration, Non Inverting configuration, Differential configuration, A Subtractor, Instrumentation amplifier, Instrumentation amplifier using Transducer bridge, V/I converter with floating load, low-voltage DC voltmeter, low-voltage AC voltmeter, V/I converter with grounded load, I/V converter, The Integrator, The Differentiator.

ACTIVE FILTERS: Filter definition, Classification of Filters, First order low pass filter butter worth filter, Filter design, Frequency scaling, Second order low pass filter butter worth filter, Filter design, First order high pass butter worth filter, Filter design, Second order high pass butter worth filter, High order filters, Band pass filters: wide band-pass filter, narrow band-pass filter, Band Reject Filters: wide band-reject filter, narrow band reject filter, All Pass Filter.

SPECIALIZED IC APPLICATIONS: Logarithmic amplifier, antilog amplifier, Basic Comparator, Zero crossing detector, Schmitt Trigger, 555 Timer, 555 Timer as Monostable Multivibrator, Frequency divider, 555 Timer as Astable Multivibrator, free running ramp generator, block diagram of a Phase locked loop and its operating principle.

TEXT BOOKS:

1. Op-amps and linear integrated circuits by Rama Kant A. Gayakwad, P.H.I.

2. Op-amps and linear integrated circuits by Robert Coughlin.

3. Applications of analog integrated circuits by Sidney Soclof PHI.

INE : 2205 - DIGITAL ELECTRONICS AND LOGIC DESIGN

Course Objectives:

The objectives of this course are to:

Introduce the concept of digital and binary systems

• Be able to design and analyze combinational logic circuits.

• Be able to design and analyze sequential logic circuits.

• Understand the basic software tools for the design and implementation of digital circuits and systems.

• Reinforce theory and techniques taught in the classroom through experiments and projects in the laboratory.

Course Outcomes:

On completion of the course, student will be able to:

- Use the basic logic gates and various reduction techniques of digital logic circuit in detail.

- Design combinational and sequential circuits.

- Design and implement hardware circuit to test performance and application.

Number systems & codes : Review of number systems, weighted codes, conversion from one to another, non weighted codes, error detecting codes, error correcting codes , binary arithmetic.

Digital logic & Boolean algebra : Basic gates OR, AND, NOT, universal gates NAND ,NOR, introduction to HDL. Boolean law & theorems, representation of switching functions, Karnaugh map representation, minimization using Karnaugh map, SOP and POS methods. Design of single out put and multi out put functions using conventional gates

Combinational circuits:

Arithmetic circuits : Half & full adders and subtractors , 4 bit binary adder, fast adder.

Data processing circuits : Multiplexers, demultiplexers, 1 of 16 decoder, seven segment decoders, encoders.

Synchronous circuits : RS flip - flops, gated flip - flops, edge triggered RS,D,JK flip - flops, master slave flip - flop, T flip- flop switch contact bounce circuits, analysis of sequential circuits.

Registers and Counters : Types of registers, serial in – Serial out, Serial in – parallel out, parallel in – Serial out , Parallel in - Parallel out registers, design of Asynchronous & Synchronous counters, mod counter , Decade counters, Presettable counters, Digital clock.design of programmable logic array (PLA) and programmable array logic (PLD)

Text Books:

1. Digital Principles and Applications. Albert paul Malvino and Donaldp. Leach, T.M.H.

2. Digital Integrated Electronics. Herbert Taub and Donald Schilling, Mcgraw Hill Co.

3. Digital Logic and Computer Design by M. Morris Mano, P.H.I.

IN 2206 DLD Lab

Course Educational Objective: This course gives an overview of logic gates, Adders and Subtractors, Code converters, Decoders and multiplexers.

Course Outcomes: At the end of the course, the student will be able to

CO1 : Understand the operation of different types of Flip Flops and logic circuits

CO2: Analyze the characteristics of logic circuits

CO3: Design an logic circuit

List of Experiments

1. Verification of Logic gates
2. Construction of adders and subtractors
3. Code converters
4. Four bit Adder
5. BCD to 7 Segment display
6. Decoders
7. Multiplexers
8. Verification of Flip Flops using SSI gates.
9. Ripple counters
10. MOD 11 Ripple counters.

IN2207 Electrical measurements lab

Course Objectives:

This course provides

- Adequate knowledge of constructing DC and AC bridge circuits and implementing bridge balancing conditions for measurement of resistance, inductance and capacitance.

- Immense knowledge on calibration of ammeters and voltmeters and their range extensions

- Practical capability for handling CRO for measurement of various parameters

- Exposure to measure power in single phase and three phase circuits

Course Outcomes:

The student will be able to

- Design and construction of bridge circuits for measuring various parameters

- Handle CRO

- Calibrate devices like ammeters, voltmeters, watt meters and energy meters

List of Experiments:

1. Measurement of Low Resistance by Kelvin's Double Bridge Method.
2. Measurement of Inductance of low Q coils ($1 < Q < 10$) by maxwells bridge
3. Measurement of Inductance of high Q coils ($Q > 10$) by hay bridge
4. Measurement of capacitance by Schering bridge

5. Study of Galvanometer and Determination of Sensitivity and Galvanometer Constants.
6. Calibration of Voltmeters
7. Calibration of Ammeters
8. Extension of ranges of ammeters and voltmeters
9. Testing of Energy meters (Single phase type).
10. Measurement of voltage, current using CRO.
11. Measurement of Phase in CRO using Lissajous figures
12. Measurement of Power in a single phase circuit
13. Measurement of Power and Power Factor in a three phase AC circuit by two-wattmeter method.
14. Measurement of R, L and C using Q meter

IN 2208 MATLAB Skills

Course Objectives:

- Getting acquainted with data types and functions in MATLAB
- Usage of MATLAB for solving mathematical expressions
- Practiced to programming and app handling
- Students will be introduced to different inbuilt functions and modules provided by Matlab for control applications.

Course outcomes:

- Use computational tools to support analysis and synthesis requirements in control.
- Support documentation in the form of graph, figure, audio-visuals etc.

Introduction: Desktop Basics, Matrices and Arrays, Array Indexing, Workspace Variables, Text and Characters, Calling Functions, 2-D and 3-D Plots, Programming and Scripts Help and Documentation. Entering Commands, Data Types, Operators and Elementary Operations, Loops and Conditional Statements.

Data Import and Analysis: Import and export data, including large files, pre-processing data, visualize and explore Access data from text files, spreadsheets, hardware, other software, or the web. Explore the data to identify trends, test hypotheses, and estimate uncertainty. Create customized algorithms, visualizations, and models.

Mathematics: Linear algebra, differentiation and integrals, Fourier transforms, and other mathematics, Math provide a range of numerical computation methods for analyzing data, developing algorithms, and creating models. Core functions use processor-optimized libraries for fast vector and matrix calculations.

Graphics: Two- and three-dimensional plots, images, animation, Graphics functions include 2-D and 3-D plotting functions to visualize data

and communicate results. Customize plots either interactively or programmatically.

Programming: Scripts, functions, live scripts and classes. Files and folders programming utilities. Develop apps interactively using App Designer, or programmatically using MATLAB® functions

Text Books:

- A Hand book on Numerical technique lab : MATLAB based experiments, K.K.Sharma, Wiley publisher.
- Modeling and simulation using MATLAB- Simulink, 2nd Edition, Sailendra Jain, Wiley publisher
- Basics of MATLAB Programming, R. Balaji

Reference Book:

- MATLAB Help file documentation available in MATLAB Version 10.1

IN 2209 ENVIRONMENTAL SCIENCE

(Common for all Branches)

Course Objectives

The objectives of the Environmental Science course are to

- Familiarize the fundamental aspects of environment and the environmental management
- Provide information of some of the important international conventions which will be useful during the future endeavors after graduation.
- Make realize the importance of natural resources management for the sustenance of the life and the society.
- Apprise the impact of pollution getting generated through the anthropogenic activities on the environment
- Provide the concept of Sustainable Development, energy and environmental management
- Impart knowledge on the new generation waste like e-waste and plastic waste.

Course Outcomes

After completion of the course the students will have

- Knowledge on the fundamental aspects of environment and the environmental management
- The knowledge on the salient features of the important international conventions
- Understanding of the importance of natural resources management for the sustenance of the life and the society.
- Familiarity on various forms of pollution and its impact on the environment.

- Understand the elements of Sustainable Development, energy and environmental management
- Knowledge on the new generation waste like e-waste and plastic waste.

SYLLABUS

Introduction: Structure and functions of Ecosystems-Ecosystems and its Dynamics-Value of Biodiversity-impact of loss of biodiversity, Conservation of bio-diversity. Environmental indicators - Global environmental issues and their impact on the ecosystems.

Salient features of International conventions on Environment: Montreal Protocol, Kyoto protocol, Ramsar Convention on Wetlands, Stockholm Convention on Persistent Organic Pollutants, United Nations Framework Convention on Climate Change (UNFCCC),

Natural Resources Management: Importance of natural resources management-Land as resource, Land degradation, Soil erosion and desertification, Effects of usage of fertilizer, herbicides and pesticide-watershed management.

Forest resources: Use and over-exploitation, Mining and dams – their effects on forest ecosystems and the living beings.

Water resources: Exploitation of surface and groundwater, Floods, droughts, Dams:benefits and costs.

Mineral Resources: Impact of mining on the environment and possible environmental management options in mining and processing of the minerals. Sustainable resource management (land, water, and energy), and resilient design under the changing environment.

Environmental Pollution: Local and Global Issues. Causes, effects and control measures. Engineering aspects of environmental pollution control systems.

Air pollution: impacts of ambient and indoor air pollution on human health. Water pollution: impacts water pollution on human health and loss of fresh water resources. Soil pollution and its impact on environment. Marine pollution and its impact on blue economy. Noise pollution.

Solid waste management: Important elements in solid waste management- Waste to energy concepts. Air (prevention and control of pollution) Act, Water (prevention and control of pollution) Act and their amendments. Salient features of Environmental protection Act, 1986.

Sustainable Development: Fundamentals of Sustainable Development– Sustainability Strategies and Barriers – Industrialization and sustainable development. Circular economy concepts in waste (solid and fluid) management.

Energy and Environment: Environmental Benefits and challenges, Availability and need of conventional energy resources, major environmental problems related to the conventional energy resources, future possibilities of energy need and availability. Solar Energy: process of photovoltaic energy conversion, solar energy conversion technologies and devices, their principles, working and applications, disposal of solar panel after their usage. Biomass energy: Concept of biomass energy utilization, types of biomass energy, conversion processes, Wind Energy, energy conversion technologies, their principles, equipment and suitability in context of India.

Management of plastic waste and E-waste: Sources, generation and characteristics of various e- and plastic wastes generated from various industrial and commercial activities; Waste management practices including onsite handling, storage, collection and transfer. E-waste and plastic waste processing alternatives. E-Waste management rules and Plastic waste management rules, 2016 and their subsequent amendments.

Text Books:

1. Bharucha, Erach (2004). Textbook for Environmental Studies for Undergraduate Courses of all Branches of Higher Education, University Grants Commission, New Delhi.
2. Basu, M., Xavier, S. (2016). Fundamentals of Environmental Studies, Cambridge University Press, India
3. Masters, G. M., & Ela, W. P. (1991). Introduction to environmental engineering and science. Englewood Cliffs, NJ: Prentice Hall.
4. Enger, E. and Smith, B., Environmental Science: A Study of Interrelationships, Publisher: McGraw-Hill Higher Education; 12th edition, 2010.

Reference Books:

1. Sharma, P. D., & Sharma, P. D. (2005). Ecology and environment. Rastogi Publications
2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
3. Clark R.S. (2001). Marine Pollution, Clanderson Press Oxford (TB)
4. Jadhav, H & Bhosale, V.M. (1995). Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
5. MoEF&CC, Govt. of India, CPCB: E-waste management rules, 2016 and its amendments 2018.
6. MoEF&CC, Govt. of India, CPCB: Plastic waste management rules, 2016.

III/IV B.TECH ECE (FOUR YEAR COURSE) & II/IV B.Tech+ M.Tech

(six year dual degree course)

(with effect from 2020-2021 admitted batch onwards)

B.Tech & B.Tech+M.Tech

II Year - I Semester

Course Category	Course Title	Hours per week	Internal	External	Total	
Credits						
code		L T P	Marks	Marks	Marks	C
EC-2101 BS	Mathematics III	3 0 0	30	70	100	3
EC-2102 PC	Analog Electronic Circuits	3 0 0	30	70	100	3
EC-2103 PC	Electrical Machines	3 0 0	30	70	100	3
EC-2104 PC	Signals & Systems	3 0 0	30	70	100	3
EC-2105 HSS	Managerial Economics	3 0 0	30	70	100	3
EC-2106 PC	Networks and Machine Lab	0 0 3	50	50	100	1.5
EC-2107 PC	Analog Electronics and Circuits Lab with Simulation	0 0 3	50	50	100	1.5
EC-2108 PC	Digital ICs and HDL Lab	0 0 3	50	50	100	1.5
EC-2109 SC	Matlab Programming	1 0 2	50	50	100	2
EC-2110 MC	Professional Ethics & Universal Human values	0 0 0	—	100	100	0
EC-2111 MC	NCC/NSS	0 0 2	—	—	—	0
Total Credits						21.5

B.Tech & B.Tech+M.Tech

II Year - II Semester

Course Category	Course Title	Hours per week	Internal	External	Total	
Credits						
code		L T P	Marks	Marks	Marks	C
EC-2201 ES	MIV	3 0 0	30	70	100	3
EC-2202 BS/PC	Electromagnetic Field Theory and Transmission Lines	3 0 0	30	70	100	3
EC-2203 PC	Microprocessors and Microcontrollers	3 0 0	30	70	100	3
EC-2204 PC	Probability theory and Random Process	3 0 0	30	70	100	3
EC-2205 PC	Analog Communications	3 0 0	30	70	100	3
EC-2206 PC	Microprocessors & Microcontrollers Lab	0 0 3	50	50	100	1.5
EC-2207 PC	Analog Communications Lab	0 0 3	50	50	100	1.5
EC-2208 SC	Python Programming	1 0 2	50	50	100	2
EC-2209 MC	Environmental Science	0 0 0	—	100	100	0

Total Credits

20

Summer Internship(Community Service)

EC-2101 : MATHEMATICS-III

B.Tech & B.Tech+M.Tech

II Year - I Semester

(With effect from the admitted batch of 2020-2021)

Subject Code: External Examination - Max. Marks: 70
 No. of Credits: 3 Internal Examination - Max. Marks: 30

No. of Periods/ Week: 3 Total Marks: 100

OBJECTIVES: In general, the students are introduced with a knowledge on the topics: Vector Calculus, Partial differential equations, their applications and Integral Transforms (Fourier transforms, FST, FCT) so as to facilitate them to use these concepts in core subjects.

The objectives, in particular are to learn:

- the basic knowledge and applications of Vector Calculus used in Engineering problems.
- About the gradient, divergence and curl under the differentiation of scalar and vector point functions, also on Line-, Surface- and Volume integrals under the integration of point functions along with their applications in Engineering issues.
- Transformation theorems such as Green's theorem in the plane, Stoke's theorem, Gauss Divergence theorem and their applications.
- How to formulate the Partial Differential Equations from the relation between the dependent and independent variables, the methods of solving first order first degree linear, non-linear Partial Differential Equations, Homogeneous and Non homogeneous linear partial differential equations with constant coefficients.
- The procedure to find out the solutions of Partial Differential Equations by using the method of separation of variables (product method) about the formulation of one dimensional wave (string equation), one-and two-dimensional Heat flow equations, Laplace's equation in Cartesian and polar coordinates, and how to solve these equations using the method of separation of variables.
- The concept of integral transforms, namely, Fourier transforms, Fourier Sine, Cosine and related inverse transforms, and their applications in solving several Physical and Engineering problems.

Unit-I : (VECTOR CALCULUS-DIFFERENTIATION) Differentiation of vectors, curves in space, velocity and acceleration, relative velocity and relative acceleration, scalar and vector point functions, vector operator ∇

applied to scalar point functions- gradient, applied to vector point functions- divergence and curl. Physical interpretation of gradient, divergence and curl (i.e., ∇), Irrotational and Solenoidal fields, the relations obtained after ∇ applied twice to point functions, ∇ applied to products of two functions.

Unit-II : (VECTOR INTEGRATION) : Integration of vectors, line integral, circulation, work done, surface integral-flux, Green's theorem in the plane, Stoke's theorem, volume integral, Gauss Divergence theorem. (All theorems without proofs) Introduction of orthogonal curvilinear coordinates, cylindrical and spherical polar coordinates

Unit-III : (PARTIAL DIFFERENTIAL EQUATIONS) : Formation of partial differential equations, solutions of partial differential equations- equations solvable by direct integration, linear equations of first order: Lagrange's Linear equation, non-linear equations of first order, Charpit's method. Homogeneous linear equations with constant coefficients- rules for finding the complementary function, rules for finding the particular integral (working procedure), non- homogeneous linear equations.

Unit-IV : (APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS) : Method of separation of variables, One dimensional wave equation- vibrations of a stretched string, one dimensional Heat flow equation, Two dimensional heat flow in steady state - solution of Laplace's equation in Cartesian and polar coordinates (two dimensional).

Unit-V : (INTEGRAL TRANSFORMS (Fourier Transform) : Introduction, definition, Fourier integral, Sine and Cosine integrals, Complex form of Fourier integral, Fourier transform, Fourier Sine and Cosine transforms, Finite Fourier Sine and Cosine transforms, properties of Fourier transforms. Convolution theorem for Fourier transforms, Parseval's identity for Fourier transforms, Fourier transforms of the derivatives of a function, simple applications to Boundary value problems.

TEXT BOOKS:

Scope and treatment as in "Higher Engineering Mathematics", by Dr. B.S.Grewal, **43rd Edition**, Khanna Publishers.

REFERENCE BOOKS:

1. Graduate Engineering Mathematics by V B Kumar Vatti, I.K.International publications
2. Advanced Engineering Mathematics by Erwin Kreyszig.
3. A text book of Engineering Mathematics by N.P. Bali and Dr. Manish Goyal, Lakshmi Publications.
4. Mathematical Methods of Science & Engineering aided with MATLAB by Kanti B.Dutta, Cengage Learning India Pvt. Ltd.
5. Higher Engineering Mathematics by B. V. Ramana, Tata McGraw Hill Company.

6. Advanced Engineering Mathematics by H.K.Dass. S.Chand Company.

OUTCOMES: After going through this course, the students would be able to:

- operate the differential operator 'del' to the scalar and vector point functions, Calculate the Gradient, Divergence and Curl, Vector normal to a surface, maximum rate of change of a scalar field, test whether two surfaces are to cut orthogonally or not.
- find the rate per unit volume at which the physical quantity is issuing from a point, the rate of inflow minus out flow using the Divergence and the angular velocity of rotation at any point of the vector field using the Curl.
- **test** whether the given motion is irrotational or rotational, whether a vector force acting on a particle is conservative or not
- find out the potential function from a given vector field.
- obtain the well known Laplace and poisson equations from an irrotational field
- understand to determine the work done by a force field and circulation using a Line integral
- find out the Line, Surface and Volume integrals, find flux using surface integral and volumes using the volume integral.
- apply the vector integral theorems (Green's theorem in the plane, Stoke's and Divergence theorems) for evaluating the double and triple integrals as these are used to find areas and volumes.
- know the methods of solving Linear and Non linear first order and first degree partial differential equations.
- solve the Linear Partial Differential Equations with constant coefficients (homogeneous and non homogeneous) and know the procedure for finding the complementary function and particular integrals
- apply the method of separation of variables to obtain solutions to the boundary value problems involving Linear partial differential equations occurred in engineering studies
- solve wave equation, heat flow equation and the Laplace's equations in Cartesian and polar coordinates using the method of separation of variables.
- apply and extend the knowledge of Fourier transform techniques in solving several Initial and Boundary value problems of Engineering, such as in Conduction of heat / Thermodynamics, Hydraulics transverse vibrations of a string, oscillations of an elastic beam, bending of beams, electrical circuits, free and forced vibrations of a membrane and transmission lines, etc.

EC - 2102 : ANALOG ELECTRONICS CIRCUITS

Course Objectives:

- To prepare students to perform the analysis of any Analog electronics circuit.
- To empower students to understand the design and working of BJT / FET.
- To empower students to understand the design and working of amplifiers and oscillators.
- To empower students to understand the design and working of Operational Amplifier.
- To prepare the students for advanced courses in Communication system Circuit Design.

Course Outcomes:

- Acquire basic knowledge of physical and electrical conducting properties of semiconductors.
- Develop the Ability to understand the design and working of BJT / FET amplifiers and Operational Amplifier.
- Develop the Ability to understand the design and working of BJT / FET oscillators.
- Develop the Ability to understand the design and working of Communication system Circuit Design.

SYLLABUS

Small Signal High Frequency Transistor Amplifier models

BJT: Transistor at high frequencies, Hybrid- common emitter transistor model, Hybrid- conductance's, Hybrid-capacitances, validity of Hybrid-model, determination of high frequency parameters in terms of low frequency parameters, CE short circuit current gain, current gain with resistive load, cut-off frequencies, frequency response and gain bandwidth product.

FET: Analysis of common source and common drain amplifier circuits at high frequencies.

Multistage Amplifiers : BJT and FET RC Coupled Amplifiers – Frequency Response. Cascaded Amplifiers. Calculation of Band Width of Single and Multistage Amplifiers. Concept of Gain Bandwidth Product.

Feedback Amplifiers : Concept of Feedback Amplifiers – Effect of Negative feedback on the amplifier Characteristics. Four Feedback Amplifier Topologies. Method of Analysis of Voltage Series, Current Series, Voltage Shunt and Current Shunt feedback Amplifiers.

Sinusoidal Oscillators : Condition for oscillations –LC Oscillators – Hartley, Colpitts, Clapp and Tuned Collector Oscillators – Frequency and amplitude Stability of Oscillators – Crystal Oscillators – RC Oscillators – RC Phase Shift and Weinbridge Oscillators.

Power Amplifiers : Classification of Power Amplifiers – Class A, Class B and Class AB power Amplifiers. Series Fed, Single Ended Transformer Coupled and Push Pull Class A and Class B Power Amplifiers. Cross-over Distortion in Pure Class B Power Amplifier, Class AB Power Amplifier – Complementary Push Pull Amplifier, Derating Factor – Heat Sinks.

Tuned Voltage Amplifiers : Single Tuned and Stagger Tuned Amplifiers – Analysis – Double Tuned Amplifier – Bandwidth Calculation.

Text Books :

1. Integrated Electronics, Analog Digital Circuits and systems, Jacob Millman and D. Halkias, McGraw Hill, 1972
2. Electronic Devices and Circuits by Salivahanan, N.Suresh Kumar and A.Vallava Raj TMH, 2nd Edition, 1998.
3. Electronic Circuit Analysis, B.V.Rao, K.RajaRajeswari et.al, Pearson Publishers

References:

1. Electronic Devices and Circuits, G.S.N. Raju, IK International Publications, New Delhi, 2006.
2. Electronic Devices and Circuits – G.K.Mithal, Khanna Publishers, 23rd Edition, 2004.

EC- 2103 : ELECTRICAL MACHINES

Course Objectives:

- Study of DC machines.
- Study of Transformers
- To introduce the concepts of ideal synchronous machines and poly-phase induction machines.
- Applications which will be utilized in the electrical machines with its performance and theory of operation.

Course Outcomes:

- Explain the theory of ideal synchronous machines and, basic machine relation.
- Analyze and apply the concept of steady state analysis and electrical transients in single phase and poly phase machines.
- Evaluate the basic operation and performance of special machines and can select special machines for different purpose

SYLLABUS

DC MACHINES: Constructional Features, Function of Commutator, Induced EMF and Torque Expressions, Relationship Between Terminal Voltage and Induced EMF for Generator and Motoring Action, Different Types of Excitation and Performance Characteristics of Different Types of DC Machines, Starting and Speed Control of DC Motors, Losses and Efficiency, Efficiency by Direct Loading, Swinburne's Test and Hopkin's Test, Applications of DC Machines.

TRANSFORMERS : Constructional Details, EMF Equation, Equivalent Circuit, Voltage Regulation, Losses and Efficiency, Auto – Transformers, Instrument Transformers, Open/Short – Circuit Tests and Determination of Efficiency and Regulation.

THREE – PHASE INDUCTION MACHINES : Construction, Rotating Magnetic Field and 3ph Induction Motor, Power Flow Diagram, Torque and Torque-slip Characteristics, Condition for Max. Torque and its Value, Starting and Speed Control, Losses and Efficiency, Equivalent Circuit and Circle Diagram of Induction Motor, No – Load and Rotor – Blocked Tests and Efficiency and Torque – Speed Characteristics.

THREE – PHASE SYNCHRONOUS MACHINES : Generation of EMF, Constructional Details, Induced EMF, Synchronous Generator on No –Load and Load, Synchronous Impedance and Voltage Regulation. V – Curves and Inverted V – Curves, Synchronous Condenser, Starting of Synchronous Motors, Applications of Synchronous Machines.

SINGLE – PHASE MOTORS : Double Revolving Field Theory, Methods of Starting Single Phase Induction Motors, Universal Motor, Stepper Motor.

Text Books:

1. Electrical Machines, S. K. Bhattacharya, TMH Publications N. Delhi.
2. A First Course In Electrical Engineering, S. M. Tiwari, A. S. Binsaroor, Wheeler Publication.

EC-2104 : Signals & Systems

Course Objectives:

- To explain signals and systems representations/classifications and also describe the time and frequency domain analysis of continuous time signals with Fourier series.
- Fourier transforms and Laplace transforms.
- To understand Sampling theorem, with time and frequency domain analysis of discrete time signals with DTFS, DTFT and Z-Transform.

· To present the concepts of convolution and correlation integrals and also understand the properties in the context of signals/systems and lay down the foundation for advanced courses.

Course Outcomes:

- Analyze the discrete time signals and system using different transform domain techniques.
- Design and implement LTI filters for filtering different real world signals.
- Develop different signal processing applications using DSP processor.

SYLLABUS

Introduction to signals and linear time Invariant systems : Continuous – Time and Discrete –Time signals, Signal Energy and Power, Periodic Signals, Even and odd Signals, continuous- Time complex Exponential and Sinusoidal Signals, Discrete –Time complex Exponential and Sinusoidal Signals, Periodicity Properties of Discrete –Time Complex Exponentials, The Unit Impulse and Unit step Functions, The Discrete- Time Unit Step and Unit Impulse Functions, The Continuous-Time Unit impulse and Unit step Sequence, Continuous –Time and Discrete –Time Systems, Interconnections of Systems, Basic System Properties, Discrete –Time LTI Systems: The Convolution Sum, The Representation of Continuous –Time Signals in terms of Impulses, The Commutative property, Casual LTI Systems Described by Differential and Difference Equations, Singularity Functions.

Fourier Series Representation of Periodic Signals : Introduction, Fourier Series Representation of continuous time Periodic Signals, convergence of the Fourier Series, Properties of continuous time Fourier Series, Fourier Series representation of discrete time periodic signals, Properties of discrete time Fourier Series.

Continuous and Discrete time Fourier Transform : Introduction, Representation of Aperiodic signals, The continuous time Fourier Transform, The Fourier Transform for periodic signals, Properties of the continuous time Fourier Transform, The convolution Property, Multiplication property, Systems characterized by linear constant-coefficient differential equations. Discrete time Fourier Transform, Representation of Aperiodic signals discrete time Fourier Transform, Fourier Transform for periodic signals, Properties of the Discrete time Fourier Transform, The convolution property, The multiplication property, Duality, Systems characterized by linear constant co-efficient differential equations.

Convolution and correlation of signals : System analysis by Convolution, Convolution as a superposition of impulse response, some Convolution relationships, Graphical interpretation of Convolution, Convolution of a function with a unit impulse, Signal comparison, Correlation

and Convolution, Some properties of correlation functions, Correlation functions for nonfinite energy signals, Detection of periodic signals in the presence of Noise by correlation, Determination of the waveform of a periodic signal masked by Noise, Extraction of a signal from Noise by filtering.

Laplace Transform : Introduction, The Laplace Transform, the region of convergence for Laplace Transforms, The Inverse Laplace Transform, Geometrical evaluation of the Fourier transform from the Pole-Zero plot, Properties of Laplace Transforms, The initial and Final value theorems, Analysis and characterization of LTI systems using the Laplace Transforms.

Sampling Theorem and Z-transform : Introduction, reconstruction of a signal from its samples using interpolation, The effect of Undersampling: aliasing, Discrete time processing of continuous time signals, sampling of Discrete time signals. The ZTransform, The Inverse Z-Transform, Geometrical evaluation of the Z-Transform from the Pole-Zero plot, Properties of Z-Transform, The initial theorems, some common Z-transform pairs, Analysis and characterization of LTI systems using the Z-Transforms, System function algebra and block diagram representation, The unilateral Z-Transform.

Textbooks:

1. Signals and Systems, Alan V. Oppenheim, Alan S. Willsky and Ian T. Young, PHI, 2ndEdn.
2. Signals Systems and Communication, B. P. Lathi, BS Publication
3. Signals and Systems, K. Raja Rajeswari and B. V. Rao, Prentice Hall of India.

References:

1. Signals and Systems- Simon Haykin and Van Veen, Wiley 2ndEdn.
2. Signals and Systems – P.RameshBabu and R.AnandaNatarajan 3rdEdn.

EC-2105 : Managerial Economics

Course Objectives:

- To integrate the concept of price and output decisions of firms under various market structure.
- The objective of this course is to impart the knowledge of economics as a subject and its importance while business.
- The business decisions are made scientifically on the basis of all available information.
- To familiarize the students with the basic concept of microeconomics.
- To understand the demand and supply analysis in business applications

- To familiarize with the production and cost structure under different stages of production.

- To understand the pricing and output decisions under various market structure.

- To understand and apply the various decision tools to understand the market structure.

Course Outcomes:

- To understand the concepts of cost, nature of production and its relationship to Business operations.

- To apply marginal analysis to the “firm” under different market conditions.

- To analyze the causes and consequences of different market conditions.

- To integrate the concept of price and output decisions of firms under various market structure.

SYLLABUS

Significance of Economics and Managerial Economics: Economics: Definitions of Economics- Wealth, Welfare and Scarcity definition Classification of Economics- Micro and Macro Economics.

Managerial Economics: Definition, Nature and Scope of Managerial Economics, Differences between Economics and Managerial Economics, Main areas of Managerial Economics, Managerial Economics with other disciplines.

Demand Analysis : Demand - Definition, Meaning, Nature and types of demand, Demand function, Law of demand - Assumptions and limitations. Exceptional demand curve. (Two periods)

Elasticity of demand - Definition, Measurement of elasticity, Types of Elasticity (Price, Income, Cross and Advertisement), Practical importance of Price elasticity of demand, Role of income elasticity in business decisions, Factors governing Price Elasticity of demand.

Demand Forecasting - Need for Demand forecasting, Factors governing demand forecasting, Methods of demand forecasting: Survey methods- Experts' opinion survey method and consumers Survey methods.

Utility Analysis: Utility- Meaning, Types of Economic Utilities, Cardinal and Ordinal Utility, Total Utility, Marginal Utility, The law of Diminishing Marginal Utility and its Limitations.

Theory of Production and Cost analysis: Production - Meaning, Production function and its assumptions, use of production function in decision making; Law of Variable Proportions: three stages of the law.

Cost analysis - Nature of cost, Classification of costs - Fixed vs. Variable costs, Marginal cost, Controllable vs. Non - Controllable costs,

Opportunity cost, Incremental vs. Sunk costs, Explicit vs. Implicit costs, Replacement costs, Historical costs, Urgent vs. Postponable costs, Escapable vs. unavoidable costs, Economies and Diseconomies of scale.

Market Structures : Definition of Market, Classification of markets; Salient features or conditions of different markets - Perfect Competition, Monopoly, Duopoly, Oligopoly, Importance of kinked demand curve; Monopolistic Competition.

Pricing Analysis : Pricing - Significance: Different Pricing methods- Cost plus pricing, Target pricing, Marginal cost pricing, Going -rate pricing, Average cost pricing, Peak load pricing, Pricing of joint Products, Pricing over the life cycle of a Product, Skimming pricing Penetration pricing, Mark-up and Mark- down pricing of retailers.

Business cycles, Inflation and Deflation: Business cycles - Definition, Characteristics, Phases, Causes and Consequences; Measures to solve problems arising from Business cycles.

Inflation -Meaning, Types, Demand- pull and Cost push inflation, Effects of Inflation, Anti- inflationary measures.

Deflation- Meaning, Effects of Deflation, Control of Deflation, Choice between Inflation and Deflation.

Text Books:

1. Sankaran,S., Managerial Economics, Marghan Publications, 2015, Chennai.

2. Aryasri, A.R., Managerial Economics and Financial Analysis, MC Graw Hill Education, New Delhi,2015.

Reference Books:

1. Dwivedi, D.N., Managerial Economics, Vikhas Publishing House Pvt. Ltd. 6th Edition, New Delhi,2004.

2. Dewett, K.K., Modern Economic Theory, S.Chand & Company Ltd., New Delhi, 2005.

EC-2106 : Networks and Machine Lab

Course Objectives:

- To verify Superposition Theorem
- To verify Reciprocity Theorem
- To verify Thevenin's Theorem
- To verify Ohm's law
- To verify Kirchhoff's law
- To verify no load and blocked rotor tests on 3-phase squirrel cage Induction motor

· To verify Open circuit test and short circuit test on 1-phase transformer

Course Outcomes:

· Understand the concepts of various theorems and open circuit and no load tests practically.

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LIST OF EXPERIMENTS

I. NETWORK LAB EXPERIMENTS

1. Verification of Superposition Theorem
2. Verification of Reciprocity Theorem
3. Verification of Thevenin's Theorem
4. Calibration of UPF Wattmeter
5. Verification of Ohm's law
6. Verification of Kirchhoff's law

II. ELECTRICAL MACHINES LAB EXPERIMENTS

7. No load and blocked rotor tests on 3-phase squirrel cage Induction motor
8. Regulation of alternator by synchronous Impedance method
9. Open circuit test and short circuit test on 1-phase transformer
10. Swin burner's test
11. No load and load characteristics of self-excited Shunt generator

EC-2107 : Analog Electronics and Circuits Lab with Simulation

Course Objectives:

- To study various feedback Amplifiers, oscillators practically
- To study various feedback Amplifiers, oscillators through software simulations.

Course Outcomes:

- To understand the concepts of various feedback Amplifier, oscillators practically
- To understand the concepts of various feedback Amplifier, oscillators through software simulations.

SYLLABUS

LIST OF EXPERIMENTS

1. Current series feedback Amplifier
2. Colpitts oscillator
3. RC-Phase shift oscillator

4. Two stage RC-Coupled Amplifier
5. Wein bridge oscillator
6. Hartley Oscillator
7. Class-B Push pull Amplifier
8. Voltage series feedback Amplifier
9. Common source FET Amplifier
10. Tuned Voltage Amplifier
11. Applications of Operational Amplifier
12. Frequency response of Op-amp

(Software Simulation)

13. Common emitter and common source Amplifier
14. Two stage RC coupled Amplifier
15. RC Phase shift oscillator using transistors
16. Class-A Power Amplifier (transformer less)
17. Class-B complementary symmetry Amplifier
18. High frequency common base (BJT) and common gate (JFET)

Amplifier

EC-2108 : Digital ICs and HDL Lab

Course Objectives:

- To study logic gates, realization of Gates by using universal building blocks practically.
- To study flip-flops, registers and counters practically.
- To study logic gates, realization of Gates by using universal building blocks through software simulations.

Course Outcomes:

- To understand the concepts of logic gates, realization of Gates by using universal building blocks practically.
- To understand the concepts of flip-flops, registers and counters practically.
- To understand the concepts of logic gates, realization of Gates by using universal building blocks through software simulations.

syllabus

LIST OF EXPERIMENTS

HARDWARE EXPERIMENTS

1. Logic Gates
2. Realization of Gates by using universal building blocks

3. Realization of SOP and POS
4. Verification of Demorgan's Laws
5. Half Adder & Full adder
6. Function generation by using Decoders & Multiplexers.
7. Realization of Flip - flops
8. 4-bit Ripple counter
9. Mod-8 Synchronous counter.
10. 4 - bit Shift-register
11. Seven segment display

SIMULATION EXPERIMENTS

1. Simulation of Logic gates
2. Simulation of Full adder
3. Simulation of Multiplexer & De-Multiplexer
4. Simulation of Decoder & Encoder
5. Simulation of Flip flops (SR & D)
6. Simulation of Up-down counter& Shift register

EC-2109 : SKILL ORIENTED COURSE MATLAB PROGRAMMING

Course Objectives:

1. To Impart the Knowledge to the students with MATLAB software. [This enhances programming knowledge in Research and Development].
2. To provide a working introduction to the Matlab technical computing environment. [Themes of data analysis, visualization, and programming].
3. To introduce students the use of a high-level programming language, Matlab. [scientific problem solving with applications and examples from Engineering].

Course outcomes:

- By the end of this course, the student will be able to
1. Understand the basics of Matlab
 2. Break a complex task up into smaller, simpler tasks
 3. Tabulate results and Analyse.

Chapter 1 : Introduction to MATLAB : The MATLAB desktop, the command window, the command history window, the MATLAB workspace, getting help, special symbols

Chapter 2 : MATLAB Basics : Matrices and Vectors: Input, Indexing (or subscripting), Matrix manipulation, Creating vectors. Matrix and Array Operations: Arithmetic operations, Relational operations, Logical operations,

Elementary math functions, Matrix functions, A Special Note on Array Operations.

Chapter 3 : Introduction to plotting Using simple x, y plots, printing a plot, exporting a plot as a graphical image, multiple plots, line color, line style, marker style, grid and legend.

Chapter 4 : Script files and functions. Command- Line Functions: Inline functions, Anonymous functions, Finding the determinant of a matrix, finding eigenvalues and eigenvectors, solving a linear system, roots of a polynomial, matrix factorizations, Generation of Various Signals and Sequences (Periodic and Aperiodic), such as Unit impulse, unit step, square, saw tooth, triangular, sinusoidal, ramp, sinc, exponential. generation of random numbers.

Text Books.

1. A Guide to MATLAB for beginners and Experienced users by Brian R.Hunt, Ronald R Lipsman.

2. Getting Started with MATLAB: A Quick Introduction for Scientists & Engineers by Rudra pratap.

Exercise :

1. Suppose that $x=3$ and $y=4$ Use MATLAB to evaluate the following expression:

2. Answer the following questions for the array shown here.

(a) What is the size of array1?

(b) What is the value of array1(1,4)?

(c) What is the size and value of array1(:,1:2:5)?

(d) What is the size and value of array1([1 3], end)?

3. Assume that array array1 is defined as shown, and determine the contents of the following subarrays

(a) array1(3, :) (b) array1(:,3) (c) array1(1:2:3,[3 3 4]) (d)

array1([1 1],:)

4. The voltage across a resistor is related to the current flowing through it by Ohm's law $V=IR$ and the power consumed in the resistor is given by the equation $P=I^2R$. Write a program that creates a plot of the power consumed by a 1000 Ω resistor as the voltage across it is varied from 1 V to 200 V. Create two plots, one showing power in watts, and one showing power in dBW (dB power levels with respect to a 1 W reference).

5. The equation of a straight line is $y = mx + c$, where m and c are constants. Compute the y-coordinates of a line with slope $m = 0.5$ and the intercept $c = -2$ at the following x-coordinates: $x = 0, 1.5, 3, 4, 5, 7, 9$, and 10.

6. Create a vector t with 10 elements: 1, 2, 3, ..., 10.

Now compute the following quantities:

7. Plot $y=\sin x$, $0 \leq x \leq 2\pi$, taking 100 linearly spaced points in the given interval. Label the axes and put "plot created by your name" in the title

8. Assume that the complex function $f(t)$ is defined by the equation

Plot the amplitude and phase of function f for $0 \leq t \leq 4$

9. Write an M-file to evaluate the equation for all values of x between -1 and 3, in steps of 0.1. Do this twice, once with a for loop and one with vectors. Plot the resulting function using a 3-point thick dashed red line.

10. Create a mesh, surface plot and contour plot of the function for the interval $-1 \leq x \leq 1$ and $-2 \leq y \leq 2$. In each case, plot the real part of z versus x and y .

11. Create an upper triangular matrix with the following

$A = \text{diag}(1:6) + \text{diag}(7:11,1) + \text{diag}(12:15,2)$.

Now use the upper off-diagonal terms of A to make A a symmetric matrix with the following command: $A = A + \text{triu}(A,1)'$.

12. Create a 10 by 10 random matrix with the command $A = \text{rand}(10)$. Do the following operations.

EC-2110 : MANDATORY COURSE

Professional Ethics and Universal Human Values

(Effective from 2020-2021 Admitted Batches) (Common for all Branches)

Course Objectives:

The objective of the course is Six fold:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- This course will illuminate the students in the concepts of laws and its applicability to engineers
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection, Development of commitment and courage to act and also enable the students to imbibe and internalize the Values and Ethical Behaviour in the personal and professional lives
- To enable the students to imbibe the Values and Ethical Behavior in the personal and Professional lives
- The students will learn the rights and responsibilities Individual, employee, team member and a global citizen

Course Outcomes:

By the end of the course Student will be able to:

- Grasp the meaning of the concept – Law and also Get an overview of the laws relating to Engineers and also Apprehend the importance of being a law abiding person and They would have better critical ability

- Self-explore by using different techniques to live in harmony at various levels

- Analyze themselves and understand their position with respect to the moral and ethical character needed for a successful and satisfactory work life

- Students are expected to become more aware of themselves and their surroundings (family, society, nature)

- They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.

- They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society)

SYLLABUS

Need, Basic Guidelines, Content and Process for Value Education, Self-Exploration—what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation - as the process for self-exploration, Continuous Happiness and Prosperity - A look at basic Human Aspirations, Right understanding, Relationship and Physical Facility - the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels. Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking, Include practice sessions and case studies.

Understanding Harmony in the Human Being - Harmony in Myself!

- Understanding human being as: a co-existence of the sentient 'I' and the material 'Body', the needs of Self ('I') and 'Body' - happiness and physical facility, the Body as an instrument of 'I' (I being the doer, seer and enjoyer), the characteristics and activities of 'I' and harmony in 'I', the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail, P to ensure Sanyam and Health, Include practice sessions and case studies.

Understanding Harmony in the Family and Society - Harmony in Human – Human Relationship

- Understanding values in human-human relationship: meaning of Justice (nine universal

values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship, the meaning of Trust; Difference between intention and competence, the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship, the harmony in the society (society being an extension of family), Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society, Universal Order from family to world family, Include practice sessions and case studies.

Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

- Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature recyclability and self-regulation in nature, Understanding Existence as Co-existence of mutually interacting units in all – pervasive space, Holistic perception of harmony at all levels of existence, Include practice sessions and case studies.

Concept of Law and Law of Torts

- Understanding Essentials of a Valid Contract and the basics of contract law protecting rights and obligations, Introduction to the Law of Torts and the basics to protect oneself and the company Law affecting the Workplace Employers Responsibilities/Duties Hiring Practices, Introduction to Intellectual Property Law, Professional Code of Conduct for Engineers, Relationship between Law and Ethics, Include practice sessions and case studies.

Implications of the above Holistic Understanding of Harmony on Professional Ethics

- Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems, Case studies of typical holistic technologies, management models and production

systems, Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations, Include practice sessions and case studies.

Text Books

1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. R R Gaur, R Asthana, G P Bagaria, "Teachers' Manual for A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2
3. R. Subramanian, "Professional Ethics", Oxford University Press.
4. S.B. Srivastha, "Professional Ethics & Human Values", SciTech Publications (India) Pvt. Ltd. New Delhi.
5. D.R. Kiran, "Professional Ethics & Human Values", TATA Mc Graw Hill Education.
6. Saroj Kumar, "Business Law" and Avtar Singh, "Law of Contract"

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantik, 1999.
2. A. N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book), Mohandas Karamchand Gandhi "The Story of My Experiments with Truth", E. F. Schumacher. "Small is Beautiful", Slow is Beautiful – Cecile Andrews, J C Kumarappa "Economy of Permanence", Pandit Sunderlal "Bharat Mein Angreji Raj" and Dharampal, "Rediscovering India"
4. G K Kapoor, "Business Law" and Sen & Mitra, "Business & Commercial Laws" and Calvin Frank Allen, "Business law for Engineers"
5. Hilgard, E. R.; Atkinson, R. C. & Atkinson, R.L. (1975). *Introduction to Psychology*. 6th Edition. New Delhi: Oxford and IBH Publishing Co. Pvt. Ltd.
6. Govindarajan, M; Natarajan, G. M. & Senthilkumar, V.S. (2013). *Professional Ethics & Human Values*. Prentice Hall: New Delhi
7. Gogate, S. B. (2011). Human Values & Professional Ethics. Vikas Publishing: New Delhi.

8. Charles E Harris Jr., Michael S Pritchard, Michael J Rabins, "Engineering Ethics, Concepts Cases: 4e, Cengage learning, 2015.

9. Caroline Whitbec, " Ethics in Engineering Practice & Research: 2e, Cambridge University Press 2015.

EC-2201 : MATHEMATICS-IV

II/IV B.Tech. (Four Year Degree Course) & II/VI B.Tech. (Six Year Double Degree Course) Semester-II Mathematics – IV

(With effect from the admitted batch of 2020-2021)

Subject Code:	External Examination - Max. Marks: 70
No. of Credits: 3	Internal Examination - Max. Marks: 30
No. of Periods/ Week: 3	Total Marks: 100

Objectives: The student should be able to use the concepts of difference equations, -transforms, Numerical differentiation and Sampling theory. The student should know the applications of the difference equations in the deflection of a loaded string. The student should be able to estimate unknown parameters of population and apply the tests of hypothesis. They should be able to evaluate -transform, inverse -transforms and apply these transforms to solve difference equations. The student should be able to know the techniques in the evaluation of numerical solution of ordinary differential equations.

UNIT-I : (Functions of Complex Variables) : Introduction-Limit and continuity of $f(z)$ - Derivative of $f(z)$, Cauchy-Reimann Equations, Analytic Functions, Harmonic functions, Orthogonal systems, Applications to flow problems, Geometrical representation of $f(z)$. Integration of complex functions, Cauchy's theorem, Cauchy's integral formula and their applications.

Unit-II : (Conformal Mappings and Contour Integration) : Introduction to Conformal transformation, Bilinear transformation, Series of complex terms -Taylor's and Laurent's series (without proofs), Zero's and Singularities of analytic functions. Residues and Calculations of residues, Cauchy's Residue Theorem, Evaluation of real definite integrals: Integration around unit circle, semi circle.

UNIT-III : (Difference Equations & Z-transforms) : Introduction - Formation of difference equations - Linear difference equations - Rules for finding complementary function - Rules for finding particular integral - simultaneous difference equations with constant coefficients - Applications to deflection of a loaded string.

Introduction to Z-Transforms - Some standard Z-transforms - Linear Property - Damping Rule - Shifting U_n to the right and to the left-multiplication by -Two basic theorems - Some useful Z-transforms - Inverse Z-transformation - Convolution theorem - Convergence of Z-transform - Two

sided Z-transform - Evaluation of inverse Z-transform - Application to Difference equations.

UNIT-IV : (Correlation, Regression and Distributions) : Introduction - correlation - coefficient of correlation - Lines of regression. Introduction to Discrete and Continuous Random Variables - Distributions: binomial distribution, Poisson distribution, exponential distribution, normal distribution.

UNIT-V : (Sampling Theory) : Introduction - Testing of hypothesis - Level of significance - Confidence limits - Test of significance of large samples - comparison of large samples- Test of significance for means of two large samples.

Student t-distribution - Significance test of sample mean - Significance test of difference between sample means - Chi-square test - Goodness of fit - F-distribution.

TEXT BOOK:

Scope and treatment as in "Higher Engineering Mathematics", by Dr.B.S.Grewal, 43rd Edition, Khanna Publications.

REFERENCE BOOKS:

1. Graduate Engineering Mathematics by V B Kumar Vatti, I.K.International publications
2. Advanced Engineering Mathematics by Erwin Kreyszig.
3. A text book of Engineering Mathematics by N.P. Bali and Dr.Manish Goyal; Lakshmi publications.
4. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.
5. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.
6. Engineering Mathematics series by Chandrica Prasad.

EC-2202 : Electromagnetic Field Theory and Transmission Lines

Course Objectives:

- Define the Basic Electrostatic and Magneto static Law Derive the Maxwell's Equation and apply to the basic electromagnetic problem.
- Analyze the boundary conditions, at the interface of two different media and also time varying electric and magnetic fields.
- Explain the wave propagation in different types of mediums and also transmission line fundamentals.
- Demonstrate the smith chart-configuration

Course Outcomes:

- To evaluate the design and problem solving skills
- Able to define electrostatic and magneto static laws

- Able to derive the Maxwell's equations in static and dynamic fields
- Able to describe energy density on electric/magnetic fields' and poynting theorem.
- Able to analyze the EM wave propagation in different mediums
- Able to relate the wave propagation through transmission lines and compute the impedance using smith chart for matching the load impedance.

SYLLABUS

Electrostatics : Coulomb's Law, Electric Field Intensity – Fields due to Different Charge Distributions, Electric Flux Density, Gauss Law and Applications, Electric Potential, Maxwell's Two Equations for Electrostatic Fields, Energy density, Convection and Conduction Currents, Continuity Equation, Relaxation Time, Poisson's and Laplace's Equations; Capacitance.

Magneto statics : Biot-Savart Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Maxwell's Two Equations for Magneto static Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Inductances and Magnetic Energy.

Maxwell's Equations : Faraday's Law and Transformer emf, Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's Equations in Different Final Forms and Word Statements. Conditions at a Boundary Surface: Dielectric-Dielectric and Dielectric-Conductor Interfaces. Related Problems.

Electromagnetic Waves : Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves, Wave Propagation in Lossless and Conducting Media, Conductors & Dielectrics – Characterization, Polarization, Reflection and Refraction of Plane Waves – Normal and Oblique Incidences for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection, Surface Impedance. Poynting Vector and Poynting Theorem

Transmission Lines : Introduction to Transmission line equations, Primary & Secondary constants Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Losslessness /Low Loss Characterization, Distortion , Loading, SC and OC Lines, Reflection Coefficient, VSWR, $\Gamma/8$, $\Gamma/4$, $\Gamma/2$ line impedance Transformations, Smith Chart – Configuration and Applications.

Waveguides : Introduction, Rectangular Waveguides, electric and magnetic field patterns in TE₁₀ and TE₁₁ mode configuration, modes of TE wave in rectangular waveguide, field equations, impossibility of TEM wave propagation in waveguides, cutoff frequency of rectangular waveguide, propagation constant, wave impedance, phase velocity, group velocity, dominant mode and degenerate modes, related problems.

Textbooks

1. Electromagnetic Field Theory and Transmission Lines, Gottapu Sasibhushana Rao, Wiley India Pvt. Ltd., New Delhi, 1st Ed., 2012.
2. Electromagnetics with Applications, Kraus and Fleisch, McGraw Hill, 1999.
3. Electromagnetic Field Theory and Transmission Lines, G.S.N. Raju, Pearson Education (Pvt., Ltd., New Delhi, 2005.

References:

1. Elements of Electromagnetic – Matthew N.O. Sadiku, Oxford Univ. Press, 3rd ed., 2001.
2. Engineering Electromagnetics, W. H. Hayt Jr., McGraw Hill – New York.
3. EM Waves and Radiating Systems, E. C. Jordan, PHI, 1997.

EC-2203 : Microprocessors and Microcontrollers

Course Objectives:

- To introduce the architecture and operation of typical microprocessors and microcontrollers.
- To familiarize with the programming and interfacing of microprocessors and microcontrollers.
- To provide strong foundation for designing real world applications using microprocessors and microcontrollers.

Course Outcomes:

- Assess and solve basic binary math operations using the microprocessor and explain the microprocessor's and Microcontroller's internal architecture and its operation within the area of manufacturing and performance.
- Apply knowledge and demonstrate programming proficiency using various addressing modes and data transfer instructions of the target microprocessor and microcontroller.
- Design electrical circuitry to the Microprocessor I/O ports in order to interface the processor to external devices.
- Evaluate assembly language programs and download the machine code that will provide solutions real world control problems.

SYLLABUS

8086/8088 MICROPROCESSORS : Register organization of 8086, Architecture, signal description of 8086, physical memory organization, general bus operation, I/O addressing capability, special purpose activities, Minimum mode, maximum mode of 8086 system and timings, the processor

8088, machine language instruction formats, addressing mode of 8086, instruction set of 8086, assembler directives and operators.

PROGRAMMING WITH 8086 MICROPROCESSOR : Machine level programs, programming with an assembler, Assembly language programs, introduction to stack, stack structure of 8086/8088, interrupts and interrupt service routines, interrupt cycle of 8086, non-maskable interrupt and maskable interrupts, interrupt programming.

BASIC AND SPECIAL PURPOSE PROGRAMMABLE PERIPHERALS AND THEIR INTERFACING WITH 8086/88 : Semiconductor memory interfacing, dynamic RAM interfacing, interfacing I/O ports, PIO 8255 modes of operation of 8255, interfacing to D/A and A/D converters, stepper motor interfacing, control of high power devices using 8255. Programmable interrupt controller 8259A, the keyboard/display controller 8279, programmable communication interface 8251 USART, DMA Controller 8257.

ADVANCED MICRO PROCESSORS : Salient features of 80386DX, architecture and signal description of 80386, register organization of 80386 and addressing modes, data types of 80386, real address mode of 80386, protected mode of 80386, segmentation and Paging, virtual 8086 mode and enhanced mode. Instruction set of 80386. The coprocessor 80387.

8051 MICROCONTROLLER : Introduction to microcontrollers, 8051 Microcontrollers, 8051 pin description, connections, I/O ports and memory organization, MCS51 addressing modes and instructions, assembly language programming tools.

PIC MICROCONTROLLERS AND ARM 32-BIT MICROCONTROLLER : Overview and features, PIC16Cx7X instructions, interrupts in PIC 16C61/71, PIC 16F8XX Flash controllers, I/O ports and timers. Introduction to 16/32 Bit processors, ARM architecture and organization, ARM / Thumb programming model, ARM / Thumb instruction set.

TEXT BOOKS:

1. A.K.Ray, K.M.Bhurchandi, "Advanced Microprocessors and Peripherals", Tata McGraw Hill Publications, 2000.
2. N.Sentil Kumar, M.Saravanan, S.Jeevananthan, "Microprocessors and Microcontrollers", Oxford University Press, 2010.

REFERENCES:

1. Ajay V Deshmukh, "Microcontrollers", TATA McGraw Hill publications, 2012.
2. Krishna Kant, "Microprocessors and Microcontrollers", PHI Publications, 2010.

EC- 2204 : Probability theory and Random Process

Course Objectives:

- Understand concepts of probability, conditional probability and independence.
- Understand random variables and probability distributions.
- Be familiar with some of the commonly encountered random variables, in particular the Gaussian random variable.
- Be able to obtain the distributions of functions of random variables.
- Be able to relate probability theory to real statistical analysis.
- Understand moment generating and characteristic functions.

Course Outcomes:

- To the axiomatic formulation of modern Probability Theory and think of random variables as an intrinsic need for the analysis of random phenomena.
- To obtain the concept of random processes and determine covariance and spectral density of stationary random processes.

SYLLABUS

Probability Theory : Sample spaces, Events, Probability definition and Axioms, Mathematical model of experiments, Probability as relative frequency, Joint and conditional probability, Properties of joint probability and conditional probability, Total probability, Bayes' theorem, Independent events: Two events and multiple events, properties of independent events.

Random Variables and Operations on one random variable : Random variable concept, Distribution function, Density function, Gaussian random variable, Conditional distribution and density function, Expectation, Moments, Functions that give moment, Transformations of a random variable.

Multiple random variables : Vector random variables, Joint distribution and its properties, Joint density and its properties, Conditional distribution and density, statistical independence, Distribution and density of a sum of random variables, Central limit theorem.

Operations on multiple random variables : Expected values of a function of random variables: Joint moments about the Origin, joint central moments, Joint characteristic functions, Jointly Gaussian random variables: Two random variables, n-random variables, properties of Gaussian random variables, Transformations of multiple random variables: One function, Multiple functions, Inequalities of Chebyshev and Schwartz.

Random Processes : The Random Process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, concept of Stationarity and Statistical Independence, First-Order Stationary Processes, Second- Order and Wide-Sense Stationarity, (N-Order) and Strict-Sense Stationarity, Time Averages and Ergodicity, Mean-Ergodic Processes, Autocorrelation Function and Its

Properties, Cross-Correlation Function and Its Properties, Covariance Function and their properties, Weiner-Kinchine Theorem, Gaussian Random Processes, Poisson Random Process.

Linear Systems with Random Inputs : System Response – Convolution, Mean and Mean-squared Value of System Response, autocorrelation Function of Response, Cross-Correlation Functions of Input and Output, Power Density Spectrum of Response, Cross-Power Density Spectrums of Input and Output, Band pass, Band-Limited and Narrowband Processes.

Textbook:

1. Probability Theory and Random Signal Principles, Peyton Z. Peebles, Jr, 4th edition Tata McGraw Hill Publishers, 2002.
2. Probability Theory and Random Processes, S. P. Eugene Xavier, S. Chand and Co. New Delhi, 1998 (2nd Edition).

References:

1. Fundamentals of Applied Probability and Random processes, Oliver C. Ibe, Elsevier Publications, 2007.
2. Probability, Random Variables and Stochastic Processes – Athanasios Papoulis and S. Unnikrishna Pillai, PHI, 4th Edition, 2002.
3. Probability theory and Stochastic Processes, B. Prabhakara Rao, T.S.R. Murthy, BS Publications, Hyderabad, 2012.

EC 2205 : Analog Communication

Course Objectives:

- To introduce the concepts of analog communication systems.
- To equip students with various issues related to analog communication such as modulation, demodulation, transmitters and receivers and noise performance.

Course Outcomes:

- Gain the knowledge of components of analogue communication system.
- To analyze various methods of baseband/band pass Analog transmission and detection.
- Analyze and allocate performance objectives to components of an analog communication system and to design analogue communication systems.
- To evaluate the performance of analog communications in the presence of noise

SYLLABUS

Linear Modulation Systems: Need for Modulation, Frequency Translation, Method of Frequency Translation, Amplitude Modulation,

Modulation Index, Spectrum of AM Signal, Modulators and Demodulators (Diode detector), DSB-SC Signal and its Spectrum, Balanced Modulator, Synchronous Detectors, SSB Signal, SSB Generation Methods, Power Calculations in AM Systems, Application of AM Systems.

Angle Modulation Systems: Angle Modulation, Phase and Frequency Modulation and their Relationship, Phase and Frequency Deviation, Spectrum of an FM Signal, Bandwidth of Sinusoidally Modulated FM Signal, Effect of the Modulation Index on Bandwidth, Spectrum of Constant Bandwidth FM, Phasor Diagram for FM Signals, FM Generation: Parameter variation method, Indirect method of Frequency Modulation (Armstrong Method), Frequency Multiplication, PLL FM Demodulator, Pre – emphasis and De –emphasis, Comparison of FM and AM.

Noise in AM and FM Systems: Sources of Noise, Resistor Noise, Shot Noise, Calculation of Noise in a Linear System, Frequency Domain representation of Noise, The effect of Filtering on the Probability density of Gaussian Noise, Effect of filter on the power spectral Density of Noise, Narrow Bandwidth, Quadrature components of Noise, Power spectral density of Noise, Probability Density of Noise and their time derivatives, representation of Noise using Orthonormal coordinates, Noise in AM Systems, Noise in Angle Modulation Systems, Comparison between AM and FM with respect to Noise, Threshold Improvement in Discriminators, Comparisons between AM and FM.

Radio Transmitters: Classification of Radio Transmitters, Principle of a Radio Transmitters, AM and FM Transmitters, Radio Telegraph and Radio Telephone Transmitters, SSB Transmitters.

Radio Receivers: Radio receiver Types, AM Receivers – RF Section, Frequency Changing and Tracking, Intermediate Frequency and IF Amplifiers, Automatic Gain Control (AGC); FM Receivers – Amplitude Limiting, FM Demodulators, Ratio Detectors, ISB Receiver, Comparison with AM Receivers, Extensions of the Super-heterodyne Principles, Additional Circuits.

Pulse Analog Modulation methods: Pulse Modulation techniques, Sampling, Types of Sampling and its analysis, Time division Multiplexing, Pulse Amplitude Modulation, Pulse Width Modulation, Pulse position modulation, Pulse Code Modulation.

Text Books:

Principles of Communication Systems, H. Taub , D. L. Schilling and GouthamSahe, TMH 3rd edition, 2007.

2. Principle of Communication Systems, Simon Haykins (2nd Edition).

3. Electronic Communication Systems, G. Kennedy, McGraw Hill, 1977 (2nd Edition).

References:

1. Modern Digital and Analog Communication Systems, B. P. Lathi (2nd Edition).

2. Communication systems, R.P.Singh and S.D.Sapre 2nd edition TMH 2008

3. Electronic Communications Modulation and Transmission, Robert J. Schoenbeck, PHI N. Delhi, 1999.

EC- 2206 : Microprocessors and Microcontrollers Lab

Course Objectives:

- To study programming of 8086 ESA-86/88 kit for various operations like addition subtraction, multiplication etc
- To study 8086 programming using MASM 32 assembler.
- To study 8051 programming using KEIL software simulator

Course Outcomes:

- To understand the concepts of programming of 8086 ESA-86/88 kit for various operations like addition subtraction, multiplication etc
- To understand the concepts of programming of 8086 using MASM 32 assembler
- To understand the concepts of programming of 8051 using KEIL software simulator

SYLLABUS

LIST OF PROGRAMS 8086 ESA-86/88 KIT PROGRAMMING

1. Write a Program to add two 16 bit numbers stored in two memory locations 2000h and 2002h and store the result in another memory location 2004h.

2. Write a Program to divide two 16 bit numbers stored in two memory locations 2000h and 2002h and store the result in another memory location 2004h.

3. Write a Program to multiply two 16 bit numbers stored in two memory locations 2000h and 2002h and store the result in another memory location 2004h.

4. Write a Program to add two 32 bit numbers stored in two memory locations 2000h and 2004h and store the result in another memory location 2008h.

5. Write a program to find factorial of a given number.

8086 PROGRAMMING USING MASM32 ASSEMBLER :

6. Write a program to perform addition operation on two multi byte numbers.

7. Write a program to perform subtraction operation on two multi byte numbers.

8. Write a program to sort a given set of hexadecimal numbers.

9. Write a program to find whether the given string is a palindrome or not.

10. Write a program for inserting an element at a specified location in a given string.

11. Write a program to convert BCD numbers into equivalent binary value. Write a subroutine for the conversion.

12. Write a program to read a keyboard and display the characters on the PC screen using DOS/BIOS commands.

8051 PROGRAMMING USING KEIL SIMULATOR

13. Write a program to generate a square wave of 50% duty cycle at pin P2.1 using timer 0 in mode1. Assume XTAL=11.0592MHz.

14. Write a program to send a message "WELCOME" serially at 9600 baud rate continuously through serial port of 8051.

8086 INTERFACING

15. Write a program to interface stepper motor.

16. Write a program to interface keyboard with 8279 display controller

EC- 2207 : Analog Communications Lab

Course Objectives:

- To study various analog modulation and demodulation concepts practically.

Course Outcomes:

- To understand the concepts of analog modulation and demodulation concepts practically

syllabus

LIST OF EXPERIMENTS

1. AM Modulation and Demodulation
2. Low Pass Filter using passive components
3. High Pass Filter using passive components
4. Active Notch Filter
5. Frequency Modulation and Demodulation
6. Pre-emphasis and De-emphasis
7. T – Type attenuator
8. Band pass filter using passive components
9. Mixer characteristics

10. SSB-SC modulation and demodulation.

EC-2208 : SKILL ORIENTED COURSE/SOFT SKILL COURSE

Python Programming

Course Objectives:

The Objectives of Python Programming are

- To learn about Python programming language syntax, semantics, and the runtime environment
- To be familiarized with universal computer programming concepts like data types, containers
- To be familiarized with general computer programming concepts like conditional execution, loops & functions
- To be familiarized with general coding techniques and object-oriented programming

Course Outcomes:

- Develop essential programming skills in computer programming concepts like data types, containers
- Apply the basics of programming in the Python language
- Solve coding tasks related conditional execution, loops
- Solve coding tasks related to the fundamental notions and techniques used in object-oriented programming

Unit-1 : Introduction: Introduction to Python, Program Development Cycle, Input, Processing, and Output, Displaying Output with the Print Function, Comments, Variables, Reading Input from the Keyboard, Performing Calculations, Operators. Type conversions, Expressions, More about Data Output.

Data Types, and Expression: Strings Assignment, and Comment, Numeric Data Types and Character Sets, Using functions and Modules.

Decision Structures and Boolean Logic: if, if-else, if-elif-else Statements, Nested Decision Structures, Comparing Strings, Logical Operators, Boolean Variables. Repetition Structures: Introduction, while loop, for loop, Calculating a Running Total, Input Validation Loops, Nested Loops.

UNIT-2 : Control Statement: Definite iteration for Loop Formatting Text for output, Selection if and if else Statement Conditional Iteration The While Loop

Strings and Text Files: Accessing Character and Substring in Strings, Data Encryption, Strings and Number Systems, String Methods Text Files.

UNIT-3 : List and Dictionaries: Lists, Defining Simple Functions, Dictionaries Design with Function: Functions as Abstraction Mechanisms, Problem Solving with Top Down Design, Design with Recursive Functions

UNIT-4 : Modules: Modules, Standard Modules, Packages.

UNIT-5 : File Operations: Reading config files in python, Writing log files in python, Understanding read functions, read(), readline() and readlines(), Understanding write functions, write() and writelines(), Manipulating file pointer using seek, Programming using file operations

Text Books:

1) Fundamentals of Python First Programs, Kenneth. A. Lambert, Cengage.

2) Python Programming: A Modern Approach, Vamsi Kurama, Pearson.

Reference Books:

1) Introduction to Python Programming, Gowrishankar.S, Veena A, CRC Press.

2) Introduction to Programming Using Python, Y. Daniel Liang, Pearson.

EC-2209 : MADATARY COURSE ENVIRONMENTAL SCIENCE

(Effective from 2020-2021 Admitted Batches)

(Common for all Branches)

Course Objectives

The objectives of the Environmental Science course are to

- Familiarize the fundamental aspects of environment and the environmental management
- Provide information of some of the important international conventions which will be useful during the future endeavors after graduation.
- Make realize the importance of natural resources management for the sustenance of the life and the society.
- Apprise the impact of pollution getting generated through the anthropogenic activities on the environment
- Provide the concept of Sustainable Development, energy and environmental management
- Impart knowledge on the new generation waste like e-waste and plastic waste.

Course Outcomes

After completion of the course the students will have

- Knowledge on the fundamental aspects of environment and the environmental management
- The knowledge on the salient features of the important international conventions
- Understanding of the importance of natural resources management for the sustenance of the life and the society.
- Familiarity on various forms of pollution and its impact on the environment.
- Understand the elements of Sustainable Development, energy and environmental management
- Knowledge on the new generation waste like e-waste and plastic waste.

SYLLABUS

Introduction: Structure and functions of Ecosystems-Ecosystems and its Dynamics-Value of Biodiversity-impact of loss of biodiversity, Conservation of bio-diversity. Environmental indicators - Global environmental issues and their impact on the ecosystems. Salient features of International conventions on Environment: Montreal Protocol, Kyoto protocol, Ramsar Convention on Wetlands, Stockholm Convention on Persistent Organic Pollutants, United Nations Framework Convention on Climate Change (UNFCCC),

Natural Resources Management: Importance of natural resources management-Land as resource, Land degradation, Soil erosion and desertification, Effects of usage of fertilizer, herbicides and pesticide-watershed management.

Forest resources: Use and over-exploitation, Mining and dams – their effects on forest ecosystems and the living beings.

Water resources: Exploitation of surface and groundwater, Floods, droughts, Dams:benefits and costs.

Mineral Resources: Impact of mining on the environment and possible environmental management options in mining and processing of the minerals. Sustainable resource management (land, water, and energy), and resilient design under the changing environment.

Environmental Pollution: Local and Global Issues. Causes, effects and control measures. Engineering aspects of environmental pollution control systems.

Air pollution: impacts of ambient and indoor air pollution on human health. Water pollution: impacts water pollution on human health and loss of fresh water resources. Soil pollution and its impact on environment. Marine pollution and its impact on blue economy. Noise pollution.

Solid waste management: Important elements in solid waste management- Waste to energy concepts. Air (prevention and control of

pollution) Act, Water (prevention and control of pollution) Act and their amendments. Salient features of Environmental protection Act, 1986.

Sustainable Development: Fundamentals of Sustainable Development– Sustainability Strategies and Barriers – Industrialization and sustainable development. Circular economy concepts in waste (solid and fluid) management.

Energy and Environment: Environmental Benefits and challenges, Availability and need of conventional energy resources, major environmental problems related to the conventional energy resources, future possibilities of energy need and availability. Solar Energy: process of photovoltaic energy conversion, solar energy conversion technologies and devices, their principles, working and applications, disposal of solar panel after their usage. Biomass energy: Concept of biomass energy utilization, types of biomass energy, conversion processes, Wind Energy, energy conversion technologies, their principles, equipment and suitability in context of India.

Management of plastic waste and E-waste: Sources, generation and characteristics of various e- and plastic wastes generated from various industrial and commercial activities; Waste management practices including onsite handling, storage, collection and transfer. E-waste and plastic waste processing alternatives. E-Waste management rules and Plastic waste management rules, 2016 and their subsequent amendments.

Text Books:

1. Bharucha, Erach (2004). Textbook for Environmental Studies for Undergraduate Courses of all Branches of Higher Education, University Grants Commission, New Delhi.
2. Basu, M., Xavier, S. (2016). Fundamentals of Environmental Studies, Cambridge University Press, India
3. Masters, G. M., & Ela, W. P. (1991). Introduction to environmental engineering and science. Englewood Cliffs, NJ: Prentice Hall.
4. Enger, E. and Smith, B., Environmental Science: A Study of Interrelationships, Publisher: McGraw-Hill Higher Education; 12th edition, 2010.

Reference Books:

1. Sharma, P. D., & Sharma, P. D. (2005). Ecology and environment. Rastogi Publications
2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
3. Clark R.S. (2001). Marine Pollution, Clanderson Press Oxford (TB)
4. Jadhav, H & Bhosale, V.M. (1995). Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
5. MoEF&CC, Govt. of India, CPCB: E-waste management rules, 2016 and its amendments 2018.

6. MoEF&CC, Govt. of India, CPCB: Plastic waste management rules, 2016.

BACHELOR OF TECHNOLOGY (B.TECH.)

GEO-INFORMATICS ENGINEERING

Group - B

Geo-Informatics Engineering

Semester III (Second year)

Course code	Category	Course Title	Hours per week			Internal Marks	External Marks	Total Credits	
			L	T	P				
GI 2101	BS	Probability and Statistics	3	0	0	30	70	100	3
GI 2102	PC	Fundamentals of atmospheric systems	3	0	0	30	70	100	3
GI 2103	PC	Fundamentals of Geology	3	0	0	0	30	70	100
GI 2104	PC	Object Oriented Programming through C++ and JAVA	3	0	0	30	70	100	3
GI 2105	HSS	Managerial Economics	3	0	0	30	70	100	3
GI 2106	PCLAB	Geology Practicals	0	0	3	50	50	100	1.5
GI 2107	PCLAB	Geomorphology Practicals	0	0	0	3	50	50	100
GI 2108	PCLAB	Object Oriented Programming Practical	0	0	3	50	50	100	1.5
GI 2109	SC	AutoCAD	1	0	2	50	50	100	2
GI 2110	MC	Professional Laws & Ethics and Universal Human values	0	0	0		100	100	
GI 2111	MC	NCC/NSS	0	0	2	-	-	-	0
Total Credits									21.5

Semester IV (Second year)

Course code	Category	Course Title	Hours per week			Internal Marks	External Marks	Total Credits	
			L	T	P				
GI 2201	ES	Information technology and Applications	3	0	0	30	70	100	3
GI 2202	BS/ PC	Principles of Physical Oceanography	3	0	0	30	70	100	3
GI 2203	PC	Photogrammetry and Photo interpretation	3	0	0	30	70	100	3
GI 2204	PC	Remote Sensing -I	3	0	0	30	70	100	3

GI 2205	PC	Spatial data analysis using Python programming	3	0	0	30	70	100	3
GI 2206	PC Lab 1.5	Remote Sensing & Image Interpretation Practicals	0	0	3	50	50	100	
GI 2207	PC Lab	Photogrammetry and Photo Interpretation Practical	0	0	3	50	50	100	1.5
GI 2208	SC	Mobile App Design	1	0	2	50	50	100	2
GI 2209	MC	Environmental Science	0	0	0	100	100		
Total Credits									20

Summer Internship (Community Service)

GI 2101: PROBABILITY AND STATISTICS

Course Objectives:

The objective of the course is to introduce the students to:

- The basic concepts in probability, conditional probability and independent events.
- The random variables and mathematical expectation.
- Different types of distributions, designs and queueing models.
- The concept of reliability, series and parallel systems.

Course Outcomes:

Upon completion of this course the student will be able to,

- Find derivatives of random variables
- Evaluate distributions, Regressions and Transformation of random variables.
- Understand random process classification, Markov process and queueing models
- Understand concept of reliability, Series and parallel systems
- Understand design of experiments, quality control and different designs

Probability and Random Variables : Probability concepts, Random variables, Moments, Moment Generating function, Binomial, Poisson, Geometric, Negative binomial, Exponential, Gamma, Weibull distributions, Functions of random variable, Chebychev inequality.

Two Dimensional Random Variables, Marginal and conditional distributions, Covariance, Correlation and Regression, Transformation of random variables, Central limit theorem.

Random Processes: Classification, Stationary and Markov processes, Poisson process, pure birth process, Birth and death process, Markov chains, Markovian queueing models.

Reliability Engineering; Concepts of reliability, Hazard function, Series and parallel systems, Reliability and Availability of Markovian systems, Maintainability, Preventive maintenance.

Design of Experiments and Quality Control : Completely randomized design, Randomized block design, Latin square design, Process control, Control charts of measurements and attributes, Tolerance limits.

Textbooks

- Miller, I.R and Freund, J.D., Probability and Statistics for engineers, Prentice-Hall, 1995
- Kapur, J.N and Saxena, H.C, Mathematical statistics, S. Chand & Company Ltd., New Delhi, 1997
- Balagurusamy, E, Reliability engineering, Tata-McGraw Hill Publishers, New Delhi, 1984
- Bhat, U.N, Elements of applied stochastic processes, Wiley Series in Probability and Mathematical statistics, New York, 1983

GI 2102: FUNDAMENTALS OF ATMOSPHERIC SYSTEMS

Course Objectives:

The Objective of the course is

- To impart the basic knowledge in concepts of Atmosphere Science and Meteorology.
- To give knowledge on weather system and disturbances.
- To impart knowledge on weather forecasting.

Course outcomes:

Upon completion of this course the student will be able to,

- Understand the atmospheric structure and composition.
- Measure atmospheric pressure and wind parameters.
- Understand concepts of monsoons and their movements.
- Understand weather disturbances and weather forecasting models.

The Atmosphere: Nature, origin, composition and vertical structure.

Insolation and Heat Budget: Insolation, solar constant, distribution, atmospheric depletion of solar radiation, heat budget, latitudinal heat budget. Temperature of the atmosphere: Heat and temperature, processes of heat energy transfer, heating and cooling of atmosphere; Controls of temperature; Distribution of temperature: Air temperature and its measurement, measurement of sunshine and insolation; Horizontal distribution, seasonal distribution, vertical distribution, temperature inversion.

Air Pressure and winds: Measurement of air pressure, variations of air pressure and weather, pressure gradient; Pressure variations: diurnal and seasonal; basic atmospheric pressure patterns; vertical variation in air

pressure; horizontal distribution of pressure; seasonal variations in pressure pattern;

Wind: Factors affecting wind direction and speed, wind observation and measurement; wind shift.

General circulation of the atmosphere: Thermal circulation on non-rotating earth, thermal circulation on a rotating earth. Surface wind systems. Departure from idealized circulation pattern; Surface wind systems; Latitudinal shifting of wind belts; Longitudinal variations in air flow patterns; Winds in tropical region; Sub tropical winds; Westerlies; polar winds; Jet stream

Atmospheric Moisture: Sources of atmospheric moisture, humidity measurements, evaporation, factors affecting evaporation, potential evapotranspiration; Clouds: Formation and classification.

Precipitation: Causes, forms, processes, and types, observations of precipitation, regional distribution and seasonal variation of precipitation, artificial precipitation.

Monsoons: Economic importance of monsoon, concepts of the origin of monsoon, Asian monsoon; Indian monsoon, burst of monsoon, climatic significance of monsoon.

Weather disturbances: Air masses: source regions, classification, air mass modification.

Fronts: General characteristics, frontogenesis and frontolysis, classification of fronts.

Tropical disturbances: Types of tropical disturbances, origin of tropical cyclones, movement and tracks of hurricanes, hurricane seasons, regional distribution.

Thunderstorms, tornadoes and waterspouts: Thunderstorms-origin and structure, stage of development, Thunderstorm electricity and thunder, precipitation in thunder storm, classification and distribution; tornadoes and waterspouts.

Weather forecasting and analysis: Historical background, how weather forecasting is done, types of weather forecasts, weather forecasting methods, satellites in weather forecasting.

Applied climatology: climate and natural vegetation, climate and agriculture, climate and animal husbandry, climate and housing, Air pollution and health, climate and human comfort, climate and urban planning

Textbooks:

- Climatology, Lal, D.S., ShardaPustak Bhawan,11,University road,Allahabad,2003

- General climatology, Howard J. Critchfield, Prentice-Hall of India private Limited, New Delhi, 1987

- Physical Geography, Tikka, R.N., KedarNath Ram Nath&Co, Meerut, 2006

- Meteorology Today, C.Donald Ahrens, West Publishing company, New York, Third edition

- Atmosphere,weather and climate, Siddhartha, K., Kishalaya Publications Pvt.Ltd.,2004

GI 2103: FUNDAMENTALS OF GEOLOGY

CourseObjectives:

The Objective of the course is

- To train the student in basics of geology, i.e.Origin of the earth, layers of earth.

- To impart knowledge on rock and mineral types, geological landforms and formations.

- To impart knowledge on geophysical investigations.

- To teach importance of geology in designing of dams, reservoirs, tunnels and roads.

CourseOutcomes:

Upon successful completion the student will be able to,

- Understand the dynamics of Earth – endogenetic and exogenetic forces.

- Identify different minerals and their properties.

- Identify different rocks, their origin and properties.

- Identify lithology and structure of geological formations.

- Understand geological importance in different civil engineering projects.

Branches of Geology – Solar system, Origin of the Earth, Age of the Earth, Interior of the Earth, Isostasy, Elements of seismology, Earthquakes, Volcanoes, Elementary knowledge on continental drift and plate tectonics with evidences. Groundwater.

Crystal symmetry, forms, twinning; crystal chemistry; optical mineralogy, classification of minerals, diagnostic physical and optical properties of rock forming minerals. – study of the following rock forming minerals – Olivine family, Quartz family, Feldspar family, Amphibole Family, Pyroxene family, Mica family, Garnet – Processes of ore mineral formation – Coal and petroleum – origin and occurrence in India.

Igneous rocks - classification, forms, Structures and textures – Description of Granite, Syenite, Diorite, Gabbro, Pegmatite, Dolerite and Basalt. Sedimentary rocks - classification, forms, structures and textures- Description of sandstone, limestone, shale, Conglomerate and breccia. Metamorphic rocks - classification, forms, structures and Textures-

Description of Quartzite, Marble, Slate, Phyllite, Gneiss and Schist, Khondalite, Charnockite. Igneous and metamorphic provinces of India.

Strike, Dip, Plunge; Description and classification of folds, faults, Joints and Unconformities; Use of Brunton compass; Clinometer compass.

Stratigraphy: Stratigraphic principles; Geological time scale, major stratigraphic divisions of India. -Major geological formation of India: Archeans group, Cuddapah system, Vindhyan formations, Gondwana system, Deccan traps, siwaliks. Geology and Mineral Resources of Andhra Pradesh.

Geophysical Investigations(Electrical, Seismic survey) for constructions of dams, reservoirs, buildings, roads, coastal structures, and Tunnels. Importance of geology in construction and development of civil Engineering projects.

Textbooks

- Parbin Singh, "Engineering and General Geology", Katson Publication House, 2013.

- K.M. Bangar "Principles of Engineering Geology. Standard publishers Distributors.

- Krynine and Judd, "Engineering Geology and Geotechniques", McGraw Hill Book Company, 1970.

Reference

- Legeet, "Geology and Engineering", McGraw Hill Book Company, 1998.

- Blyth, "Geology for Engineers", ELBS, 1985.

GI 2104: OBJECT ORIENTED PROGRAMMING THROUGH C++ AND JAVA

Course Objectives:

The objective of the course is

- To understand the concepts and features of object oriented programming.

- To examine key aspects of C++ and Java.

- To learn java's exception handling mechanism, multithreading, packages and interfaces.

- To develop skills in internet programming using applets and swing.

Course Outcomes:

Upon completion of the course the student will be able to

- Define, understand and differentiate Object oriented concepts.

- Understand basics of Java.

- Create different classes and Objects.

- understand concept of Inheritance, Polymorphism.

- Design and develop applications using applets and swings.

Overview of objectoriented programming (OOP): OOP paradigm, basic concepts underlying OOP: data abstraction and encapsulation, objects and classes, inheritance, polymorphism. Operator overloading, function overloading, single inheritance, multiple inheritance.

Review of Language constructs of C used in C++: variables, types and type declarations, user defined data types; increment and decrement operators, relational and logical operators; if then else clause; conditional expressions, input and output statement, loops, switch case, arrays, stacks, queues, structure, unions, functions, pointers; preprocessor directives and examples of these applications in C++

Creation of Classes and Objects, accessing class members, Private Vs Public, Constructor and Destructor, Objects, Member Functions , Method definition, Inline Function Implementation, Constant member functions, Overloading Member Functions ,Need of operator overloading, prefix and postfix, overloading binary operators and examples in C++.Inheritance and types, protected data, private data, public data, inheriting constructors and destructors, constructor for virtual base classes, constructors and destructors of derived classes, and virtual functions, size of a derived class, order of invocation.

Polymorphism and Virtual Functions, Importance of virtual function, abstract base classes and pure virtual functions, virtual destructors, File and Streams Components of a file, different operation of the file, communication in files, creation of file streams, stream classes, header files, updating of file, opening and closing a file, file pointers and their manipulations, functions manipulation of file pointers, detecting end-of file.

JAVA Language: Basics of Java, Constants, Variables, and Data Types, Operators and Expressions, Decision Making and Branching, Decision Making and Looping, Class fundamentals, declaring objects, assigning object reference variables, introducing methods, Constructors, this keyword, Garbage collection, The Finalize () method, A stack class, Over loading constructors, Using objects as parameters, Arguments passing, Returning objects, Recursion.

Advanced OOP in Java: Arrays, Strings and Vectors

Inheritance basics, Member access and inheritance, using super class, creating a multilevel hierarchy, Method overriding, Dynamic method dispatch, Using abstract classes, Using final with inheritance, The object class. Packages: Putting Classes Together, Defining a package,

Understanding classpath, Importing Packages, Defining an interface, Implementing interfaces, Applying Interfaces, Variable in interfaces.

Multithreaded Programming, Managing Errors and Exceptions.

Applet Programming: The applet class, Applet architecture, An applet skeleton: Initialization and termination, Overriding update, Status window, Handling events: The event class, Processing mouse events, Handling keyboard events, HTML applet tag, Passing parameters to applets, Applet context and show document, The audio clip & applets tub interface, Outputting to the console. Swing concepts, JDBC connectivity

Managing Input / Output Files in JAVA.

Textbooks

- Object Oriented Programming in C++ by E. Balaguruswamy, TMH Publishing Co. Ltd., New Delhi
- Mastering C++ by KR Venugopal and Rajkumar, T Ravishankar; Tata McGraw Hill Publishing Co. Ltd., New Delhi
- Programming with Java: A Primer, 3E, E BALAGURUSAMY, Tata McGraw Hill
- The Complete Reference JAVA, Patrick Naughton and Herbert Schildt, Tata McGraw-Hill Publishing Company Ltd

References:

- Object Oriented Programming using C++ by B Chandra, Narosa Publishing House Pvt.Ltd., Daryaganj, New Delhi 110002
- Object Oriented Programming using C++ by R Rajaram , New age International (P) Ltd, Publishers New Delhi.

GI 2105 MANAGERIAL ECONOMICS

(Common for all Branches)

Course Objectives:

- To bring about an awareness about the nature of Managerial Economics and its linkages with other disciplines.
- To understand the Micro and Macro Environment of Business.
- To familiarize the prospective engineers with the concepts and tools of Managerial Economics with an objective to understand the real world of business.

Course Outcomes:

- After completion of the course, student will be able to:
- Understand the various economic activities in business and industry.
- Analyse the real-world business problems.

• Make optimal business decisions for the effective and efficient management of Organisations.

Significance of Economics and Managerial Economics:

Economics: Definitions of Economics- Wealth, Welfare and Scarcity definitions Classification of Economics- Micro and Macro Economics.

Managerial Economics: Definition, Nature and Scope of Managerial Economics, Differences between Economics and Managerial Economics, Main areas of Managerial Economics, Managerial Economics with other disciplines.

Demand and Utility Analysis: Demand - Definition, Meaning, Nature and types of demand, Demand function, Law of demand - Assumptions and limitations. Exceptional demand curve.

Elasticity of demand - Definition, Measurement of elasticity, Types of Elasticity (Price, Income, Cross and Advertisement), Practical importance of Price elasticity of demand, Role of income elasticity in business decisions, Factors governing Price Elasticity of demand.

Utility Analysis: Utility- Meaning, Types of Economic Utilities, Cardinal and Ordinal Utility, Total Utility, Marginal Utility, The law of Diminishing Marginal Utility and its Limitations.

Theory of Production and Cost analysis: Production - Meaning, Production function and its assumptions, use of production function in decision making; Cost analysis - Nature of cost, Classification of costs - Fixed vs. Variable costs, Marginal cost, Controllable vs. Non - Controllable costs, Opportunity cost, Incremental vs. Sunk costs, Explicit vs. Implicit costs, Replacement costs, Historical costs, Urgent vs. Postponable costs, Escapable vs. Unavoidable costs, Economies and Diseconomies of scale.

Market Structures: Definition of Market, Classification of markets; Salient features or conditions of different markets - Perfect Competition, Monopoly, Duopoly, Oligopoly, Importance of kinked demand curve; Monopolistic Competition.

Pricing and Business Cycles: Pricing Analysis: Pricing – Significance; Different Pricing methods- Cost plus pricing, Target pricing, Marginal cost pricing, Going -rate pricing, Average cost pricing, Peak load pricing, Pricing of joint Products, Pricing over the life cycle of a Product, Skimming pricing Penetration pricing, Mark- up and Mark- down pricing of retailers. Business cycles - Definition, Characteristics, Phases, Causes and Consequences; Measures to solve problems arising from Business cycles.

Text Books:

1. Sankaran, S., Managerial Economics, Marghan Publications, 2015, Chennai.
2. Aryasri, A.R., Managerial Economics and Financial Analysis, MC Graw Hill Education, New Delhi, 2015.

Reference Books:

1. Dwivedi, D.N., Managerial Economics, Vikhas Publishing House Pvt. Ltd. 6th Edition, New Delhi, 2004.
2. Dewett, K.K., Modern Economic Theory, S.Chand & Company Ltd., New Delhi, 2005.

GI 2106 GEOLOGY PRACTICALS

Course Objective

This course is to train the students to in the laboratory to interpret the geological maps, models, rocks and mineral samples.

Course Outcomes:

Upon successful completion of the course, the student get necessary experimental knowledge and training to

- Identify the minerals based on their physical properties by simple tests.
- Solve various geological problems.
- Classify rocks using basic geologic classification systems.
- Interpret the geological structures in the geological maps and model.

GEOLOGY EXERCISES

1. Working with Geological maps and sections.
2. Identification of some important rock forming minerals.
3. Description and Identification of typical rocks.
4. Identification of geological structures-folds, faults and joints.

GI 2107 GEOMORPHOLOGY PRACTICALS

Course Objective:

The course enables the students to identify various geomorphological features from topographic maps in the laboratory.

Course Outcomes:

Upon successful completion of the course, the student will gain necessary knowledge to:

- Identify Landforms from topographic maps.
- Gain in-depth knowledge topographic profiles.
- Prepare slope maps.
- Interpret lithological and climatic controls in formation of different drainage patterns

GEOMORPHOLOGY EXERCISES

1. Description of landform models.
2. Topographic profiles – projected and composite profiles.
3. Preparation of slope maps.

4. Stream profiles from topographic maps.
5. Landform interpretation from topographic maps.
6. Drainage Morphometry.

GI 2108: OBJECT ORIENTED PROGRAMMING PRACTICALS

Course Objective:

The objective of the course is

- To impart knowledge about basic Java language syntax and semantics to write Java programs and use concepts such as variables, conditional and iterative execution methods etc.
- To teach the fundamentals of object-oriented programming in Java, including defining classes, objects, invoking methods etc. and exception handling mechanisms.
- To impart knowledge on the principles of inheritance, Polymorphism, packages and interface.

Course Outcomes:

Upon completion of the course the student will be able to,

- Write object oriented programme using c++.
- Write object oriented programs with Java.
- Identify classes, objects, members of a class and relationships among them needed for a specific problem.
- Write Java application programs using OOP principles and proper program structuring.

Cycle -I : Write a function using variables as arguments to swap the values of a pair of integers Write a program to read a matrix of size m*n from the keyboard and display the same on the screen.

Define a class to represent a bank account including the following members: - Data members: a) Name of the depositors; b) Account number; c) Type of account; d) Balance amount in the account and Member function - To assign initial values, To deposit an amount, To withdraw an amount after checking the balance, To display the name and balance.

Create a class Float that contains 2 float data members. Overload all the 4 arithmetic operators so that to operate on the objects of float. Operations related to file handling

Cycle – II : Write programs in JAVA to implement the following concepts-Streams and File operations; Packages in JAVA; Exception handling mechanism; Applets and applications; Multi-threading in JAVA; Fundamental applications using swing.

GI 2109: AutoCAD

Course Objectives:

The Objective of the course is to,

- Introduce the concepts of CAD, its interface.
- Teach different tools and Geometry.
- Impart knowledge on different layouts&annotations.
- Introduce the concept of 3d CAD.

Course Outcomes:

Upon successful completion of the course the student will be able to,

- Operate CAD interface.
- Utilize different tools of CAD.
- Performs drawings and modify their geometry and annotations.
- Gain knowledge on 3d CAD.
- Import survey data and calculate different parameters.

Introduction: About Autodesk & AutoCAD, CAD History, Graphical User Interface, Application Menu, Workspaces, Ribbon, File Tabs, Accessing Help, Drawing Templates, Standards Based Design, Create New Drawings and Templates, Managing Layers, Configure Object Property Settings, Automatic Management of Layers, Layer Functions and Display

Geometry: Drawing Creation Workflows and Organization, Structuring Data in Drawings, Reusing and Editing Structured Data. Tools for Creating Key Geometry: Core Design Tools: Creating Rectangles, Placing Hatch, Fillets, Chamfers, Contours, Power Snaps, Centerlines, Construction Lines, Designing with Lines, Adding Standard Feature Data for Holes and Slots.

Tools for Manipulating Geometry : Editing Tools, Power Commands, Associative Hide.

Drawing & Printing: Model Space Views in Layouts, Creating Drawing Sheets in Model Space, Annotation, Title Blocks and Drawing Borders. Dimensioning and Annotating Drawings; Annotation and Annotation Symbols, Creating Dimensions, Editing Dimensions. Printing Concepts, Working in Layouts, Creating Layouts, Guidelines for Layouts. Import & Export, DWG Files, IGES Files, Project Documentation, Printing Layouts, Print & Plot Settings. Projects Printing / Plotting

AutoCAD 3D: AutoCAD Civil 3D GUI, AutoCAD Civil 3D Toolspace, AutoCAD Civil 3D Panorama, Workshops, AutoCAD Civil 3D Projects, Sharing Data, Using Data Shortcuts for Project Management.

Lines and curves, Introduction to Parcels, Creating and Editing Parcels, Parcel Reports, Labels, Tables.

Survey & Surfaces: Survey Workflow Overview, Survey Figures, Points, Importing Survey Data, Point Groups. Surface Processes, Surface Properties, Contour Data, Other Surface Data, Breaklines and

boundaries, Surface Labels. Surface Volume Calculations, Surface Analysis Display.

GI 2110 Professional Laws & Ethics and Universal Human values

(Common for all Branches)

Course Objectives:

The objective of the course is Six fold:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- This course will illuminate the students in the concepts of laws and its applicability to engineers
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection, Development of commitment and courage to act and also enable the students to imbibe and internalize the Values and Ethical Behaviour in the personal and professional

lives

· To enable the students to imbibe the Values and Ethical Behavior in the personal and Professional lives

· The students will learn the rights and responsibilities Individual, employee, team member and a global citizen

Course Outcomes:

By the end of the course Student will be able to:

- Grasp the meaning of the concept – Law and also Get an overview of the laws relating to Engineers and also Apprehend the importance of being a law-abiding person and They would have better critical ability
- Self-explore by using different techniques to live in harmony at various levels
- Analyze themselves and understand their position with respect to the moral and ethical character needed for a successful and satisfactory work life
- Students are expected to become more aware of themselves and their surroundings (family, society, nature)
- They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
- They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society) Need, Basic Guidelines, Content and Process for Value Education

Self-Exploration—what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation - as the process for self-exploration, Continuous Happiness and Prosperity - A look at basic Human Aspirations, Right understanding, Relationship and Physical Facility - the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels. Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking, Include practice sessions and case studies.

Understanding Harmony in the Human Being - Harmony in Myself!

Understanding human being as: a co-existence of the sentient 'I' and the material 'Body', the needs of Self ('I') and 'Body' - happiness and physical facility, the Body as an instrument of 'I' (I being the doer, seer and enjoyer), the characteristics and activities of 'I' and harmony in 'I', the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail, P to ensure Sanyam and Health, Include practice sessions and case studies.

Understanding Harmony in the Family and Society - Harmony in Human – Human Relationship Understanding values in human-human relationship: meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship, the meaning of Trust; Difference between intention and competence, the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship, the harmony in the society (society being an extension of family), Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society, Universal Order from family to world family, Include practice sessions and case studies.

Understanding Harmony in the Nature and Existence - Whole existence as Coexistence Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature recyclability and self-regulation in nature, Understanding Existence as Co-existence of mutually interacting units in all – pervasive space, Holistic perception of harmony at all levels of existence, Include practice sessions and case studies.

Concept of Law and Law of Torts

Understanding Essentials of a Valid Contract and the basics of contract law protecting rights and obligations, Introduction to the Law of Torts and the basics to protect oneself and the company Law affecting the Workplace

Employers Responsibilities/Duties Hiring Practices, Introduction to Intellectual Property Law, Professional Code of Conduct for Engineers, Relationship between Law and Ethics, Include practice sessions and case studies.

Implications of the above Holistic Understanding of Harmony on Professional Ethics Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations, Include practice sessions and case studies.

Text Books

1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. R R Gaur, R Asthana, G P Bagaria, "Teachers' Manual for A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2
3. R. Subramanian, "Professional Ethics", Oxford University Press.
4. S.B. Srivastha, "Professional Ethics & Human Values", SciTech Publications (India) Pvt. Ltd. New Delhi.
5. D.R. Kiran, "Professional Ethics & Human Values", TATA Mc Graw Hill Education.

Saroj Kumar, "Business Law" and Avtar Singh, "Law of Contract"

Reference Books

1. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan VidyaPrakashan, Amar kantak, 1999.
2. A. N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book), MohandasKaramchand Gandhi "The Story of My Experiments with Truth", E. F.Schumacher. "Small is Beautiful", Slow is Beautiful –Cecile Andrews, J C
- Kumarappa "Economy of Permanence", PanditSunderlal "Bharat Mein Angreji Raj" and Dharampal, "Rediscovering India

4. G K Kapoor, "Business Law" and Sen & Mitra, "Business & Commercial Laws" and Calvin Frank Allen, "Business law for Engineers"
5. Hilgard, E. R.; Atkinson, R. C. & Atkinson, R.L. (1975). Introduction to Psychology. 6th Edition. New Delhi: Oxford and IBH Publishing Co. Pvt. Ltd.
6. Govindarajan, M; Natarajan, G. M. & Senthilkumar, V.S. (2013). Professional Ethics & Human Values. Prentice Hall: New Delhi
7. Gogate, S. B. (2011). Human Values & Professional Ethics. Vikas Publishing: New Delhi.
8. Charles E Harris Jr., Michael S Pritchard, Michael J Rabins, "Engineering Ethics, Concepts Cases: 4e, Cengage learning, 2015.
9. Caroline Whitbec, "Ethics in Engineering Practice & Research: 2e, Cambridge University Press 2015.

SEMESTER--II

GI 2201 INFORMATION TECHNOLOGY AND APPLICATIONS

Course Objectives:

The Objective of the course is

- To teach basics of computers and different components.
- To give knowledge on different types of data and their representation.
- To impart overview of Operating system fundamentals and software.
- To impart knowledge business information systems, e-commerce.
- To impart knowledge on Computer networking, Internet, Email.

Course Outcome:

Upon successful completion the student will be able to

- Identify computer, its components and other devices.
- Understand different types of computer data, storage.
- Understand and operate different operating systems and other applications.
- Explain E-commerce architecture, payment schemes, Intellectual property rights.
- Operate internet, email and communicate through internet.

Computer Fundamentals: Introduction to computers, types of computers, basic components of computer systems- CPU-memory, Input devices-KeyBoard, smart cards, Light pen, touch screen, mouse, digitizer. Output devices – Video display devices, flat panel display, printers, audio output

Data Acquisition: Acquisition of Numbers and Textual Data: Input units, internal representation of numeric data, representation of characters, error detecting codes. Acquisition of image Data: Acquisition of textual data, pictures, storage format for pictures, fundamentals of image compression, image acquisition with digital camera.

Acquiring Audio Data: basics of audio signals, acquiring and storing audio signals.

Acquisition of Video: Capturing a moving scene with a video camera, compression of video data, MPEG compression standard.

Computer Software: Overview of Operating Systems: operating system fundamentals, software – system software, application software (overview of Word, Excel, PowerPoint). Overview of Windows; Linux (Windows-Desktop-Control panel -Start menu; Operations on file (new, save, copy, edit, etc).

Business Information Systems and E-commerce: Types of information needed by organizations, Management structure and information needs, design of an operational information system, system life cycle, computer system for transaction processing.

E-commerce: Introduction, Business to business, business to customer and customer to customer e-commerce, their advantages and disadvantages. E-commerce system architecture, payment schemes, electronic cheque payment, Cash transactions, EDI, Intellectual properties rights and e-commerce.

Computer Networks and Internet: Overview of computer Networks and Internet: computer networks - LAN, WAN and their applications, intranet, naming computers connected to internet.

Some Internet Applications: Email, Information browsing, WWW, Information retrieval from the web, Other facilities provided by the browser, audio on the internet, pictures, animation, video on the internet. Introduction to applications such as Google maps and Google earth

Text books

- Introduction to Information technology by V. Rajaraman, PHI
- Information technology: Theory and Practice by Pradeep K. Sinha, Priti Sinha, PHI

Reference Books:

- Introduction to Computers by Peter Norton
- Information Technology: Principles and Applications Hardcover – 1 January 2004 by Ray Ajoy Kumar, Acharya Tinku

GI 2202: PRINCIPLES OF PHYSICAL OCEANOGRAPHY

Course Objective:

The Objective of the course is,

- To impart knowledge on Oceans and their physical properties

- To impart knowledge on oceanographic instruments, measurement of different parameters
- To give knowledge on ocean waves, tides and their characteristics.
- To impart knowledge on sea level change, its effects and conservation of Marine resources

Course Outcomes:

Upon successful completion of the course the student will be able to,

- Understand the concept of oceans, their importance and physical properties.
- Understand measurement of sea temperature, salinity. Waves.
- Explain Tides, waves and their characteristics.
- Understand about sea level changes, its effects.
- Identify different marine resources and their conservation concepts.

The World Oceans; Physical Properties of Sea Water and their Distribution: Salinity of Sea Water: Factors Affecting Salinity, Salinity Distribution in Oceans. Temperature in the Oceans: Factors Influencing Sea Water Temperature, Temperature Distribution in Oceans. Pressure; Density: Factors Affecting Density of Ocean Water, Density distribution in the Oceans; Colour of Sea Water: Colour Determination, Factors influencing the Colour of Sea Water. Light Transmission in Sea Water: Extinction Coefficients in the Sea, Variation of Extinction Coefficient; Sound Transmission in Sea Water: Velocity of Sound Waves, Variation of Sound Velocity in the Ocean, Refraction of Sound-Shadow Zone and Sound Channel, Attenuation of Sound in the Ocean.

Oceanographic Instruments and methods: Sea Water Temperature Measurement, Salinity Measurement, Current Measurement, Ocean Wave Measurements, Tide Measuring Instruments, Water Transparency Measurement, Radiation Measurement and Platform- Sea and Airborne and Remote Sensing Satellites, Satellite Navigation, DGPS, Eco-sounder.

Ocean Waves: Classification of Ocean Waves, Characteristics of Waves, Motion of an Ocean Wave, Wind-Generated Waves, Wave Height Conditions in Different Regions of the Oceans, Deep Water Wave Characteristics in the Arabian Sea and Bay of Bengal of Indian Coasts, Wave Propagation in Shallow Water, Problem Waves.

Ocean Tides: Tide Producing Forces, Tide Characteristics, Tidal Theories, Harmonic Analysis and Prediction of Tides, Tidal Ranges and Tidal Periods, Tidal Bore

Water Masses: Introduction, T-S diagrams, Properties of Water Masses, Types of Water Masses.

Ocean Circulation: Introduction, Currents: Some General observations, Factors controlling Ocean Circulation, El Nino, Western Intensification of

currents, Currents in Atlantic Ocean, Currents in Pacific Ocean, Currents in Indian Ocean.

Sea level changes: Introduction, Evidences for Sea Level Changes, Mechanisms of Sea level Changes, Impact of Sea level Change, Impact of Projected Sea level rise.

Marine Resources: Introduction, Maritime zones, Types of Marine Resources, Resources: extent, distribution and utilization, Problems of Marine Resources-Marine Pollution, Conservation of Marine Resources.

Text Books:

- Descriptive Physical Oceanography, Reddy, M.P.M., Oxford & IBH Publishing Co. 2001
- Oceanography – A Brief Introduction, Siddhartha, K., Kishalaya Publications, 2004
- Introductory Oceanography, Harold V. Thurman, Macmillan Publishing Company, 1994
- Introductory Oceanography, J. Weisberg and H. Parish, McGraw-Hill Kogakusha, 1974
- Descriptive Physical Oceanography, George L. Pickard and William J. Emery, Pergamon Press, Fourth Edition.

GI 2203: PHOTOGRAMMETRY AND PHOTO INTERPRETATION

Course Outcomes:

The Objective of the course is,

- To impart knowledge on basic concepts of Photogrammetry.
- To impart knowledge on aerial photographs, measurements and interpretation.
- To measure different errors and elevations from photographs.
- To impart knowledge on importance of aerial photographs in different surveys and projects.

Course Outcomes:

Upon successful completion of course the student will be able to,

- Classify the photogrammetry methods and their applications.
- Determine the scale, ground coordinates and the aerial extent of aerial photograph.
- Demonstrate interior and exterior orientation on two overlapping aerial photographs.
- Measure parallax and compute elevations from parallax measurements.
- Prepare mosaics, orthophotos and photomaps for mapping of resources.

Fundamentals of Photogrammetry and photo interpretation; History of aerial photography; Types of photographs: vertical and oblique photographs. Aerial cameras: lens, optical axis, focal length, focal plane and fiducial marks; Principal Point; Geometry of vertical photographs.

Scale on vertical photographs – over flat terrain and variable terrain; average photo scale; Methods of determining the scale on vertical photographs. Overlap, side lap and flight planning. Stereoscopic viewing of vertical photographs; Depth perception; Stereoscopes and their use; Vertical exaggeration – factors involved and determination

Relief Displacement on vertical photographs. Determination of horizontal ground lengths, directions and angles from photo coordinates. Parallax: Y-parallax and X-Parallax; Parallax measurement – monoscopic method and stereoscopic method – principle of floating mark

Aerial mosaics: comparison with maps. Elements of air photo pattern: rock types, landforms, surface drainage patterns, erosion features, gray tones, vegetative and land use details

Applications of aerial photographic techniques in soil surveys; forest surveys, agricultural and land use planning; geological and geomorphological investigations; civil engineering projects.

Latest developments in Photogrammetry: UAV survey, Drone surveying.

Textbooks

1. 'Elements of Photogrammetry' by P.R.Wolf and B.A. Dewitt, McGraw Hill, 2004
2. 'Remote Sensing and image Interpretation' by Thomas M. Lillesand and R.W. Kiefer, John Wiley & Sons, Inc., 2000
3. 'Aerial Photographic interpretation' by Donald R. Lueder, McGraw-Hill 1959
4. P.J. Curran, Principles of Remote Sensing, ELBS/Longman 1985

GI 2204: REMOTE SENSING -I

Course Objective:

The Objective of this course is,

- To impart knowledge on remote sensing basics.
- To give knowledge on EMR interaction with different earth surface features.
- To impart knowledge on different remote sensing techniques.
- To impart knowledge on different remote sensing satellite programs.

Course Outcomes:

Upon successful completion the student will be able to

- Understand basic concepts of Remote Sensing.
- Analyze energy interaction in the atmosphere and earth surface features.
- Identify earth surface features from satellite images.
- Understand concepts of different remote sensing techniques.

Introduction: Remote sensing system, Observe Earth from space. Remote Sensing-A historic prospective, Indian remote sensing programme. The earth Observation Evolution-Paradigm shift, Legal and ethical aspect. Electro Magnetic Radiation (EMR): Velocity of EM radiation, Propagation of EM waves, Attenuation, quantum nature of EM radiation, Thermal emission, EM radiation for Remote Sensing Fundamentals of Radiometry: Measure Geometry-concept of the solid angle, radiometric quantities, Surface characteristic for Radiometric Measurements, Observation geometry in Remote sensing, Radiometric Measurements, scene Reflectance Measurement. Physical Basis of Signature: Signature in the Reflective OIR region, Thermal Infrared (TIR), Microwave region.

EMR Interaction with Atmosphere: Atmospheric characteristics – atmospheric gas composition – pressure and temperature variation with altitude – Rayleigh, Mie scattering and non-selective scattering – atmospheric windows – Atmospheric effects on solar radiation and microwave spectrum – Thermal infrared radiation – Emissivity – Emittance of materials – Kirchoff's Law in spectroscopy – Wien's Displacement Law, Stefan Boltzmann Law – ocean colour temperature measurement – Introduction to Microwave Remote sensing EMR Interaction with Earth materials: Spectral signature concepts – Factors affecting spectral reflectance of materials. Instruments used to study the spectral reflectance – spectrophotometer – spectro-radiometer.

Remote Sensor –An overview: Classification of Remote sensor, selection of sensor parameters, spatial resolution, spectral resolution, radiometric resolution, Temporal resolution Optical and Infrared sensors: Quality of Image in Optical system, Imaging mode, Photographic camera, Television camera, Opto-mechanical scanners, Opto-mechanical scanners operated from satellites, Push broom cameras, Whisk broom cameras. Microwave sensors.

Platforms & Sensors: Principles of satellite Missions, Locating satellites in space, Types of Orbit, Airborne platforms – balloons, helicopters, aircrafts – Space borne platforms – Sun synchronous and Geosynchronous satellites – Projectile geometry – Land coverage – Repetivity – On track and Across track stereovision capability. IRS, LANDSAT, SPOT, CANADA, JAPAN, EUROPEAN, satellite series. Sensors and its specifications, Multispectral Scanner (MSS) used in Landsat series satellites, Return Beam Vidicon (RBV) used in Landsat series satellites, Thematic Mapper (TM) used in Landsat series satellites, High Resolution Visible (HRV) Imager used in

SPOT Satellite, Linear Image Self Scanning (LISS) Camera used in IRS series, WiFS, AWiFS, MODIS, Thermal Scanners.

Image Interpretation: Introduction to image Interpretation. Basic principles of Image Interpretation, Elements of Image Interpretation. Techniques of image Interpretation and interpretation Keys Methods of searching and sequence of Interpretation. Methods of analysis and Reference levels.

Textbooks

1. Lillesand T.M. and Kiefer R.W. Remote Sensing and Image Interpretation (4th ed), John Wiley and Sons, Inc, New York, 2000
2. Fundamentals of Remote sensing- George Joseph, University Press.
3. Floyd F. Sabins, Jr. Remote Sensing – Principles and Interpretation W.H. Freeman and Company, New York, 1986.

References

- Raymond. M. Measures – “Laser Remote Chemical Analyses John Wiley and sons, 1988.
- Pandey S.N. Principles and Applications of Photogeology. Wiley Eastern, 1987.
- Drury S.A. Image Interpretation in Geology, Chapman and Hall, London, 1983.
- Arumugam. M. Engineering Physics, Anuradha Publishers, 1998.
- Janza. F.J., Blue, H.M., and Johnston, J.E., “Manual of Remote Sensing Vol. I., American Society of Photogrammetry, Virginia, U.S.A., 1975.

GI 2205: SPATIAL DATA ANALYSIS USING PYTHON PROGRAMMING

Course Objective:

The objective of the course is,

- To introduce the basic concepts of python, its data types, variables.
- To impart knowledge Arcpy module of and its operation.
- To impart knowledge on using raster, vector layers in PyQGIS
- To train in creation of maps, workflows and perform different spatial analyses.

Course Outcome:

Upon successful completion of the course the student will be able to,

- Understand basics of python and its importance in spatial data.
- Performs basic Geoprocessing tasks in ArcGIS python module.
- Load and manage different spatial data layers.
- Develop python plugins.

- Create maps and performs different kinds of spatial analyses.

Introduction to Python- The Basic elements of Python, Objects, Expressions, and Numerical Types, Variables and Assignment, IDLE, Branching Programs, Strings and Input, Iteration.

Functions, Scoping, and Abstraction- Function Definitions, Keyword Arguments and Default Values, Scoping, Specifications, Recursion, Global Variables, Modules, Files.

Testing and Debugging, Exceptions and Assertions, Classes and Object-Oriented Programming- Abstract Data Types and Classes, Inheritance, Encapsulation and Information Hiding, Mortgages, An Extended Example.

Basic Geoprocessing Scripts with ArcPy- Introduction, Using The ArcGIS Python Window, Accessing ArcPy with Python, Executing Tools from A Script, Using ArcGIS Desktop Help, Using Variables to Store Data, Accessing ArcPy Modules with Python. Managing Map Documents and Layers, Executing Geoprocessing Tools from Scripts.

PyQGIS- Introduction, Loading Layers, Using Raster Layers, Using Vector Layers, Geometry Handling, Projections Support, Using Map Canvas, Map Rendering and Printing, Expressions, Filtering and Calculating Values, Developing Python Plugins, IDE settings for writing and debugging plugins.

Creating Dynamic Maps- Introduction, QGIS Workflows- Creating an NDVI, Geocoding addresses, creating raster footprints, performing network analysis, Routing along streets, tracking a GPS, Creating a mapbook, Finding the least cost path, Performing nearest neighbor analysis, Creating a heat map, Creating a dot density map, Collecting field data, Computing road slope using elevation data, Geolocating photos on the map and Image change detection

Text Books:

1. Zelle, John M. *Python programming: an introduction to computer science*. Franklin, Beedle & Associates, Inc., 2004.
2. Pimpler, E. (2015). *Programming ArcGIS with Python Cookbook*. Packt Publishing Ltd.
3. Lawhead, J., 2017. *QGIS python programming cookbook*. Packt Publishing Ltd.

Reference Books:

1. Chaowei Yang, *Introduction to GIS Programming and Fundamentals with Python and ArcGIS*. ISBN 9781466510081.

GI 2206: REMOTE SENSING& IMAGE INTERPRETATION PRACTICALS

Course Objective:

The Objective of the course is,

- To train student in operation of spectral radiometer.
- To impart knowledge on satellite image interpretation.
- To impart knowledge with bands, indexes of satellite images.
- To impart knowledge on preparation of base maps and their interpretation.

Course Outcomes:

Upon successful completion the student will be able to,

- Read ancillary information of remotely sensed data.
- Calculate different parameters of satellite images.
- Identify the different features from imageries.
- Interpret images and prepare thematic maps.

Remote Sensing& Image Interpretation Practical

- Operating Spectral radiometer in the field to collect radiometric values from various natural and artificial features of land surface.
- Identification of various land features from the satellite images in association with topo sheets and field visits. Calculations of coverage of satellite images for different latitudes, number of swath paths for various satellites.
- Study of imagery indexes.
- Visual study of single band images.
- Visual study of multi-spectral images.
- Preparation of base maps from the topographic maps.
- Preparation of thematic maps from visual interpretation.

GI 2207: PHOTOGRAMMETRY AND PHOTO INTERPRETATION PRACTICAL

Course Objectives:

The Objective of the course to train student in,

- Calculation of scale,parallax,principal points from aerial photographs.
- Preparation of aerial mosaics.
- Identification and Interpretation of different features and phenomena from aerial photographs.

Course outcomes

Upon completion of the course the student will be able to,

- Operate Stereoscope to view aerial Photographs.
- Determine geometrical elements of aerial photograph
- Analyze the aerial photographs for physical measurements.
- Prepare aerial mosaics.
- Identify and Interpret different landforms from aerial Photographs.

Aerial Photographic Interpretation Practical

- Testing stereo vision; Use of Lens stereoscope and Mirror stereoscope;
- Use of Parallax Bar for height calculation from aerial photographs; Calculation of scale of the photographs; Marking Principal point and conjugate principal point on the stereo pairs
- Preparation of aerial mosaics; Interpretation of aerial photographs for identification of landforms of fluvial, Aeolian, glacial, coastal, volcanic and arid processes
- Identification of tectonic elements from aerial photographs.

GI 2208: MOBILE APP DESIGN

COURSE OBJECTIVES:

The objective of the course is

- To facilitate students to understand android SDK and IOS app
- To help students to gain a basic understanding of Android application development
- To inculcate working knowledge of Android Studio development tool

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to:

- Identify various concepts of mobile programming that make it unique from programming for other platforms,
- Critique mobile applications on their design pros and cons,
- Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces,
- Program mobile applications for the both Android and IOS operating system that use basic and advanced phone features
- Deploy applications to the Android marketplace for distribution.

Introduction: Introduction to Mobile Computing, Introduction to Android Development Environment Factors in Developing Mobile Applications:-+Mobile Software Engineering, Frameworks and Tools, Generic UI Development, Android User.

More on UIs: VUIs and Mobile Apps, Text-to-Speech Techniques, Designing the Right UI, Multichannel andMultimodal UIs.

Internets and Services: Android Intents and Services, Characteristics of Mobile Applications, Successful Mobile Development.

Storing and Retrieving Data: Synchronization and Replication of Mobile Data, Getting the Model Right, Android Storing and Retrieving Data, Working with a Content Provider. Communications Via Network and the Web: State Machine, Correct Communications Model, Android Networking and Web

Telephony: Deciding Scope of an App, Wireless Connectivity and Mobile Apps, Android Telephony

Notifications and Alarms: Performance, Performance and Memory Management, Android Notifications and Alarms

Graphics: Performance and Multithreading, Graphics and UI Performance, Android Graphics

Multimedia: Mobile Agents and Peer-to-Peer Architecture, Android Multimedia

Location: Mobility and Location Based Services, Android. Putting It All Together: Packaging and Deploying, Performance Best Practices, Android Field Service App.

Security and Hacking: Active Transactions, More on Security, Hacking Android.

Platforms and Additional Issues: Development Process, Architecture, Design, Technology Selection, Mobile App Development Hurdles, Testing.

GI 2209: ENVIRONMENTAL SCIENCE

(Common for all Branches)

Course Objectives:

The objectives of the Environmental Science course are to

- Familiarize the fundamental aspects of environment and the environmental management'
- Provide information of some of the important international conventions which will be useful during the future endeavors after graduation.
- Make realize the importance of natural resources management for the sustenance of the life and the society.
- Apprise the impact of pollution getting generated through the anthropogenic activities on the environment
- Provide the concept of Sustainable Development, energy and environmental management
- Impart knowledge on the new generation waste like e-waste and plastic waste.

Course Outcomes:

After completion of the course the students will have

- Knowledge on the fundamental aspects of environment and the environmental management

- The knowledge on the salient features of the important international conventions

- Understanding of the importance of natural resources management for the sustenance of the life and the society.

- Familiarity on various forms of pollution and its impact on the environment.

- Understand the elements of Sustainable Development, energy and environmental management

- Knowledge on the new generation waste like e-waste and plastic waste.

Introduction: Structure and functions of Ecosystems-Ecosystems and its Dynamics-Value of Biodiversity-impact of loss of biodiversity, Conservation of bio-diversity. Environmental indicators - Global environmental issues and their impact on the ecosystems.

Salient features of International conventions on Environment: Montreal Protocol, Kyoto protocol, Ramsar Convention on Wetlands, Stockholm Convention on Persistent Organic Pollutants, United Nations Framework Convention on Climate Change (UNFCCC),

Natural Resources Management: Importance of natural resources management-Land as resource, Land degradation, Soil erosion and desertification, Effects of usage of fertilizer, herbicides and pesticide-watershed management.

Forest resources: Use and over-exploitation, Mining and dams – their effects on forest ecosystems and the living beings.

Water resources: Exploitation of surface and groundwater, Floods, droughts, Dams: benefits and costs.

Mineral Resources: Impact of mining on the environment and possible environmental management options in mining and processing of the minerals.

Sustainable resource management (land, water, and energy), and resilient design under the changing environment.

Environmental Pollution: Local and Global Issues. Causes, effects and control measures. Engineering aspects of environmental pollution control systems.

Air pollution: impacts of ambient and indoor air pollution on human health. Water pollution: impacts water pollution on human health and loss of fresh water resources. Soil pollution and its impact on environment. Marine pollution and its impact on blue economy. Noise pollution.

Solid waste management: Important elements in solid waste management- Waste to energy concepts. Air (prevention and control of

pollution) Act, Water (prevention and control of pollution) Act and their amendments. Salient features of Environmental protection Act, 1986.

Sustainable Development: Fundamentals of Sustainable Development– Sustainability Strategies and Barriers – Industrialization and sustainable development. Circular economy concepts in waste (solid and fluid) management.

Energy and Environment: Environmental Benefits and challenges, Availability and need of conventional energy resources, major environmental problems related to the conventional energy resources, future possibilities of energy need and availability. Solar Energy: process of photovoltaic energy conversion, solar energy conversion technologies and devices, their principles, working and applications, disposal of solar panel after their usage. Biomass energy: Concept of biomass energy utilization, types of biomass energy, conversion processes, Wind Energy, energy conversion technologies, their principles, equipment and suitability in context of India.

Management of plastic waste and E-waste: Sources, generation and characteristics of various e- and plastic wastes generated from various industrial and commercial activities; Waste management practices including onsite handling, storage, collection and transfer. E-waste and plastic waste processing alternatives. E-Waste management rules and Plastic waste management rules, 2016 and their subsequent amendments.

Text Books:

1. Bharucha, Erach (2004). Textbook for Environmental Studies for Undergraduate Courses of all Branches of Higher Education, University Grants Commission, New Delhi.
2. Basu, M., Xavier, S. (2016). Fundamentals of Environmental Studies, Cambridge University Press, India
3. Masters, G. M., & Ela, W. P. (1991). Introduction to environmental engineering and science. Englewood Cliffs, NJ: Prentice Hall.
4. Enger, E. and Smith, B., Environmental Science: A Study of Interrelationships, Publisher: McGraw-Hill Higher Education; 12th edition, 2010.

Reference Books:

1. Sharma, P. D., & Sharma, P. D. (2005). Ecology and environment. Rastogi Publications
2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
3. Clark R.S. (2001). Marine Pollution, Clanderson Press Oxford (TB)
4. Jadhav, H & Bhosale, V.M. (1995). Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
5. MoEF&CC, Govt. of India, CPCB: E-waste management rules, 2016 and its amendments 2018.

6. MoEF&CC, Govt. of India, CPCB: Plastic waste management rules, 2016.

MECHANICAL ENGINEERING

Scheme of Instruction and Examination for B.tech Mechanical Engineering

(From 2020-2021 Admitted Batches)

B.Tech & B.Tech+M.Tech II Year - I Semester

Course Category	CreditsC	Course Title	Hours per week			Internal Marks	External Marks	Total Marks	
			L	T	P				
MC2101	BS	Metallurgy & Material Science	4	0	0	30	70	100	3
MC2102	PC	Theory of Machines	4	0	0	30	70	100	3
MC2103	PC	Basic Thermodynamics	4	0	0	30	70	100	3
MC2104	PC	Manufacturing Processes	4	0	0	30	70	100	3
MC2105	HSS	Managerial Economics	4	0	0	30	70	100	3
MC2106	PC	Strength of Materials Lab	0	0	3	50	50	100	1.5
MC2107	PC	M.T-I LAB	0	0	3	50	50	100	1.5
MC2108	PC	Machine Drawing	0	0	3	50	50	100	1.5
MC2109	SC	MAT Lab	1		2	50	50	100	2
MC2110	MC	Professional Ethics and Universal Human Values	0	0	0	00	100	100	0
MC2111	MC	NCC/NSS	0	0	2	-	-	-	0
Total Credits									21.5

B.Tech & B.Tech+M.Tech II Year - II Semester

Course Category	CreditsC	Course Title	Hours per week			Internal Marks	External Marks	Total Marks	
			L	T	P				
MC2201	ES	Strength of Materials-II	4	0	0	30	70	100	3
MC2202	BS/PC	Dynamics of Machinery	4	0	0	30	70	100	3
MC2203	PC	Applied Thermodynamics	4	0	0	30	70	100	3
MC2204	PC	Metal Cutting & Machine Tools	4	0	0	30	70	100	3
MC2205	PC	Design of Machine Elements	4	0	0	30	70	100	3
MC2206	PC	I.C Engines Lab	0	0	3	50	50	100	1.5
MC2207	PC	Dynamics of Machinery Lab	0	0	3	50	50	100	1.5
MC2208	SC	Computer Aided Modelling	1	0	2	50	50	100	2
MC2209	MC	Environmental Science	0	0	0	00	100	100	0

MC-2101METALLURGYANDMATERIALSCIENCE

(Effective from the batch admitted during 2020-2021-APSCHE)

Periods/week: 4 Th

Ses. : 30 Exam : 70

Examination(Theory):3hrs. Credits:3

Course Objectives:

- Give basic knowledge of science behind materials & physical metallurgy.
- Introduce the concept of structure property relations. Provide an understanding of basic structure and crystal arrangement of materials
- Knowledge about different phases & phase diagram. Knowledge about classification, applications of Ferrous & non-ferrous alloys.
- Introduction to heat treatment techniques.
- Develop intuitive understanding of the subject to present a wealth of real world engineering examples to give students a feel of how material science is useful in engineering practices.

Course Outcomes:

- Analyze the Structure of materials at different levels, basic concepts of crystalline materials like unit cell, FCC, BCC, HCP, APF (Atomic Packing Factor), Co-ordination Number etc.
- Explain the concept of phase & phase diagram & understand the basic terminologies associated with metallurgy. Construction and identification of phase diagrams and reactions.
- Understand the Fe- C Phase diagram & analyze the microstructures of different cast iron and steels.
- Explain features, classification, applications of various Ferrous & Non-Ferrous alloys.
- Understand and suggest the heat treatment process & types. Significance of properties Vs microstructure. Introduce the concept of hardenability & demonstrate the test used to find hardenability of steels.

SYLLABUS

Structure of crystalline solids: Atomic structure & bonding in solids- Crystal structures-calculation of radius, Crystallography: Classification of Crystals-Bravais lattices-Miller Indices Coordination Number and Atomic Packing Factor for different cubic structures-Imperfection in solids, point defects, Linear defects, Planar defects and Volume defects-Concept of Slip & twinning.

Phase diagrams: Basic terms- phase rule- Lever rule & free energy of phase mixtures cooling curves-Phase diagram & phase transformation- construction of phase diagrams-binary phase diagrams -Brass, Bronze, Al-Cu and AlSi phase diagrams-Invariant reactions, eutectic, peritectic, eutectoid,

peritectoid, metatectic & monotectic reactions, Iron-carbon phase diagram & microstructures of plain carbon steel & cast iron

Heat treatment: Heat treatment of steel- Annealing, and its types, normalizing, hardening, tempering, martempering, austempering- TTT diagrams, drawing of TTT diagram, TTT diagram for hypo- & hypereutectoid steels, effect of alloying elements, CCT diagram- Martensitic transformation, nature of martensitic transformation- Surface hardening processes like case hardening, carburizing, cyaniding, nitriding Induction hardening, hardenability, Jominy end-quench test, Age hardening of Al & Cu alloys Precipitation Hardening

Engineering Alloys: Properties, composition, microstructure and uses of low carbon, mild medium & high carbon steels. stainless steels, high speed steels, Hadfield steels, tool steels- Cast irons, gray CI, white CI, malleable CI, SC iron- The light alloys- Al & Mg & Titanium alloys- Copper & its alloys: brasses & bronzes- super alloys, Smart materials- Nanomaterials.

Composite Materials: Classification of composite materials, dispersion strengthened, particle reinforced and fiber reinforced composite laminates properties of matrix and reinforcement materials and structural applications of different types of composite materials.

Nano-Materials- Introduction and Applications. Powder Metallurgy: Powder Metallurgy process, Preparation of powders, Characteristics of Metal powders, mixing, compacting, sintering, Applications of Powder Metallurgy. Forming and shaping of plastics- Extrusion and Injection moulding. Ferrous And Non -Ferrous Materials: Composition, properties and application of ferrous and Non ferrous metals and their alloys. Brief study of cast iron, steels, copper and aluminum

Text Books:

1. "Materials Science & Engineering- An Introduction", William D. Callister Jr. Wiley India Pvt. Ltd. 6th Edition, 2006, New Delhi.

2. Physical Metallurgy, Principles & Practices", V Raghavan. PHI 2nd Edition 2006, New Delhi.

References

1. Introduction to Physical Metallurgy by Sidney HAVNER Tata McGraw-Hill Education 1997

2. Materials Science And Engineering: A First Course By V. Raghavan PHI 5th Edition 2011, New Delhi

MC-2102 THEORY OF MACHINES

Periods/week: 4 Th

Ses. : 30 Exam : 70

Examination(Theory):3hrs. Credits: 3

COURSE OBJECTIVES:

- To know the basics of Machine and mechanism.
- To know the degrees of freedom of machine
- Kinematic pairs and kinematic inversion
- To know the Kinematic analysis of mechanism and cams
- ok now velocity polygons, instantaneous centre method.
- To know the synthesis of mechanism by graphical method
- To know lower pair mechanism.
- To know the Friction and motion
- To understand the drive mechanism
- To understand the Dynamic Force Analysis.
- To understand the governors
- Static and dynamic analysis

COURSE OUTCOMES:

- Understanding of machine and mechanism.
- How the static and dynamic strength parameters for a material are measured in standardized tests.
- Ability to draw the kinematic analysis by displacement, velocity and acceleration diagrams.
- Understanding the geometric analysis of various mechanism by instantaneous centre, Kennedy's theorem.
- Understanding the four bar mechanism, slider crank mechanism
- Grashof's criterion of movability and synthesis of mechanism by graphical method.
- Understanding the lower pair mechanism by straight line motion mechanism, pantographs, engine indicator mechanisms, Automobile steering mechanism and Hooke's joint.
- Understanding various types of friction and friction on bearings and clutches.
- Understanding various drives like gears, gear trains,
- Understanding D'Alembert's principle, Dynamically equivalent system and Turning-moment diagrams.
- Understanding principle of governors its types and Sensitiveness of a governor

SYLLABUS

Mechanisms and Machines: Introduction; Mechanism and machine; Rigid and resistant bodies; Link; Kinematic pair; Degrees of freedom; Classification of kinematic pairs; Kinematic chain; Linkage, mechanism and structure; Mobility of mechanisms; The four-bar chain; Mechanical advantage; Transmission angle; The slider-crank chain; Double slider crank chain; Miscellaneous mechanisms.

Velocity Analysis: Introduction; Absolute and relative motions; Vectors; Addition and subtraction of vectors; Motion of a link; Four-link mechanism; Velocity images; Angular velocity of links; Velocity of rubbing; Slider-crank mechanism; Crank and slotted lever mechanism; Algebraic methods;

Instantaneous center (I-center); Kennedy's theorem; Locating I-centers; Angular velocity ratio theorem; centrode.

Acceleration Analysis: Introduction; Acceleration; Four-link mechanism; Four-link mechanism; Acceleration of intermediate and offset points; Slider-crank mechanism; Coriolis acceleration component; Crank and slotted lever mechanism; Algebraic methods; Klein's construction; Velocity and acceleration from displacement-time curve.

Lower Pairs: Introduction; Pantograph; Straight line mechanisms; Engine indicators; Automobile steering gears; Types of steering gears; Hooke's joint; Double Hooke's joint.

Friction: Introduction; Kinds of friction; Laws of friction; Coefficient of friction; Inclined plane; Screw threads; Wedge; Pivots and collars; Friction clutches; Rolling friction; Antifriction bearings; Greasy friction; Greasy friction at a journal; Friction axis of a link; Film friction; Mitchell thrust bearing.

Dynamic Force Analysis: Introduction; D'Alembert's principle; Equivalent offset inertia force; Dynamic analysis of four-link mechanism; Dynamic analysis of slider-crank mechanism; Velocity and acceleration of piston; Angular velocity and angular acceleration of connecting rod; Engine force analysis; Turning moment on crankshaft; Dynamically equivalent system; Inertia of the connecting rod; Inertia force in reciprocating engines (Graphical method); Turning-moment diagrams; Fluctuations of energy; Flywheels.

Governors: Introduction; Types of governors; Watt governor (simple conical governor); Porter governor; Proell governor; Hartnell governor; Hartung governor; Wilson-Hartnell governor (radial-spring governor); Pickering governor; Spring-controlled gravity governor; Inertia governor; Sensitiveness of a governor; Hunting; Isochronism; Stability; Effort of a governor; Power of a governor; Controlling force.

Text Book:

1. Theory of Machines by R.S. Khurmi & J.K. Gupta

Reference books:

1. Theory of Machines by Thomas Bevan.
2. Theory of Machines by S.S. Rattan.

MC-2103 BASIC THERMODYNAMICS

Periods/week: 4 Th Ses. : 30 Exam : 70
Examination (Theory): 3 hrs. Credits: 3

OBJECTIVES COURSE

- To educate students about the behavior of real gases and the significance of ideal gas theory
- To educate the students about the properties of ideal gas and their relationship

- To familiarize the students about the behavior of ideal gases under heating, cooling, compression and expansion processes
- To educate the students about the working principle of combustion engines (internal and external) and their cycles such as Otto, Diesel, Atkinson, Ericson, Brayton, etc., and their comparison

OUTCOMES COURSE

- Students realize the practical importance of ideal gas theory and the use of real gases in combustion engines such as IC Engines and Gasturbines
- Students are able to calculate the properties of the gases such as internal energy, enthalpy and entropy.
- Students are able to estimate the losses which occur during operation of the heat engines, and their maximum possible operating efficiencies under STP conditions.
- Students can estimate the maximum work-output delivered by the heat engines and maximum work consumed by the reversed heat engines

SYLLABUS

Introduction: Basic concepts; Thermodynamics systems; Micro & Macro systems; Homogeneous and heterogeneous systems; Concept of continuum; Pure substance; Thermodynamic equilibrium; State; Property; Path; Process; Reversible and irreversible cycles; Work; Heat; Point function; Path function; Heat transfer.

Zeroth law of thermodynamics; Concept of equality of temperatures- Joule's experiments- First law of thermodynamics- Isolated systems and steady flow systems- Specific heats at constant volume and pressure- Enthalpy- First law applied to flow systems- Systems undergoing a cycle and change of state- First law applied to steady flow processes- Limitation of first law of thermodynamics.

Perfect gas laws- Equation of state- Universal gas constant, various non-flow processes- Properties of end states- Heat transfer and work transfer- Change in internal energy- throttling and free expansion- Flow processes- Deviations from perfect gas model- Vanderwall's equation of state- Compressibility charts- Variable specific heats.

Second law of thermodynamics- Kelvin Planck statement and Clausius statement and their equivalence, Corollaries- Perpetual motion machines of first kind and second kind- Reversibility and irreversibility- Cause of irreversibility- Carnot cycle- Heat engines and heat pumps- Carnot efficiency- Clausius theorem- Clausius inequality- Concept of entropy- Principles of increase of entropy- Entropy and disorder.

Availability and irreversibility- Helmholtz function and Gibbs function- Availability in steady flow- Entropy equation for flow process- Maxwell's equations- Tds relations- Heat capacities.

I.C. engines: classification-comparison of two stroke and four stroke engines-comparison of S.I. and C.I. engines-Air cycles-Otto, Diesel, Dual, Stirling, Ericson and Atkinson cycles and their analysis- Valve timing and port timing diagrams-Efficiencies-air standard efficiency, indicated thermal efficiency, brake thermal efficiency, mechanical efficiency, volumetric efficiency and relative efficiency-Testing and performances of I.C. engines

Combustion in I.C. Engines: S.I. engines- Normal combustion and abnormal combustion-Importance of flame speed and effect of engine variables-types of abnormal combustion pre-ignition and knock, Fuel requirements and fuel rating, anti-knock additions.

Text Books:

1. Engineering Thermodynamics, by P.K. Nag, Tata McGraw-Hill Publications Company.
2. Applied Thermodynamics- I by R. Yadav, Central Book House.
3. Engineering Thermodynamics by K. Ramakrishna, Anuradha agencies.
4. I.C. Engines by V. Ganesan
5. I.C. Engines, by Mathur and Sharma

References Books:

1. Engineering Thermodynamics by Rathakrishnan, Prentice-Hall India.
2. Engineering Thermodynamics by Y.V.C. Rao.
3. Thermal Engineering by R.K. Rajput, S. Chand & Co.
4. Engineering Thermodynamics Work and Heat Transfer, by G.F.C Rogers and Y.R. Mayhew, ELBS publication
5. Engineering Thermodynamics by Zemansky.

MC-2104 MANUFACTURING PROCESSES

Periods/week: 4 Th Ses. : 30 Exam : 70
Examination (Theory): 3 hrs. Credits: 3

Course Objectives:

- To emphasize the importance of manufacturing sciences in the day-to-day life.
- To study the principles of manufacturing processes like casting.
- To acquaint gating design for different metal casting processes
- To impart knowledge about principles and criteria of yielding during forming of metals,

- To inculcate the principle, thermal and metallurgical aspects of welding processes.
- To impart knowledge about analysis of common and newer welding techniques.

Course Outcomes: At the end of the course the student will be able to-

- Designate casting process, interpret pattern, core and mold making.
- Evaluate gating system design and acquire knowledge on various furnaces.
- Elucidate various bulk metal forming processes and categorize various sheet metal operations.
- Study the welding process behavior for common and newer welding techniques
- Analyze different casting, forming and weld defects.
- Interpret casting, forming and welding processes and their applications.

SYLLABUS

Manufacturing concepts; Product cycle; Job, batch and mass production; Primary and secondary manufacturing processes; Principle of metal casting; Terminology; Pattern; Types; Allowances; Materials; Core boxes; Selection; Testing and preparation of moldingsands; Molding tools and equipment; Machine molding; Core making; Mechanism of Solidification: Design Principles of Gates, Runners and Risers. Melting and pouring the metal; Cupola and Electric furnaces, Special casting processes: Shell mold casting; Investment casting; Permanent mould casting; Casting defects.

Formability of metals: Nature of plastic deformation, hot and cold working of metals, mechanics of metal forming; Rolling: principle, types; roll size; rolling pressure distribution and rolling force. Forging processes: principle of forging, forging techniques; forging tools and presses; forging pressure distribution and forging force; Automation of forging; Swaging; Drawing; Extrusion and its types.

Sheet metal forming: Mechanics of sheet metal working, blanking, piercing, notching, bending, stamping, stretch forming, metals pinning, embossing and coining. Different types of presses and dies, Die design. Energy rate forming processes, Principles of explosive forming and electromagnetic forming

Welding: Theory of fusion and pressure welding, flow and distribution of heat in welding, Principles and processes of arc welding (SMAW, GTAW, GMAW, FCAW, PAW, SAW); Welding equipment; Weld position and fixtures; Oxyacetylene welding; Flame cutting; Brazing and soldering;

Principle of resistance welding; Types of resistance welds; Seam welding; Projection welding; Resistance butt welding; different types of solid state welding processes; Weld inspection and testing.

Text Book:

1. Process and Materials of Manufacture (4th Edition) by Roy A. Lindberg, Prentice-Hall of India Private Limited.

2. Manufacturing Technology-Foundry, Forming and Welding by P.N. Rao, Tata McGraw-Hill Publishing Company.

Reference Books:

1. Manufacturing Engineering & Technology by Kalpak Jain, Addison Wesley Edition.

2. Materials and Processes in Manufacturing by DeMargo, Black and Kohsen, Prentice Hall of India.

3. Principles of Metal Casting by Hein and Rosenthal, Tata McGraw Hill India.

4. Mechanical Metallurgy by George E. Dieter, 3rd Edition, McGraw Hill Education, Indian Edition

MC-2105 MANAGERIAL ECONOMICS

(Common for all Branches)

Periods/week: 4 Th

Ses. : 30 Exam: 70

Examination (Theory): 3 hrs. Credits: 3

Course Objectives:

- To bring about an awareness about the nature of Managerial Economics and its linkages with other disciplines.
- To understand the Micro and Macro Environment of Business.
- To familiarize the prospective engineers with the concepts and tools of Managerial Economics with an objective to understand the real world of business.

Course Outcomes:

After completion of the course, student will be able to:

- Understand the various economic activities in business and industry.
- Analyse the real world business problems.
- Make optimal business decisions for the effective and efficient management of Organisations.

SYLLABUS

Significance of Economics and Managerial Economics:

Economics: Definitions of Economics- Wealth, Welfare and Scarcity definitions Classification of Economics- Micro and Macro Economics.

Managerial Economics: Definition, Nature and Scope of Managerial Economics, Differences between Economics and Managerial Economics, Main areas of Managerial Economics, Managerial Economics with other disciplines.

Demand and Utility Analysis: Demand - Definition, Meaning, Nature and types of demand, Demand function, Law of demand - Assumptions and limitations. Exceptional demand curve.

Elasticity of demand - Definition, Measurement of elasticity, Types of Elasticity (Price, Income, Cross and Advertisement), Practical importance of Price elasticity of demand, Role of income elasticity in business decisions, Factors governing Price Elasticity of demand.

Utility Analysis: Utility- Meaning, Types of Economic Utilities, Cardinal and Ordinal Utility, Total Utility, Marginal Utility, The law of Diminishing Marginal Utility and its Limitations.

Theory of Production and Cost analysis: Production - Meaning, Production function and its assumptions, use of production function in decision making;

Cost analysis - Nature of cost, Classification of costs - Fixed vs. Variable costs, Marginal cost, Controllable vs. Non - Controllable costs, Opportunity cost, Incremental vs. Sunk costs, Explicit vs. Implicit costs, Replacement costs, Historical costs, Urgent vs. Postponable costs, Escapable vs. Unavoidable costs, Economies and Diseconomies of scale.

Market Structures : Definition of Market, Classification of markets; Salient features or conditions of different markets - Perfect Competition, Monopoly, Duopoly , Oligopoly, Importance of kinked demand curve ;Monopolistic Competition.

Pricing and Business Cycles: Pricing Analysis : Pricing – Significance; Different Pricing methods- Cost plus pricing, Target pricing, Marginal cost pricing, Going -rate pricing, Average cost pricing, Peak load pricing , Pricing of joint Products, Pricing over the life cycle of a Product, Skimming pricing Penetration pricing, Mark- up and Mark- down pricing of retailers.

Business cycles - Definition, Characteristics, Phases, Causes and Consequences; Measures to solve problems arising from Business cycles.

Text Books:

1. Sankaran,S., Managerial Economics, Marghan Publications, 2015, Chennai.
2. Aryasri, A.R., Managerial Economics and Financial Analysis, MC Graw Hill Education, New Delhi,2015.

Reference Books:

1. Dwivedi, D.N., Managerial Economics, Vikhas Publishing House Pvt. Ltd. 6th Edition, New Delhi,2004.

2. Dewett, K.K., Modern Economic Theory, S.Chand & Company Ltd., New Delhi, 2005.

MC-2106 STRENGTH OF MATERIALS LAB

(Effective from the batch admitted during 2020-2021-APSCHE)

Periods/week:3Lab Ses. :50 Exam :50

Examination(Practical):3hrs.

Credits:1.5

Course Objectives:

- To understand the different types of loading and measure the loads.
- To understand the material properties of different materials and the ways of finding them.
- To understand the bulking property and fineness of sand grains and the methods of finding them.

Course Outcomes:

- Ability to identify different types of loads and measure them.
- Ability to measure material properties of different materials using different methods.
- Ability to measure bulking property and fineness of sand grains.

List of Experiments:

1. To study the stress strain characteristics (tension and compression) of metals by using UTM.
2. To study the stress strain characteristics of metals by using Hounsfield Tensometer.
3. Determination of compression strength of wood.
4. Determination of hardness using different hardness testing machines- Brinell's, Vickers and Rockwell's.
5. Impact test by using Izod and Charpy methods.
6. Deflection test on beams using UTM.
7. Tension shear test on M.S. Rods.
8. To find stiffness and modulus of rigidity by conducting compression tests on springs.
9. Torsion tests on circular shafts.
10. Bulking of sand.
11. Punch shear test, hardness test and compression test by using Hounsfield tensometer.
12. Sieve Analysis and determination of fineness number.

MC-2107 MANUFACTURING TECHNOLOGY LAB-I

(Effective from the batch admitted during 2020-2021-APSCHE)

Periods/week:3Lab Ses.: 50 Exam : 50
Examination(Practical):3hrs. Credits: 1.5

Course Objectives:

- To appreciate the tools, materials, machines used for making products in Foundry, Welding and Machine shop.
- Be aware of the work and tool material relationship in machine shop.
- To recognize the different welding techniques for different materials.
- To realize the various moldings and cores used for making of moulds and cores.

Course Outcomes:

They have

- Ability to prepare molds, cores for a given component.
- Capability to complete different joints, welds for a given component by GAS and ARC welding processes.
- Aptitude to make taper turning, thread cutting and offset turning on different materials by Lathe machine.
- Skill to make spur gears, keyways etc. by using different machines.

LIST OF EXPERIMENTS:

Use of basic tools and operations of the following trades.

S.No.	Trade	No. of exercises
1.	Foundry	3
2.	Welding	2
3.	Lathe Step and taper turning	1
	Thread cutting Offset turning	11
4.	Milling	1 (Spur gear)
5.	Shaper	1

6. Cylindrical grinding, Surface grinding, Planing, Slotting and Capstan lathe (only demonstration in one class for the entire batch of students).

7. Disassembling and assembling of *
- Machine Tool (Lathe)
 - I.C. engine
 - Pump
 - Gearbox

*Not for examination

MC-2108 MACHINE DRAWING

Periods/week:3Lab Ses.:50 Exam :50
Examination(Practical):3hrs. Credits:1.5

Course Objectives:

The objectives of this course are

- To learn basic conventions adopted in machine drawing and production drawing.
- To familiarize the machine elements such as screw fasteners, keys, cotter joints and riveted joints used in design.
- To provide the knowledge of machine elements such as couplings, bearings, pipe joints used in design.
- To understand the assembly drawings of engine parts and machine parts.
- To impart the knowledge of production drawing.

Course Outcomes:

- Comprehend the basic conventions needed for machine drawing.
- Understand the geometric dimensioning and tolerances used in industry.
- Execute the drawings of various mechanical components with appropriate proportions.
- Design the assembly drawings from part drawings.
- Develop the part drawings from their assembly.

SYLLABUS:

Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs and ribs. Limits, Tolerances and Fits-Indication of surface roughness, preparation of process sheets. Screw threads and Screw Fastenings using standard Empirical formulae. Riveted joints, Keys, Cotter-joints, Pin-joints.

Shaft couplings: Box and split muff couplings, Flanged, Flexible, Universal and Oldham couplings, shaft bearings, Brackets and Hangers, Pipe joints. Orthogonal views and Sectional views of machine parts.

Introduction to Production drawing, Component drawing, Assembly drawing, Machine shop drawing, Pattern-shop drawing, Sheet metal drawing.

Assembly drawing of Stuffing box, Connecting rod, Screws jack, Bench Vice, Plummer block, Tailstock.

Production drawings of Spur, Bevel and Helical gears, swivel bracket, main spindle, crank, revolving centre, jigs and fixtures.

TextBooks:

1. MachineDrawing,byN.D.Bhatt,CharotalPublishingHouse.
2. EngineeringDrawing,byA.C.Parkinson,WheelerPublishing.
3. Production Drawing by K.L. Narayana, P. Kannaiah, K. Venkata Reddy, New Age International Publishing

Reference:

1. Machine Drawing by K.L. Narayan, P. Kannaiah and K. Venkata Reddy, New Age

MC-2109MATLAB (Skill Oriented Course)

(Effective from the batch admitted during2020-2021-APSCHE)

Periods/week:1 Th 2Lab Ses.:50 Exam :50
Examination(Practical):3hrs. Credits: 2

Course Objective:

The objectives of this course are

- To Impart the knowledge to the students with MATLAB software.
- To provide a working introduction to the Matlab technical computing environment.
- To introduce the use of a high-level programming language-Matlab.

Course Outcomes:

At the end of the course the student shall be able to (Using MATLAB programming Language)

- Perform matrix operations.
- Plot two dimensional, three dimensional graphs.
- Perform the linear and non-linear regression analysis for the given data.
- Determine the steady state, unsteady state solutions of ordinary differential equations.
- Compute two and three dimensional integrals and solve unconstrained optimization problems.

LIST OF EXERCISES:

1. To study the basic MATLAB commands like representing arrays, matrices, reading elements of a matrix, row and columns of matrices, Random numbers.
2. To determine Eigen values and Eigen vectors of a matrix.

3. To plot the 2 Dimensional and 3 Dimensional curves
4. To develop the equations for Linear Regression, interpolation, polynomial regression and Nonlinear regression
5. To develop the forward kinematics simulation in Matlab.
6. To perform the Air Standard Cycle Simulation in Matlab.
7. To solve the problems in Vibrations and Dynamics
8. To fit curves to data using regression.
9. To solve the problems of Genetic Algorithm in Matlab.

MC-2110 PROFESSIONALETHICS AND UNIVERSAL HUMAN VALUES

(Effective from the batch admitted during 2020-2021-APSCHE)

(Common for all Branches)

Periods/week:0 Ses. :00 Exam :100
Examination(Theory):3hrs. Credits:0

Course Objectives:

The objective of the course is Six fold:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- This course will illuminate the students in the concepts of laws and its applicability to engineers
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection, Development of commitment and courage to act and also enable the students to imbibe and internalize the Values and Ethical Behaviour in the personal and professional lives
- To enable the students to imbibe the Values and Ethical Behavior in the personal and Professional lives
- The students will learn the rights and responsibilities Individual, employee, team member and a global citizen

Course Outcomes:

By the end of the course Student will be able to:

- Grasp the meaning of the concept – Law and also Get an overview of the laws relating to Engineers and also Apprehend the importance of being a law abiding person and They would have better critical ability
- Self-explore by using different techniques to live in harmony at various levels.

- Analyze themselves and understand their position with respect to the moral and ethical character needed for a successful and satisfactory work life.
- Students are expected to become more aware of themselves and their surroundings (family, society, nature)
- They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
- They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society)

SYLLABUS

Need, Basic Guidelines, Content and Process for Value Education

Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation - as the process for self-exploration, Continuous Happiness and Prosperity - A look at basic Human Aspirations, Right understanding, Relationship and Physical Facility - the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels. Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking, Include practice sessions and case studies.

Understanding Harmony in the Human Being - Harmony in Myself!

Understanding human being as: a co-existence of the sentient 'I' and the material 'Body', the needs of Self ('I') and 'Body' - happiness and physical facility, the Body as an instrument of 'I' (I being the doer, seer and enjoyer), the characteristics and activities of 'I' and harmony in 'I', the harmony of I with the Body: *Sanyam* and Health; correct appraisal of Physical needs, meaning of Prosperity in detail, P to ensure *Sanyam* and Health, Include practice sessions and case studies.

Understanding Harmony in the Family and Society - Harmony in Human – Human Relationship Understanding values in human-human relationship: meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship, the meaning of Trust; Difference between intention and competence, the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship, the harmony in the society (society being an extension of family), Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human

Goals, Visualizing a universal harmonious order in society- Undivided Society, Universal Order from family to world family, Include practice sessions and case studies.

Understanding Harmony in the Nature and Existence - Whole existence as Coexistence Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature recyclability and self-regulation in nature, Understanding Existence as Co-existence of mutually interacting units in all – pervasive space, Holistic perception of harmony at all levels of existence, Include practice sessions and case studies.

Concept of Law and Law of Torts

Understanding Essentials of a Valid Contract and the basics of contract law protecting rights and obligations, Introduction to the Law of Torts and the basics to protect oneself and the company Law affecting the Workplace Employers Responsibilities/Duties Hiring Practices, Introduction to Intellectual Property Law, Professional Code of Conduct for Engineers, Relationship between Law and Ethics, Include practice sessions and case studies.

Implications of the above Holistic Understanding of Harmony on Professional Ethics

Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations, Include practice sessions and case studies.

Text Books

1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. R R Gaur, R Asthana, G P Bagaria, "Teachers' Manual for A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2
3. R. Subramanian, "Professional Ethics", Oxford University Press.

4. S.B. Srivasthva, "Professional Ethics & Human Values", SciTech Publications (India) Pvt. Ltd. New Delhi.

5. D.R. Kiran, "Professional Ethics & Human Values", TATA Mc Graw Hill Education.

6. Saroj Kumar, "Business Law" and Avtar Singh, "Law of Contract"

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantik, 1999.

2. A. N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, 2004.

3. The Story of Stuff (Book), Mohandas Karamchand Gandhi "The Story of My Experiments with Truth", E. F. Schumacher. "Small is Beautiful", Slow is Beautiful – Cecile Andrews, J. C. Kumarappa "Economy of Permanence", Pandit Sunderlal "Bharat Mein Angreji Raj" and Dharampal, "Rediscovering India"

4. G. K. Kapoor, "Business Law" and Sen & Mitra, "Business & Commercial Laws" and Calvin Frank Allen, "Business law for Engineers"

5. Hilgard, E. R.; Atkinson, R. C. & Atkinson, R.L. (1975). *Introduction to Psychology*. 6th Edition. New Delhi: Oxford and IBH Publishing Co. Pvt. Ltd.

6. Govindarajan, M.; Natarajan, G. M. & Senthilkumar, V.S. (2013). *Professional Ethics & Human Values*. Prentice Hall: New Delhi

7. Gogate, S. B. (2011). *Human Values & Professional Ethics*. Vikas Publishing: New Delhi.

8. Charles E Harris Jr., Michael S Pritchard, Michael J Rabins, "Engineering Ethics, Concepts Cases: 4e, Cengage learning, 2015.

9. Caroline Whitbec, " Ethics in Engineering Practice & Research: 2e, Cambridge University Press 2015.

MC-2111NSS/NCC

(Effective from the batch admitted during 2020-2021-APSCHE)

Periods/week: 2 Lab

Ses. : 00 Exam : 00

Examination (Practical):

Credits: 0

B.TECH & B.TECH+ M.TECH MECHANICAL ENGINEERING II YEAR II SEMESTER

(Admitted batch 2020-2021)

MC-2201STRENGTH OF MATERIALS-II

(Effective from the batch admitted during 2020-2021-APSCHE)

Periods/week: 4 Th

Ses. : 30 Exam : 70

Examination (Theory): 3 hrs. Credits: 3

COURSE OBJECTIVES:

- To enrich the student on the concept of fixed beams with uniform Moment of inertia as well as Non uniform Moment of inertia both under stability of beam supports and under sinking & rotation of the supports

- To make the student capable of evaluating the deflection, slope and stress of the fixed beam with uniform Moment of inertia as well as Non uniform Moment of inertia both under the stability of beam supports and under the sinking & rotation of the supports.

- To make the student understand the concept of continuous beams with uniform Moment of inertia as well as Non uniform Moment of inertia both under stability of supports as well as sinking of supports

- To make the student capable of evaluating the support moments and support reactions of the continuous beam with uniform Moment of inertia as well as Non uniform Moment of inertia.

- To make the student understand the concept of vertical compression loading on an engineering beam with four different end conditions.

- To make the student understand the concept of vertical compression loading acting on an engineering beam which is having initial curvature.

- To make the student understand the concept of eccentric vertical compression loading acting on an engineering beam with four different end conditions.

- To make the student understand the concept of vertical compression loading acting along with central point load acting perpendicular to the axis of the engineering beam with four different end conditions.

- To make the student understand the concept of vertical compression loading acting along with Non central point load acting perpendicular to the axis of the engineering beam with four different end conditions.

- To make the student understand the concept of vertical compression loading acting along with uniformly distributed load acting perpendicular to the axis of the engineering beam with four different end conditions.

- To make the student understand the concept of curved beams having different cross sections along with calculation of bending stress at any point across the cross section of the curved beam.

- To make the student understand the concept of circular rotating discs having uniform thickness and make him capable of calculating the stress on any point of the circular rotating disc.

- To make the student understand the concept of circular rotating discs having uniform strength and make him capable of modeling the thickness of the circular rotating disc.
- To make the student understand the concept of circular rotating cylinder having uniform thickness and make him capable of calculating the stress at any point of the circular rotating disc.
- To make the student understand the concept of thick cylinder under different pressure conditions so that the student can evaluate radial stress and circumferential stress at any radius of the thick cylinder.
- To make the student understand the concept of compound cylinder under different pressure conditions so that the student can evaluate radial stress and circumferential stress at any radius of the compound cylinder.
- To make the student capable understanding Bending axis, shear centre and unsymmetrical bending and make him capable of evaluating the stresses at any point on a both symmetrical and unsymmetrical sections
- To make the student understand the energy methods and Castigliano's theorem-1 & 2 and their application for cantilever beams and simply supported beams.

Course Outcomes:

- The student is capable of evaluating an already existing fixed beam with uniform Moment of inertia as well as Non uniform Moment of inertia which is under different loading conditions and with different support conditions and can even able to design a fixed engineering beam for any loading conditions.
- The student is capable of evaluating an already existing continuous beam with uniform Moment of inertia as well as Non uniform Moment of inertia which is under different loading conditions and with different support conditions and can even able to design a continuous engineering beam for any loading conditions
- The student is capable of evaluating any engineering column or strut under different end conditions and under different specified variable loading conditions as mentioned under objectives
- The student is capable of evaluating curved beams of different cross sections and can able to evaluate the stresses across the cross-sections of the curved beam.
- The student is capable of calculating the radial stress and circumferential stress for rotating circular disc (both hollow and solid) of uniform thickness.
- The student is capable of modeling the thickness of circular rotating disc having uniform strength.

- The student is capable of calculating the radial stress and circumferential stress for rotating circular cylinder of uniform thickness.
- The student is capable understanding Bending axis, shear centre and unsymmetrical bending and is capable of evaluating the stresses at any point on a both symmetrical and unsymmetrical sections
- The student is capable of calculating the radial and circumferential stress for both thick and compound cylinders under different pressurized conditions.
- The student is capable of using different energy methods for evaluating the deflection and slope of simply supported beams and cantilever beams

SYLLABUS

Fixed Beams: Fixing moments for a fixed beam of uniform Moment of Inertia, Effect of sinking support, slope and deflection.

Continuous beams: Analysis of continuous beam, Reactions at the supports, Effect of sinking of supports.

Energy Methods-Castigliano's theorems I

Columns and Struts: Columns with one end free and the other fixed, Both ends fixed, One end fixed and other hinged, Limitation of Euler's formula, Column with initial curvature, Column carrying eccentric load, Laterally loaded columns with Central point load

Bending of Curved Bars: Stresses in bars of circular, rectangular and trapezoidal sections.

Stresses due to rotation: Wheel rim, disc of uniform thickness, disc of uniform strength.

Thick cylinders subjected to internal and external pressure and compound cylinders.

Text Books:

1. Analysis of Structures, Vol.1, 1993 edition, by Vazirani and Ratwani.
2. Chapter VI from Advanced Topics in Strength of Materials, by Prof. L.B. Shah and Dr. R.T. Shah.

References:

1. Strength of Materials, by Timoshenko.
2. Analysis of structures by Prof V.N. Vazirani & Dr M. Ratwani & Dr S.K. Duggal
3. Strength of Materials by Dr Sadhu Singh

MC- 2202 DYNAMICS OF MACHINERY

(Effective from the batch admitted during 2020-2021-APSCHE)

Periods/week: 4 Th Ses. : 30 Exam : 70
Examination(Theory):3hrs. Credits: 3

COURSE OBJECTIVES:

The main objectives of the course are• To provide the competency about the gyroscopic concepts in various vehicles. • To impart the knowledge of cam profiles for desired motion. • To make the students visualize the gear working, gear contact & interference. • To comprehend different speed reductions of gear trains. • To understand various unbalanced systems & their balancing techniques. • To familiarize the various types of vibrations and their response.

COURSE OUTCOMES:

At the end of the course, the student will be able to

- Analyze the gyroscopic effects on different vehicles.
- Analyze cams for producing a desired motion and cams with specified contours.
- Analyze the kinematics of toothed gears
- Calculate the speeds and torques of gears used in various gear trains.
- Comprehend the balancing of the moving parts (rotating & reciprocating) statically and dynamically.
- Determine the dynamic response of various vibrating systems.

SYLLABUS

Gyroscopic Couple and Precessional Motion: Precessional and angular motion- gyroscopic couple- effect of gyroscopic couple on an aero plane and on a naval ship, stability of a four wheel vehicle moving in a curved path, stability of a two-wheel vehicle taking a turn.

Cams: Classification of followers and cams- Definitions- Motions of the follower- Uniform velocity-Simple harmonic motion-Uniform acceleration and retardation- Displacement-Velocity and acceleration diagrams. Construction of cam profiles- Cam with knife edged follower and roller follower- Cams with specified contours-Tangent cam with roller follower-Circular arc cam with flat faced follower.

Toothed gearing: Classification of toothed wheels, technical terms, conditions for constant velocity ratio of toothed wheels- Law of gearing- Velocity of sliding of teeth, forms of teeth-Length of contact, arc of contact, interference in involute gears, minimum number of teeth required on pinion to avoid interference- Methods of avoiding interference- Helical gears, Spiral gears-Efficiency of spiral gears.

Gear Trains: Types of gear trains- Simple, compound, reverted and epicyclic gear trains-Velocity ratio of epicyclic gear train- Tabular method-Algebraic method- Torques and tooth loads in epicyclic gear trains.

Balancing of Rotating and Reciprocating Masses: Balancing of a single rotating mass in the same plane and by two masses in different planes, balancing of several masses revolving in the same plane-Balancing of several masses revolving in different planes-Primary and secondary unbalanced forces of reciprocating masses, Partial balancing of unbalanced primary forces in a reciprocating engine, Partial balancing of locomotives-Effect of partial balancing of reciprocating parts of two cylinder locomotives- Variation of tractive force, Swaying couple and hammer blow-Balancing of primary and secondary forces in multi cylinder in-line engines-Direct and reverse crank-Balancing of V-Engines.

Vibrations: Definitions-Types of vibrations-Natural frequencies of free longitudinal vibrations of systems having single degree of freedom-Equilibrium method-Energy method and Rayleigh's method. Frequency of damped vibration and forced vibration with damping-Magnification factor or dynamic magnifier.

Transverse and Torsional Vibrations : Natural frequency of free transverse vibrations due to point load and uniformly distributed load acting over a simply supported shaft- Transverse vibrations for a shaft subjected to number of point loads- Energy method-Dunkerley's method, Critical speed of a shaft. Natural frequency of free torsional vibrations- Free torsional vibrations of single rotor system, two rotor system, three rotor system and gear system.

Text Book:

1. Theory of Machines by S.S. Rattan.
2. Theory of Machines by R.S. Khurmi & J.K. Gupta.

Reference books:

1. Theory of Machines by Thomas Bevan.

MC- 2203 APPLIED THERMODYNAMICS

(Effective from the batch admitted during 2020-2021-APSCHE)

Periods/week: 4 Th Ses. : 30 Exam : 70
Examination(Theory):3hrs. Credits:3

COURSE OBJECTIVES:

- To gear the student with basic principles of steam properties.
- To prepare the student for industrial application of steam.
- The student is taught to design the steam equipment so that R & D in industry is improved.

COURSE OUTCOMES:

- The student gets complete knowledge of steam and its properties.
- The student learns the complete calculation procedures for designing steam turbines, steam condensers, nozzles etc. used in thermal

power plants, steam engines, water turbines and many other industrial applications.

- The student is prepared to work in industry immediately after his course

SYLLABUS

Properties of Pure Substance: Definition of pure substance, phase change of a pure substance, p-T (Pressure-Temperature) diagram for a pure substance, p-V-T (Pressure-Volume-Temperature) surface, phase change terminology and definitions, property diagrams in common use, Formation of steam, Important terms relating to steam information, Thermodynamic properties of steam and steam tables, External work done during evaporation, Internal latent heat, Internal energy of steam, Entropy of water, Entropy of evaporation, Entropy of wet steam, Entropy of superheated steam, Enthalpy-Entropy (h-s) charts for Mollier diagram, Determination of dryness fraction-Tank or bucket calorimeter, throttling calorimeter, separating and throttling calorimeter.

Gases and Vapour Mixtures and Vapor Power Cycles : Introduction, Dalton's law and Gibbs-Dalton law, Volumetric Analysis of gas mixtures, Apparent molecular weight and gas constant, specific heats of gas mixture, Adiabatic mixing of perfect gases, Gas and vapour mixtures. Vapor power cycle-Rankine cycle-Reheat cycle-Regenerative cycle-Thermodynamic variables affecting efficiency and output of Rankine and Regenerative cycles-Improvements of efficiency, Binary vapor power cycle.

Steam Nozzles: Type of nozzles-Flow through nozzles- Condition for maximum discharge- Nozzle efficiency- Super saturated flow in nozzles-Relationship between area, velocity and pressure in nozzle flow-Steam injectors.

Steam Turbines: Classification of steam turbines- Impulse turbine and reaction turbine-Compounding in turbines-Velocity diagram in impulse and reaction turbines- Degree of reaction-Condition for maximum efficiency of reaction turbines-Effect of friction on turbines on structural features governing of turbines.

Condensers: Classification of condenser- Jet, Evaporative and surface condensers- Vacuum and its measurement- Vacuum efficiency- Sources of air leakage in condensers- Condenser efficiency- Dalton's law of partial pressures- Determination of mass of cooling water- Air pumps.

Reciprocating and Rotary Compressors: Reciprocating compressors-effect of clearance in compressors, volumetric efficiency-single stage and multi stage compressors-effect of intercooling in multi stage compressors-Van type blower-centrifugal compressor-Adiabatic efficiency-Diffuser-Axial flow compressors-Velocity diagrams, degree of reaction, performance characteristics.

Refrigeration: Bell-Coleman cycle, Vapor compression cycle-effect of suction and condensing temperature on cycle performance, Properties of common refrigerants, Vapor absorption system, Electrolux refrigerator. Principles of psychrometry and Air conditioning -Psychrometric terms, psychrometric process, air conditioning systems.

Text Books:

1. A Treatise on Heat Engineering by Vasandhani and Kumar.
2. Applied Thermodynamics-II by R. Yadav.
3. Fundamentals of Engineering Thermodynamics by E. Radhakrishna, PHI.

References:

1. Thermal Engineering, by R. K. Rajput.
2. Fluid Flow Machines, by M. S. Govinda Rao, Tata McGraw Hill publishing company Ltd.
3. Refrigeration and Air-conditioning, by C. P. Arora and Domkundwar.
4. Thermal Science and Engineering by D. S. Kumar, S. K. Kataria and Sons
5. Refrigeration and Air-conditioning, by Arora and Domkundwar, Dhanpat Rai

MC-2204 METAL CUTTING AND MACHINE TOOLS

(Effective from the batch admitted during 2020-2021-APSCHE)

Periods/week: 3 Th+1 Tut Ses. : 30 Exam : 70
Examination (Theory): 3 hrs. Credits: 3

Course Objectives:

- To provide knowledge about the metal cutting tools, tool geometry, tool materials, mechanism of metal cutting, force relations, velocity relations and machinability.
- To provide information about the working principle, specifications, classifications, parts, mechanisms, operations and attachments of an engine lathe machine, capstan and turret lathes.
- To provide awareness on the working principle, specifications, classifications, parts and operations of machine tools using single point cutting tools such as boring machines, shaper, slotter and planer machines.
- To provide understanding on the working principle, specifications, classifications, parts and operations of machine tools using multi point cutting tools such as drilling machines, grinding, and milling machines.
- To get familiar with the information about finishing operations such as lapping, honing and super finishing.
- To feed the knowledge about the classification, working principle and construction of various unconventional machining methods.

Course Outcomes:

After successful completion of this course, the student will be able to:

- Imbibe the knowledge about types of tools, their specification, materials, forces, life and cutting fluids.
- Get acquainted with types, mechanisms and attachments of an engine lathe and can perform various operations on an engine lathe and capstan and turret lathes.
- Get awareness on details about and also working with boring machines, shaper, slotter and planer machines
- Get familiar with the types, parts and operations of drilling, grinding and milling machines.
- Get the knowledge about the finishing operations like lapping, honing and super finishing.
- Know the information about various Unconventional machining methods.

SYLLABUS

Mechanics of Metal Cutting; Single point cutting tool geometry and tool signature; ASA&ISO systems; Types of chips and types of cutting; Tool materials; Cutting forces, power, velocities and temperatures; Machinability; Tool wear, tool failure and tool life; Economics of metal cutting; problems on cutting forces, tool life and economics; Cutting fluids.

Machine tools using Single Point Cutting Tools: Specifications, Classifications, Constructional details, Mechanisms, Operations, Cutting parameters and Machining time calculations of an Engine Lathe, Shaper, Slotter and Planer; Work holding and Tool holding devices on Lathe machine; Capstan and Turret lathes; Boring machines and operations;

Machine tools using Multi Point Cutting Tools: Types and geometry of Drills, Milling Cutters and Grinding wheels; Specifications, Classifications, Constructional details, Operations, Cutting parameters, Machining time and Power calculations of Drilling, Milling and Grinding machines; Indexing heads and methods; Method of specification, Selection, Loading, Glazing, Dressing and Truing of Grinding wheels; Broaching types, tools, machines and Broach time.

Finishing Operations: Operating Principle, Types and Working of Lapping, Honing, Super Finishing, Electro Polishing and Buffing operations.

Unconventional Machining Methods: Classification of unconventional machining methods, Working Principle, Constructional details, advantages, disadvantages and applications of CHM, ECM, EDM, EBM, LBM, USM, AJM and WJM.

Text Books:

1. Process and Materials of Manufacture (4th Edition) by Roy A. Lindberg, PHI Private Limited.

2. A course in Workshop Technology Vol. II by B.S. Raghuvanshi, Dhanpat Rai & Co.

Reference Books:

1. Fundamentals of Metal Machining and Machine Tools by Geoffrey Boothroyd, International Student Edition, McGraw-Hill Book Company.
2. Metal Cutting Principles by M.C. Shaw, MIT Press, Cambridge.
3. Metal Cutting-Theory and Practice by Amitabha Bhattacharya, Central Book Publishers.
4. Production Engineering by P.C. Sharma, S. Chand and Company.
5. Manufacturing Engineering & Technology by Kalpak Jain, PHI.
6. Elements of Workshop Technology Vol. II by Hazra Chowdary.

MC-2205 DESIGN OF MACHINE ELEMENTS

(Effective from the batch admitted during 2020-2021-APSCHE)

Periods/week: 4 Th

Ses. : 30 Exam : 70

Examination(Theory): 3hrs. Credits: 3

COURSE OBJECTIVES

The main objectives are: Students will be acquainted with standards like ASTM, ASME etc., safety, reliability, importance of dimensional parameters, manufacturing aspects in mechanical design.

- Students will understand to formulate and analyze stresses and strains in machine elements like shafts, springs etc. and structures under static and/ or dynamic load conditions

COURSE OUTCOMES:

Students are able to

- Understand the standards used for machine elements, safety and reliability concepts in the design of machine elements and the influence of manufacturing processes in the design of machine elements.
- Analyze stresses, strains and deflections in a machine member
- Know static failure criteria for different materials, in the design and analysis of machine components
- Know about various multidimensional fatigue failure criteria, fatigue failure and load-life relation
- Know the terminology, and types of permanent and detachable joints and design and analyze permanent joints (riveted, welded, etc.) under concentric and eccentric loading conditions and power screws
- Know design and analyze shafts with different geometrical features under various loading conditions and ability to calculate critical speed of shafts and make the design decisions accordingly
- know spring terminology, different types of springs, design and analyze coil springs (compression, tension, torsion) under various loads.

SYLLABUS

Introduction to Mechanical engineering design: traditional design method s, different design models, Problem formulation, Design considerations, engineering materials and processes and their selection, BIS designation of steels, Mechanical properties, Load determination, manufacturing considerations in design.

Design against static loads: Modes of failure, Factor of safety, Axial, bending and torsional stresses, Stress concentration factors. Static failure theories.

Fluctuations and fatigue stresses, Soderberg, Goodman and modified Goodman diagrams, fatigue failure, design consideration in fatigue

Threaded and welded joints: forms of threads, basic types of screw fastenings, ISO metric screw threads, eccentrically loaded bolted joints, Torque requirement for bolt tightening, Fluctuation loads on bolted joints, fasteners, Joints with combined stresses. Power screws, Force analysis. Collar friction, Differential and compound screws design. Types and strength of weld joints subjected to bending and fluctuating loads, cotter and knuckle joints, welded joints, different types welded joints and their design aspects, welding inspection

Shafts, keys and couplings: shafts design on strength basis, torsional rigidity basis, Design of hollow shafts, flexible shafts, ASME codes for shafts, Keys and cotter design, Flat, square keys, Splines, Rigid and flange couplings, Flexible couplings

Spring Design: classification and spring materials, Spring end formation, Design of helical compression springs, helical extension springs, torsion springs, laminated springs, Protective coatings, Equalized stress in spring leaves. Multi - leaf springs. Surge in springs, Nipping and shot peening.

Text Books:

1. Design of Machine Elements by V.B. Bhandari, TMH Publishing Co. Ltd., New Delhi

References:

1. Machine Design by Jain, Khanna Publications.
2. Machine Design by Pandya and Shaw, Charotar publications
3. Machine design, an integrated approach by R.L. Norton, 2nd edition, Pearson Education

MEC- 2206 I.C ENGINES LAB

((Effective from the batch admitted during 2020-2021- APSCHE)

Periods/week: 3 Lab Ses.: 50 Exam : 50
Examination (Practical): 3 hrs. Credits: 1.5

Course Objectives:

- Student should have hands on experience in handling different equipment's in the laboratory
- To evaluate properties of fuels and lubricating oils used in engines
- Student should learn components and functioning of compressors
- Student is expected to learn and evaluate performance of IC engines for a given set of conditions

Course Outcomes:

- Students will get hands on experience handling different types of engines available in the lab
- Students will learn to interpret the variables which can influence performance of engines/equipment's
- Students will know the safe operating regimes of different oils / equipment's available in our lab
- Student will have an exposure to a real time gas turbine which was decommissioned from Indian naval ship

List of Experiments:

1. Study and valve timing diagrams for four-stroke and study & PTD of two-stroke engines.
2. Determination of volumetric efficiency of the given air compressor by (i) plate orifice method and (ii) tank capacity method.
3. a) Determination of flash and fire points and
4. b) Canradson's carbon residue test.
5. Determination of calorific value of fuel (solid, liquid and gaseous) by Bomb calorimeter / Gas calorimeter.
6. Determination of the kinematic and absolute viscosity of the given sample oils.
7. Load test and smoke test on I.C. Engines.
8. Morse test on multi-cylinder engine.
9. Heat balance sheet on I.C. Engines.
10. Study of multi-cylinder engines and determination of firing order.
11. Study of boilers
12. Study of gas turbines

MC-2107 DYNAMICS OF MACHINERY LAB

(Effective from the batch admitted during 2020-2021- APSCHE)

Periods/week: 3 Lab Ses.: 50 Exam : 50
Examination (Practical): 3 hrs. Credits: 1.5

Course Objectives:

The objectives of this course are

- To develop competency in conducting laboratory experiments for finding moment of inertia of rigid bodies.
- To make the student familiar with commonly used mechanisms for industrial application.
- To demonstrate the various unbalanced rotating systems.
- To familiarize the various types of vibrations for spring mass system.
- To provide the process of calibration to various measuring instruments.

Course Outcomes:

At the end of the course, the student shall be able to

- Determine the moment of inertia of various machine components.
- Perform the kinematic analysis of the mechanisms.
- Analyze the moving parts (rotating parts) for dynamic and static balance.
- Evaluate the natural frequencies of various vibrating systems.
- Apply the principles of calibration for measuring instruments.

List of Experiments:

1. Determination of inertia of the given fly wheel and connecting rod.
2. Determination of modulus of rigidity of the given wire with torsion pendulum.
3. Verification of laws of balancing.
4. a) Determination of ratios of angular speeds of shafts connected by Hooke's joint.
b) Determination of ratio of times and angular velocities of With worth quick return motion mechanism.
5. To draw curves of slider displacement and crank angle and linear velocity w.r.t. time for a slider crank mechanism and compare with theoretical values.
6. To determine the relation of gyroscopic couple and compare with the theoretical values
7. To determine the radius of gyration of given bar by using bifilar and Trifilar suspension.
8. Find the CG of a connecting rod using free vibration techniques.
9. To determine natural frequency of free torsional vibrations of single rotor system.
10. Find the Natural frequency of the free un-damped vibrations of equivalent spring mass system.
11. Find the Natural frequency of the free damped vibrations of equivalent spring mass system.

12. Find the Natural frequency of the forced damped vibrations of equivalent spring mass system.

13. Find the Natural frequency of the forced un-damped vibrations of equivalent spring mass system.

14. Experiments with piezo-electric pick-up, Inductive pick-ups. Determination of characteristics- Displacement, Velocity and Acceleration.

15. Calibration of the given pressure gauge.

16. Calibration of Rotameter.

17. Calibration of Strain Gauges

a) Full Bridge

b) Half Bridge

c) Quarter Bridge

MC-2208 COMPUTER AIDED MODELLING (Skill Oriented Course)

(Effective from the batch admitted during 2020-2021-APSCHE)

Periods/week: 1 Th 2 Lab Ses.: 50 Exam : 50

Examination (Practical): 3hrs. Credits: 2

Course Objective:

· The course introduces to the student to the CATIA V5 environment with emphasis on the use of the Sketcher Workbench. It also presents an overview of the Part Design, Generative Shape Design, and Assembly Design

Course Outcomes:

At the end of the course, the student will be able to

- Use the conventional representations of materials and machine components
- Model various riveted, welded and key joints
- Generate solid models and sectional views of machine components
- Develop solid models of machine parts and assemble them
- Generate the sectional views of assembled components

List of Experiments:

1. Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs, dimensioning types, lines and rules of dimensioning
2. Types of sections – selection of section planes and drawing of sections and auxiliary sectional views. Parts not usually sectioned
3. Popular forms of Screw threads, bolts, and nuts
4. Protected Flange Coupling

5. Cotter joint and knuckle joint
6. Riveted joints for plates
7. Spigot and socket pipe joint
8. Journal bearing and foot step bearing
9. Part modelling & views
10. Assembly of stuffing box
11. Assembly of Universal coupling
12. Assembly of screw jack
13. Assembly of engine connecting rod and piston assembly
14. Assembly of feed check valve
15. Drafting of assembled components showing various views and sections

Software Packages: CATIA, Solidworks, Creo, AutoCAD etc.,

MC-2209 ENVIRONMENTALSCIENCE

(Effective from the batch admitted during 2020-2021- APSCHE)

(Common to all Branches)

Periods/week: 0 Ses. : 0Exam : 100

Examination(Theory):3hrs. Credits: 0

Course Objectives

The objectives of the Environmental Science course are to

- Familiarize the fundamental aspects of environment and the environmental management'
- Provide information of some of the important international conventions which will be useful during the future endeavors after graduation.
- Make realize the importance of natural resources management for the sustenance of the life and the society.
- Apprise the impact of pollution getting generated through the anthropogenic activities on the environment
- Provide the concept of Sustainable Development, energy and environmental management
- Impart knowledge on the new generation waste like e-waste and plastic waste.

Course Outcomes

After completion of the course the students will have

- Knowledge on the fundamental aspects of environment and the environmental management
- The knowledge on the salient features of the important international conventions

- Understanding of the importance of natural resources management for the sustenance of the life and the society.
- Familiarity on various forms of pollution and its impact on the environment.
- Understand the elements of Sustainable Development, energy and environmental management
- Knowledge on the new generation waste like e-waste and plastic waste.

SYLLABUS

Introduction: Structure and functions of Ecosystems-Ecosystems and its Dynamics-Value of Biodiversity-impact of loss of biodiversity, Conservation of bio-diversity. Environmental indicators - Global environmental issues and their impact on the ecosystems.

Salient features of International conventions on Environment: Montreal Protocol, Kyoto protocol, Ramsar Convention on Wetlands, Stockholm Convention on Persistent Organic Pollutants, United Nations Framework Convention on Climate Change (UNFCCC),

Natural Resources Management: Importance of natural resources management-Land as resource, Land degradation, Soil erosion and desertification, Effects of usage of fertilizer, herbicides and pesticide-watershed management.

Forest resources: Use and over-exploitation, Mining and dams – their effects on forest ecosystems and the living beings.

Water resources: Exploitation of surface and groundwater, Floods, droughts, Dams:benefits and costs.

Mineral Resources: Impact of mining on the environment and possible environmental management options in mining and processing of the minerals.

Sustainable resource management (land, water, and energy), and resilient design under the changing environment.

Environmental Pollution: Local and Global Issues. Causes, effects and control measures. Engineering aspects of environmental pollution control systems.

Air pollution: impacts of ambient and indoor air pollution on human health. Water pollution: impacts water pollution on human health and loss of fresh water resources. Soil pollution and its impact on environment. Marine pollution and its impact on blue economy. Noise pollution.

Solid waste management: Important elements in solid waste management- Waste to energy concepts. Air (prevention and control of

pollution) Act, Water (prevention and control of pollution) Act and their amendments. Salient features of Environmental protection Act, 1986.

Sustainable Development: Fundamentals of Sustainable Development– Sustainability Strategies and Barriers – Industrialization and sustainable development. Circular economy concepts in waste (solid and fluid) management.

Energy and Environment: Environmental Benefits and challenges, Availability and need of conventional energy resources, major environmental problems related to the conventional energy resources, future possibilities of energy need and availability. Solar Energy: process of photovoltaic energy conversion, solar energy conversion technologies and devices, their principles, working and applications, disposal of solar panel after their usage. Biomass energy: Concept of biomass energy utilization, types of biomass energy, conversion processes, Wind Energy, energy conversion technologies, their principles, equipment and suitability in context of India.

Management of plastic waste and E-waste: Sources, generation and characteristics of various e- and plastic wastes generated from various industrial and commercial activities; Waste management practices including onsite handling, storage, collection and transfer. E-waste and plastic waste processing alternatives. E-Waste management rules and Plastic waste management rules, 2016 and their subsequent amendments.

Text Books:

1. Bharucha, Erach (2004). Textbook for Environmental Studies for Undergraduate Courses of all Branches of Higher Education, University Grants Commission, New Delhi.

2. Basu, M., Xavier, S. (2016). Fundamentals of Environmental Studies, Cambridge University Press, India

3. Masters, G. M., & Ela, W. P. (1991). Introduction to environmental engineering and science. Englewood Cliffs, NJ: Prentice Hall.

4. Enger, E. and Smith, B., Environmental Science: A Study of Interrelationships, Publisher: McGraw-Hill Higher Education; 12th edition, 2010.

Reference Books:

1. Sharma, P. D., & Sharma, P. D. (2005). Ecology and environment. Rastogi Publications

2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.

3. Clark R.S. (2001). Marine Pollution, Clanderson Press Oxford (TB)

4. Jadhav, H & Bhosale, V.M. (1995). Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.

5. MoEF&CC, Govt. of India, CPCB: E-waste management rules, 2016 and its amendments 2018. MoEF&CC, Govt. of India, CPCB: Plastic waste man.

METALLURGICAL ENGINEERING SYLLABUS - IV / IV Second semester

MET-421: PROJECT

Periods/week: 20 Credits: 15 Sessionals: 50 Exam: 50

(W.E.F 2020-21 Admitted Batch)

B. Tech -II Year- I Semester

Course Credits	Category	Course Title	Hours per week			Internal Marks	External Marks	Total Marks	
Code			L	T	P				
MT 2101	BS	Metallurgical Thermodynamics I	3	0	0	30	70	100	3
MT 2102	PC	Mineral Beneficiation	3	0	0	30	70	100	3
MT 2103	PC	Iron Making	3	0	0	30	70	100	3
MT 2104	PC	Physical Metallurgy	3	0	0	30	70	100	3
MT 2105	PC	Non Metallic Materials	3	0	0	30	70	100	3
MT 2106	HSS	Managerial Economics	3	0	0	30	70	100	3
MT 2107	PC	Mineral Beneficiation Lab	0	0	3	50	50	100	1.5
MT 2108	SC	Moulding and Casting practice	1	0	2	50	50	100	2
MT 2109	MC	Professional Ethics and Universal Human Values	0	0	0	0	100	100	0
MT2110	MC	NCC/NSS	0	0	2	-	-	-	0
Total Credits									21.5

B. Tech -II Year- II Semester

Course Credits	Category	Course Title	Hours per week			Internal Marks	External Marks	Total Marks	
Code			L	T	P				
MT 2201	ES	Heat Treatment	3	0	0	30	70	100	3
MT 2202	PC	Metallurgical Thermodynamics II	3	0	0	30	70	100	3
MT 2203	PC	Non Destructive Testing	3	0	0	30	70	100	3
MT 2204	PC	Non-Ferrous Extractive Metallurgy - I	3	0	0	30	70	100	3

MT 2205	PC	Mechanical properties of Materials	3	0	0	30	70	100	3
MT 2206	PC	Metallography Lab	0	0	3	50	50	100	1.5
MT 2207	PC	Mechanical Metallurgy Lab	0	0	3	50	50	100	1.5
MT 2208	SC	Welding Practice	1	0	2	50	50	100	2
MT 2209	MC	Environmental Science	0	0	0	0	100	100	0
Total credits									20

Summer Internship (Community Service)

SYLLABUS - II / IV First semester

MT 2101 - METALLURGICAL THERMODYNAMICS – I

Periods/week: 3L -1T Credits: 3 Sessionals: 30
Exam: 70

Course Objectives:

- The prime aim of this course is to apply thermodynamics to various metallurgical aspects like first law, second law, entropy, and Ellingham Diagrams.

- The course is also intended to understand basics of thermodynamics

Course Outcomes:

At the end of the course the student will be able to:

- Relate 1st and 2nd Law of thermodynamics
- Knowledge of enthalpy, entropy and free energy. Understand the principles of thermodynamics as applied equilibrium positions of chemical reactions.
- Calculate the temperature dependence of rate constants and relate this calculation to activity and fugacity.
- To use Ellingham diagrams for extraction of metals

Introduction - Basic concepts in thermodynamics. Objectives and limitations of classical thermodynamics. Zeroth law of thermodynamics.

First Law of Thermodynamics - Forms of Energy, Heat and Work, Joules Experiments, Conservation of Energy, Concept of Maximum Work, Isothermal Expansion, Reversible, Adiabatic Expansion, Constant Pressure Processes, Constant Volume Processes, Enthalpy.

Second Law of Thermodynamics -Efficiency of cyclic process. Carnot cycle. Entropy. Thermodynamic equation of state. Statistical Entropy, Physical Meaning of Entropy, Boltzman Equation, Mixing Entropy, Stirling's Approximation,

Auxiliary Functions. Fundamental Equations of State, Maxwell Relationships. Other Thermodynamic Relations, Chemical Potential, Gibbs - Helmholtz Equation, Criteria of Equilibria.

Third law of Thermodynamics, Heat Capacity and Entropy Changes. Sensible Heats, Transformation Heats, Reaction Heats, ΔC_p , $\Delta H=f(T)$, $\Delta S=f(T)$, Adiabatic Flame Temperatures, Heat Balances.

Phase Equilibria in One Component Systems , Clausius - Claperyon Equation, Heats of Vaporization from Vapor Pressure Data, Shift in Transformation Temperature with Pressure. Ellingham diagrams and application.

Text books:

- Introduction to Metallurgical Thermodynamics, David R. Gaskell.
- Problems in Thermodynamics & Kinetics, G.S.Upadhyaya and R.N.Dubey.

Reference:

- Chemical Metallurgy, J.J.Moore
- Physical Chemistry of Metals, L.S.Darken and G.Gurry, Tata McGraw hill.
- Metallurgical Thermodynamics, ML Kapoor Part I & II
- Metallurgical Thermodynamics, Tupkary

MT 2102 - MINERAL BENEFICIATION

Periods/week: 3L Credits: 3 Sessionals: 30 Exam: 70

Course Objectives:

- Introduce students to the principles of ore comminution, liberation and particle size analysis and equipments used.
- Teach students about various methods of concentration/ separation and equipments used.
- Acquaint the students about quantifying concentration processes and selection of proper mineral dressing cycles for an ore/mineral.

Course Outcomes:

- At the end of the course the student will be able to
- Recognition of the need of the mineral dressing prior to extraction of metals.
 - Describe the working and construction details of various equipments used in mineral dressing.
 - Assess the efficiency of concentration processes.
 - Select and describe a particular concentration process suitable to the liberated ore.

Objectives and scope. Classification of minerals. An elementary concept of liberation. Comminution: Study of primary and secondary crushing and grinding units like Jaw, Gyratory, and reduction Gyratory and roll crushers. Theory of Ball Mill operation, Rittinger's, Kick's and Bond's laws of crushing and grinding.

Laboratory sizing units. Screening. Elutriation. Sedimentation. Representation of size analysis data. Sizing equipment used in industry. Elementary concepts of movement of solids in fluids. Stokes and Newton's laws. Reynold's number. Free and hindered settling. Classification and its application in mineral dressing.

Heavy media separation and coal washing. Tabling. Jigging. Magnetic and Electro static separation. Elementary treatment of principles of flotation. Surface tension, surface energy, and contact angle. Floatability, frothers, collectors and modifying agents. Differential flotation. Flotation circuits.

Study of basic de-watering techniques like-sedimentation – filtration – drying., Simple flow sheets for Beneficiation of Fe, Mn, Cr, Cu, Pb, Zn and beach sands.

Text books:

1. Principles of Mineral Dressing, Gaudin, A.M.

References;

1. Mineral Processing Technology, S.K.Jain
2. Unit operation in Chemical Engineering.

MT 2103 –IRON MAKING

Periods/week: 3LCredits: 3

Sessionals: 30

Exam:

70

Course Objectives:

- Illustrate the applications of thermodynamics and kinetics in production of pig iron and refining it.
- Outline the techniques for production and primary processing in Blast furnace.
- Differentiate between past and present production methods and examine the modern trends in iron production.
- Identify consists and effect for blast furnace irregularities and their remedial measures.

Course Outcomes:

At the end of the course the student will be able to:

- Identify the required parameters and design of a blast furnace and illustrate ancillary equipment and measures to be taken for starting and trouble shooting of Blast furnace process.
- Predict the physico-chemical phenomena taking place in blast furnace. Able to perform simple mass balance and complex problems.

- Identify and explain the modernization techniques to improve quantity, quality and minimization of waste.

- Able to predict the possible alternative processes to be followed suitable to the local conditions in view of energy, environmental and efficiency considerations.

Properties and testing of raw materials: Room temperature and high temperature physical properties, Reducibility tests, factors affecting reducibility.

Blast furnace and accessories: Description of modern blast furnace. Design of blast furnace stoves, Blast furnace refractories, Blast furnace cooling system, Gas cleaning system. Charging system, Distribution of burden in blast furnace, Blast furnace instruments.

Physical chemistry: Blast furnace physical structure, blast furnace reactions, Distribution of elements in molten metal and slag. Internal and External desulphurization, Blast furnace slag properties and uses. Acid and Basic burdening practices, Blast furnace operation, irregularities and remedies. Modern developments in blast furnace practice

Alternate routes of pig iron production: Electric arc furnace process, Low shaft furnace, Mini Blast Furnace process, Char coal furnace process. Production of wrought iron.

Text books:

1. Introduction to modern iron making, R.H. Tupkary
2. Introduction to modern iron making, A.K. Biswas
3. Physical Chemistry of Iron & Steel Making, C.Bodsworth

References:

1. MSTS-United Steel Corporation, Pittsburgh
2. Blast furnace theory & practice- Vol.I&II, Julius JH. Strybsgen

MT 2104 - PHYSICAL METALLURGY

Periods/week: 3L

Credits: 3

Sessionals: 30

Exam: 70

Course Objectives:

- The prime objective of this course is to make the student gain an understanding of the relation between microstructural characteristics and properties of metals and alloys.

- The course also critically focuses on the crystallography, phase transformations that occur in several ferrous and nonferrous metallurgical systems as a function of temperature and composition through phase equilibrium diagrams.

Course Outcomes:

At the end of the course the student will be able to:

- Explain the solidification of metals and alloys, mechanisms.

- Explain the necessity of alloys, will identify the different types of alloy phases.
- Explain the construction and identification of phase diagrams and reactions.
- Explain the Fe-Fe₃C diagram with invariant reactions.
- Explain the Cu-Zn and other binary diagrams and complex phase diagrams etc.

Solidification. Solidification of pure metals, alloys and eutectic. Nucleation and growth, Homogeneous and Heterogeneous, constitutional super cooling, coring and segregation. Phase rule, principles of construction and interpretation of binary phase diagrams. Invariant reactions, Free energy composition diagrams, uses and limitations of phase diagrams.

Equilibrium and non-equilibrium phase diagrams-Fe-C, Cu-Zn, Cu-Sn, Al-Si, Al-Cu, Pb-Sn, Sb-Sn, Ternary diagrams and interpretation of Structures on cooling. Diffusion of metals-Fick's law, mechanisms of diffusion, solutions to diffusion Equations, diffusion in alloys, Kirkendall effect, Factors affecting diffusion, grain Boundary diffusion, applications.

Text books:

1. Physical Metallurgy - S.H. Avner
2. Physical Metallurgy - V. Raghavan
3. Physical Metallurgy - Vijendra Singh
4. Mechanical Metallurgy - G.E. Dieter

Reference book:

1. Physical Metallurgy - R.E. Reed Hill

MT 2105 - NON METALLIC MATERIALS

Periods/week: 3L Credits: 3 Sessionals: 30 Exam:

70

Course Objectives:

- To impart knowledge about the uses and application of polymers
- Explain the uses and applications of various ceramics
- Describe about the uses and application of various textile materials

Course Outcomes:

At the end of the course, student will

- Appreciate the importance of polymers and their classification and apply the knowledge for the practical applications
- Describe the properties of ceramics and choose a particular ceramic for a given application.

- Correlate the structure, property and applications of ceramics and polymers.

- Able to analyse the properties of different non metallic materials and justify their choice.

Polymers: Classification, properties and applications, Molecular structure of polymers, Polymerization, Mechanical properties of polymers

Ceramics: Classification properties and applications, Mechanical properties of Ceramics, Glass and Glass ceramics, Processing of Ceramics

Classification, properties and applications of Textiles, Adhesives, polymer and ceramic Foams

Text books

1. Textbook of Polymer Science; Fred W. Billmeyer, Wiley 2007
2. Introduction to Ceramics; Kingery, Bowen, Uhlman. Wiley India Pvt Limited, 2012
3. Composite Materials: Science and Engineering; Krishan K. Chawla, Springer, 2012

MT 2106- MANAGERIAL ECONOMICS

Periods/week: 3L Credits: 3 Sessionals: 30
Exam: 70

Course Objectives:

- To bring about an awareness about the nature of Managerial Economics and its linkages with other disciplines.
- To understand the Micro and Macro Environment of Business.
- To familiarize the prospective engineers with the concepts and tools of Managerial Economics with an objective to understand the real world of business.

Course Outcomes:

After completion of the course, student will be able to:

- Understand the various economic activities in business and industry.
- Analyse the real world business problems.
- Make optimal business decisions for the effective and efficient management of Organisations.

SYLLABUS

Significance of Economics and Managerial Economics:

Economics: Definitions of Economics- Wealth, Welfare and Scarcity definitions Classification of Economics- Micro and Macro Economics.

Managerial Economics: Definition, Nature and Scope of Managerial Economics, Differences between Economics and Managerial Economics,

Main areas of Managerial Economics, Managerial Economics with other disciplines.

Demand and Utility Analysis: Demand - Definition, Meaning, Nature and types of demand, Demand function, Law of demand - Assumptions and limitations. Exceptional demand curve.

Elasticity of demand - Definition, Measurement of elasticity, Types of Elasticity (Price, Income, Cross and Advertisement), Practical importance of Price elasticity of demand, Role of income elasticity in business decisions, Factors governing Price Elasticity of demand.

Utility Analysis: Utility- Meaning, Types of Economic Utilities, Cardinal and Ordinal Utility, Total Utility, Marginal Utility, The law of Diminishing Marginal Utility and its Limitations.

Theory of Production and Cost analysis:

Production - Meaning, Production function and its assumptions, use of production function in decision making;

Cost analysis - Nature of cost, Classification of costs - Fixed vs. Variable costs, Marginal cost, Controllable vs. Non - Controllable costs, Opportunity cost, Incremental vs. Sunk costs, Explicit vs. Implicit costs, Replacement costs, Historical costs, Urgent vs. Postponable costs, Escapable vs. Unavoidable costs, Economies and Diseconomies of scale.

Market Structures : Definition of Market, Classification of markets; Salient features or conditions of different markets - Perfect Competition, Monopoly, Duopoly , Oligopoly, Importance of kinked demand curve ;Monopolistic Competition.Pricing and Business Cycles:

Pricing Analysis : Pricing – Significance; Different Pricing methods- Cost plus pricing, Target pricing, Marginal cost pricing, Going -rate pricing, Average cost pricing, Peak load pricing , Pricing of joint Products, Pricing over the life cycle of a Product, Skimming pricing Penetration pricing, Mark-up and Mark- down pricing of retailers.

Business cycles - Definition, Characteristics, Phases, Causes and Consequences; Measures to solve problems arising from Business cycles.

Text Books:

1. Sankaran,S., Managerial Economics, Marghan Publications, 2015, Chennai.

2. Aryasri, A.R., Managerial Economics and Financial Analysis, MC Graw Hill Education, New Delhi,2015.

Reference Books:

1. Dwivedi, D.N., Managerial Economics, Vikhas Publishing House Pvt. Ltd. 6th Edition, New Delhi,2004.

2. Dewett, K.K., Modern Economic Theory, S.Chand & Company Ltd., New Delhi, 2005.

MT 2107 P - MINERAL BENEFICIATION LAB

Periods/week: 3P Credits: 1.5 Sessionals:50Exam: 50

Course Objectives:

- This laboratory course critically deals with the experiments related to ore dressing principles
- Apart from this, it also concerns about laboratory models of mineral dressing operations

Course Outcomes:

At the end of the laboratory course the student will be able to:

- Pick or take a representative amount of sample and conduct sieve analysis
- Determine the reduction ratio in crushing and grinding of different materials using various size reduction units
- Analyze the grindability of different coals
- Separate or concentrate the given materials using froth flotation processes

List of experiments:

1. Sampling by coning and quartering and riffle sampler.
2. Determination of average particle size by sieve analysis.
3. Determination of optimum time of sieving.
3. Determination of optimum time of sieving.
4. Studies on size reduction using laboratory Jaw Crusher.
5. Studies on size reduction using laboratory Roll Crusher.
6. Studies on size reduction using laboratory Ball Mill.
7. Heavy media separations (sink and float experiment)
8. Laboratory experimentation Froth Flotation.
9. Determination of Grindability of Coal.

MT 2108- SKILL ORIENTED COURSE

MOULDING AND CASTING PRACTICE

Periods/week: 1L+1T+2P Credits: 2 Sessional: 0Exam: 0

Course Objectives:

1. Study on types of mould ingredients
2. Study of mould making procedures for wet and dry processes

2. Study of structural changes and hardness
3. Study of problems during melting and casting of pure metals and alloys

Course Outcomes:

At the end of the course student will be able to

1. Get moulding skill in various moulding processes
2. Gain knowledge in developing proper melting and casting procedures of various alloys
3. Know the structural and property changes on effect of moulding practices of important engineering alloys

SYLLABUS

Introduction on various mould ingredients and moulding practices of:

1. Wet moulding- Bentonite based process
2. Dry moulding- Sodium silicate process
 - a. CO₂ process
 - b. Ferrosilicon process

Melting and casting practices of:

1. Pure aluminium
2. Al-Cu binary alloys
3. Al-Cu-Mg ternary alloys

Evaluation of Castings:

1. Visual inspection
2. Microstructure studies
3. Hardness survey

MT 2109- PROFESSIONAL ETHICS AND UNIVERSAL HUMAN VALUES

Periods/week:0 Credits:0 Sessionals: 0 Exam:

0

Course Objectives:

The objective of the course is Six fold:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- This course will illuminate the students in the concepts of laws and its applicability to engineers
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence

· Strengthening of self-reflection, Development of commitment and courage to act and also enable the students to imbibe and internalize the Values and Ethical Behaviour in the personal and professional lives

· To enable the students to imbibe the Values and Ethical Behavior in the personal and Professional lives

· The students will learn the rights and responsibilities Individual, employee, team member and a global citizen

Course Outcomes:

By the end of the course Student will be able to:

· Grasp the meaning of the concept – Law and also Get an overview of the laws relating to Engineers and also Apprehend the importance of being a law abiding person and They would have better critical ability

· Self-explore by using different techniques to live in harmony at various levels

· Analyze themselves and understand their position with respect to the moral and ethical character needed for a successful and satisfactory work life

· Students are expected to become more aware of themselves and their surroundings (family, society, nature)

· They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.

· They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society)

SYLLABUS

Need, Basic Guidelines, Content and Process for Value Education

· Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation - as the process for self-exploration, Continuous Happiness and Prosperity - A look at basic Human Aspirations, Right understanding, Relationship and Physical Facility - the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels. Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking, Include practice sessions and case studies.

Understanding Harmony in the Human Being - Harmony in Myself!

- Understanding human being as: a co-existence of the sentient 'I' and the material 'Body', the needs of Self ('I') and 'Body' - happiness and physical facility, the Body as an instrument of 'I' (I being the doer, seer and enjoyer), the characteristics and activities of 'I' and harmony in 'I', the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail, P to ensure Sanyam and Health, Include practice sessions and case studies. Understanding Harmony in the Family and Society - Harmony in Human – Human Relationship- Understanding values in human-human relationship: meaning of Justice (nine universal

values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship, the meaning of Trust; Difference between intention and competence, the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship, the harmony in the society (society being an extension of family), Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society, Universal Order from family to world family, Include practice sessions and case studies.

Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

- Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature recyclability and self-regulation in nature, Understanding Existence as Co-existence of mutually interacting units in all – pervasive space, Holistic perception of harmony at all levels of existence, Include practice sessions and case studies.

Concept of Law and Law of Torts

- Understanding Essentials of a Valid Contract and the basics of contract law protecting rights and obligations, Introduction to the Law of Torts and the basics to protect oneself and the company Law affecting the Workplace Employers Responsibilities/Duties Hiring Practices, Introduction to Intellectual Property Law, Professional Code of Conduct for Engineers, Relationship between Law and Ethics, Include practice sessions and case studies.

Implications of the above Holistic Understanding of Harmony on Professional Ethics

- Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems, Case

studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations, Include practice sessions and case studies.

Text Books

1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional

Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1

2. R R Gaur, R Asthana, G P Bagaria, "Teachers' Manual for A Foundation Course in Human

Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

3. R. Subramanian, "Professional Ethics", Oxford University Press.

4. S.B. Srivastha, "Professional Ethics & Human Values", SciTech Publications (India) Pvt. Ltd. New Delhi.

5. D.R. Kiran, "Professional Ethics & Human Values", TATA Mc Graw Hill Education.

6. Saroj Kumar, "Business Law" and Avtar Singh, "Law of Contract"

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kanta, 1999.

2. A. N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, 2004.

3. The Story of Stuff (Book), Mohandas Karamchand Gandhi "The Story of My Experiments with Truth", E. F. Schumacher. "Small is Beautiful", Slow is Beautiful –Cecile Andrews, J C Kumarappa "Economy of Permanence", Pandit Sunderlal "Bharat Mein Angreji Raj" and Dharampal, "Rediscovering India

4. G K Kapoor, "Business Law" and Sen & Mitra, "Business & Commercial Laws" and Calvin Frank Allen, "Business law for Engineers"

5. Hilgard, E. R.; Atkinson, R. C. & Atkinson, R.L. (1975). *Introduction to Psychology*. 6th Edition. New Delhi: Oxford and IBH Publishing Co. Pvt. Ltd.

6. Govindarajan, M; Natarajan, G. M. & Senthilkumar, V.S. (2013). *Professional Ethics & Human Values*. Prentice Hall: New Delhi

7. Gogate, S. B. (2011). *Human Values & Professional Ethics*. Vikas Publishing: New Delhi.

8. Charles E Harris Jr., Michael S Pritchard, Michael J Rabins, "Engineering Ethics, Concepts Cases: 4e, Cengage learning, 2015.

9. Caroline Whitbec, " Ethics in Engineering Practice & Research: 2e, Cambridge University Press 2015.

SYLLABUS - II / IV Second semester

MT 2201 - HEAT TREATMENT

Periods/week: 3L Credits: 3 Sessionals: 30
Exam: 70

Course Objectives:

1. This course is mainly designed to impart knowledge about basic principles and process variables of different heat treatment processes.
2. To understand the techniques of thermo mechanical treatment, surface hardening techniques, heat treatment of steels, cast irons, non ferrous alloys in detail.
3. To gain basic knowledge about different types of phase transformations, cooling curves and effect of alloying elements on cooling curves.

Course Outcomes: At the end of the course the student will be able to:

1. Demonstrate a critical understanding of the importance of heat treatment in achieving fit for purpose in steels
2. Apply and interpret phase and continuous cooling diagrams to assess the impact of a range of heat treatment procedures
3. Choose and justify a procedure for a particular alloy in order to achieve the properties required for a particular engineering application

Phase transformation in Fe-C system, Critical temperatures. Austenite grain size designation. Inherently fine-grained and inherently coarse grained steel. Importance of grain size and its determination. Heat Treatment Furnaces and atmospheres.

T-T-T Curves. Effect of cooling on transformation of austenite, pearlite, bainite and martensite. Annealing, normalizing, hardening and tempering of steels. Austempering. Martempering. Patenting and spheroidizing.

Effect of alloying elements. Hardenability of steels. Factors affecting and its determination. Thermo-mechanical treatments. Ausforming. Strain tempering. Surface hardening. Carburising, nitriding, cyaniding, carbonitriding. Induction and flame hardening.

Text books:

1. Heat treatment, Rajan
2. Heat treatment of metals, Zakharov

References:

1. Physical Metallurgy, V. Raghavan
2. Introduction to Physical Metallurgy, S.H. Avner

3. Physical Metallurgy Principles, R.E. Reed-Hill.
4. Physical Metallurgy for Engineers, Clark and Varney

MT 2202 - METALLURGICAL THERMODYNAMICS – II

Periods/week: 3L Credits: 3 Sessionals: 30
Exam: 70

Course Objectives: This course is mainly intended to deal with

1. The laws of diffusion.
2. Interpret Ellingham diagrams
3. Identify metallurgical thermodynamics principles to be applied in phase diagrams.

Course Outcomes:

Obtain the skill to use Metallurgical Thermodynamics concept for

1. Understand and able to use Fick's I and II law.
2. Interpret Ellingham Diagram for oxides
3. Understand the thermal properties of solids, specifically, specific heat and some models for specific heat calculation.
4. Knowledge of ideal and regular solutions and free energy of mixing.
5. Apply the phase rule on the metallurgical systems.
6. Understanding of the nature of polarized electrochemical reactions and an introduction of their application in corrosion behavior of metals.

The Behavior of Gases. Compressibility Factor, Law of Corresponding States, Equations of State, Fugacity, activity and equilibrium constant. Vant Hoff's isotherm. Reactions Equilibria - The effect of temperature and pressure on equilibrium constant.

Equilibria in Gaseous Systems, The Equilibrium Constant and ΔG° , Reaction Extent Problems, Equilibria in Systems Containing Condensed Phases, Ellingham Diagram.

Solution Thermodynamics - Thermodynamic solutions. Raoult's law. Henry's law. Sievert's law. Absolute and Partial and Integral Molar Quantities, Relative and Partial Integral Molar Quantities, Ideal Solutions, Excess Quantities, Gibbs' Duhem Equation, Tangent Intercept Method, $a=f(T)$, Change in Reference State, 1 wt % Reference State Interaction Parameters. Actual solutions. Regular solutions.

Application of the laws of thermodynamics to metallurgical processes, electrochemistry, interfacial phenomena, extraction and refining of materials. Kinetics of Metallurgical reactions. Collision theory. Theory of absolute reaction rates.

Text books:

1. Introduction to Metallurgical Thermodynamics, David R. Gaskell.

2. Problems in Thermodynamics & Kinetics, G.S.Upadhyaya and R.N.Dubey.

Reference:

1. Chemical Metallurgy, J.J.Moore
2. Physical Chemistry of Metals, L.S.Darken and G.Gurry, Tata McGraw hill.
3. Metallurgical Thermodynamics, ML Kapoor Part I & II
4. *Metallurgical Thermodynamics*, Tupper.

MT 2203 – NON-DESTRUCTIVE TESTING

Periods/week: 3L Credits: 3 Sessionals: 30 Exam:

70

2Course Objectives:

1. To gain an understanding of the response of various metals under the application of stress and/or temperature.
2. Obtain a working knowledge of various hardness testing machines BHN, VHN, RHN
3. Obtain a working knowledge of creep and fatigue testing methods and analysis of data.
4. To get an exposure to NDT techniques for detection of various types of flaws.

Course Outcomes:

At the end of the course the student will be able to:

1. Understand and interpret the results of various hardness tests and impact tests.
2. Evaluate various tensile properties of ferrous and Non Ferrous Metals and solve problems related to the tensile tests.
3. Analyse the modes of failure occurring due to fatigue and suggest remedial measures.
4. Analyse the methods of failure of materials at high temperature by creep and stress rupture and the mechanisms responsible for fracture
5. Determine appropriate tests to be employed to determine the given mechanical properties using both destructive and non-destructive techniques
6. Knowledge of various testing methods for based on Destructive Techniques & Non destructive Techniques and their importance in enhancing service / component life.

Visual Examination. Leakage Testing: Penetrant methods: Principles, equipment, applications and limitations. Magnetic methods: Principles of magnetism and magnetization. Principles of magnetic particle inspection. The magnaflo machine. The process. The magnetic bath. Methods for the application of magnetic bath. Demagnetization. Application of the method. Salient features of the process.

Ultrasonic testing: Types of ultrasonic waves. Flow detection and ultrasonic energy. Interpretation of results and limitations.

X-ray radiography: Production of X-rays. X-ray tube. The Radiograph. Optical factors which effect the radiograph. X-ray films. Filters and screens. Sensitivity of a radiograph. Gamma ray radiography: Production of gamma-rays, interpretation of the radiograph. Safety precautions.

Electrical methods: Thermoelectric methods. Eddy Current methods. Detection of the eddy currents. Eddy current instruments. Continuous inspection and testing.

Reference Books:

1. Metals Hand Book Vol.11 (Non-Destructive Testing)
2. Non-Destructive Testing-W.J.Mc GONNANGLE

MT 2204 - NON FERROUS EXTRACTIVE METALLURGY –I

Periods/week: 3L Credits: 3 Sessionals: 30 Exam: 70

Course Objectives:

1. To explain the various methods of extraction of non ferrous metals.
2. To describe the procedure and equipment used for production of non ferrous metals from their ores.

Course Outcome:

At the end of the course, student would be able to recommend

1. Get detailed information about the properties of non ferrous metals, ores of non ferrous metals, pre treatment processes, thermodynamics and kinetics involved in extraction process
2. Describe and explain ore treatment techniques and learn the fundamental concepts of metallurgical pre-treatment methods, production of metals from ore, concentrate and secondary sources
3. Emphasize the strategic importance of raw and supplementary materials in the production, and explain the concepts of technological and economical feasibility
4. Identify the beneficiation of byproducts materialize during the metal production, within the framework of technology-environment-ecology
5. Explain processes based on an advanced thermodynamic perspective and explain material and energy flows related to extraction of metals and alloys
6. Understand about Extractive metallurgy processes and explain their relative merits and demerits and also Conduct a detailed and individual research about production of a specific metal, as part of their responsibility

Extraction of Metals. Aluminum. Uses. Ores. Bayer's process of Alumina production. Hall-Heroult process. Cryolite and carbon electrode manufacture.

Hoopes process of refining. Indian plant practice. New processes. Alcoa process.

Magnesium. Uses. Ores. Pidgeon's process. Extraction by Dows process.

Tin: Uses. Ores. Concentration, smelting and refining.

Copper. Uses. Pyro-metallurgical processes. New processes. Flash smelting. WORCA and Noranda processes. Hydro-metallurgy of copper. Copper production in India.

Nickel: Brief description of Ni extraction from sulphide ores.

Lead. Uses. Ores. Treatment of ore and production of metal. Zinc. Uses. Pyro-metallurgical and hydro-metallurgical extraction methods. Imperial smelting process.

Text books:

1. Extraction of Non-Ferrous Metals, HS Ray, R Sridhar and KP Abraham

References:

1. Metallurgy of Non-Ferrous Metals, Dennis, WH
2. *Non-Ferrous Metallurgy*, Sebyukov, N Min, Pub. Moscow

MT 2205 – MECHANICAL PROPERTIES OF MATERIALS

Periods/week: 3L Credits: 3 Sessionals: 30 Exam:

70

Course Objectives:

1. To gain and understanding of the response of various metals under the application of stress and/or temperature.
2. To build necessary theoretical back ground of the role of lattice defects in governing both elastic and plastic properties of metals will be discussed.
3. Obtain a working knowledge of various hardness testing machines BHN, VHN, RHN
4. Obtain a working knowledge of creep and fatigue and analysis of data.

Course Outcomes:

At the end of the course the student will be able to:

1. Describe and correlate the structure and mechanical properties of different kind of metals.
2. Identify, formulate and solve engineering problems related to mechanical behaviour.
3. To know the behaviour of material under different loading conditions.

4. Demonstrate fracture, and fatigue control on structure.

5. Selection of proper testing method to analyze physical structure and hardness of material.

6. Knowledge of how to incorporate material strength limitation into engineering design. Introduction, Impact of testing.

Tension test: Engineering stress strain curve. True stress and true strain diagram. Ductility measurements. Typical stress strain diagrams. Yield point phenomenon, strain ageing.

Compression Test: Fundamentals of testing, applications.

Hardness test: Introduction, Brinell, Vickers and Rockwell hardness, Micro hardness.

Fracture: Introduction, types of fracture in metals. Brittle fracture and impact testing: The problems of brittle fracture. Notched bar impact tests, significance of transition temperature, metallurgical factors affecting transition temperature

Creep and stress rupture: The creep curve. Stress rupture test. Structural changes during creep, mechanisms of creep deformation, High temperature alloys, presentation of engineering creep data, prediction of long time properties

Fatigue: Introduction, Stress cycles, S-N diagram, mechanisms of fatigue, Factors influencing fatigue properties, corrosion fatigue, thermal fatigue.

Text books:

1. Mechanical Metallurgy, George E Dieter, McGraw Hill.
2. Testing of Materials, A.V.K.Suryanarayana, Prentice Hall of India.

Reference Books:

1. Testing of Engineering Materials, Donald et.al., McGraw Hills.
2. Metals hand book

MT 2206 P: METALLOGRAPHY LAB

Periods/week: 3P Credits: 1.5 Sessionals: 50
Exam: 50

Course Outcomes

At the end of the course the student will be able to:

1. Can describe the metallurgical microscope, sample preparation, mounting and use/choosing of different etching reagents.
2. Can identify and report the microstructural features of ferrous and non ferrous samples observed.
3. Can operate optical microscope with an ease

4. Characterize microstructures of engineering alloys using optical microscopy

About 12 experiments on the Metallography of common ferrous and Non-Ferrous metals and alloys, experiments on thermal analysis.

MT 2207 P – MECHANICAL METALLURGY LAB

Periods/week: 3P Credits: 1.5 Sessionals: 50
Exam: 50

Course Outcomes:

At the end of the course the student will be able to:

1.Explain the methods of destructive testing (Hardness testing, Tensile testing, Impact and cupping tests) and non destructive testing (LPT, MPT and UT).

2. Analyze, interpret and present the observation from the tests conducted.

3. Identify the reasons for failure through Non-Destructive Examination.

4. Can prepare formal laboratory reports describing the experimental and the results obtained.

5. Solve material problems associated with testing.

List of Experiments:

1. Hardness testing (Brinell, Vickers, Rockwell)
2. Ericksen Cupping Test
3. Tensile & Bend Testing
4. Shore scleroscope hardness test
5. Poldi Testing
6. Cold working & annealing
7. Impact testing
8. Visual Inspection
9. Die penetration testing
10. Magnetic particle testing
11. Ultrasonic testing
12. Radiography testing

MT 2208- SKILL ORIENTED COURSE

WELDING PRACTICE

Periods/week:1L+1T+2P Credits:2 Sessionals:0Exam: 0

Course Objectives:

1. Study of welding procedures for metals and alloys

2.Study of structural changes and hardness

3.Study of problems during welding of ferrous and non-ferrous alloys

Course Outcomes:

At the end of the course student will be able to

1. Get welding skill in joining various engineering alloys

2.Gain knowledge in use of proper procedure in welding of various alloys

3.. Know the structural and property changes during welding of important engineering alloys

Welding of mild steel, Welding of Stainless steels, Welding of Aluminium alloy, Welding of Titanium alloy Shielded Metal arc welding and Gas Tungsten Arc Welding

Welding procedure : Cleaning, Edge preparation and Selection of welding parameters Identification of various zones Microstructural changes, Hardness survey,

MT 2209 – ENVIRONMENTAL SCIENCE

Periods/week:0 Credits: 0 Sessionals: 0
Exam:100

Course Objectives

The objectives of the Environmental Science course are to

- Familiarize the fundamental aspects of environment and the environmental management'

- Provide information of some of the important international conventions which will be useful during the future endeavors after graduation.

- Make realize the importance of natural resources management for the sustenance of the life and the society.

- Apprise the impact of pollution getting generated through the anthropogenic activities on the environment

- Provide the concept of Sustainable Development, energy and environmental management

- Impart knowledge on the new generation waste like e-waste and plastic waste.

Course Outcomes

After completion of the course the students will have

- Knowledge on the fundamental aspects of environment and the environmental management

- The knowledge on the salient features of the important international conventions

- Understanding of the importance of natural resources management for the sustenance of the life and the society.
- Familiarity on various forms of pollution and its impact on the environment.
- Understand the elements of Sustainable Development, energy and environmental management
- Knowledge on the new generation waste like e-waste and plastic waste.

SYLLABUS

Introduction: Structure and functions of Ecosystems-Ecosystems and its Dynamics-Value of Biodiversity-impact of loss of biodiversity, Conservation of bio-diversity. Environmental indicators - Global environmental issues and their impact on the ecosystems.

Salient features of International conventions on Environment: Montreal Protocol, Kyoto protocol, Ramsar Convention on Wetlands, Stockholm Convention on Persistent Organic Pollutants, United Nations Framework Convention on Climate Change (UNFCCC),

Natural Resources Management: Importance of natural resources management-Land as resource, Land degradation, Soil erosion and desertification, Effects of usage of fertilizer, herbicides and pesticide-watershed management.

Forest resources: Use and over-exploitation, Mining and dams – their effects on forest ecosystems and the living beings.

Water resources: Exploitation of surface and groundwater, Floods, droughts, Dams:benefits and costs.

Mineral Resources: Impact of mining on the environment and possible environmental management options in mining and processing of the minerals.

Sustainable resource management (land, water, and energy), and resilient design under the changing environment.

Environmental Pollution: Local and Global Issues. Causes, effects and control measures. Engineering aspects of environmental pollution control systems.

Air pollution: impacts of ambient and indoor air pollution on human health. Water pollution: impacts water pollution on human health and loss of fresh water resources. Soil pollution and its impact on environment. Marine pollution and its impact on blue economy. Noise pollution.

Solid waste management: Important elements in solid waste management- Waste to energy concepts. Air (prevention and control of pollution) Act, Water (prevention and control of pollution) Act and their amendments. Salient features of Environmental protection Act, 1986.

Sustainable Development: Fundamentals of Sustainable Development– Sustainability Strategies and Barriers – Industrialization and sustainable development. Circular economy concepts in waste (solid and fluid) management.

Energy and Environment: Environmental Benefits and challenges, Availability and need of conventional energy resources, future possibilities of energy need and availability. Solar Energy: process of photovoltaic energy conversion, solar energy conversion technologies and devices, their principles, working and applications, disposal of solar panel after their usage. Biomass energy: Concept of biomass energy utilization, types of biomass energy, conversion processes, Wind Energy, energy conversion technologies, their principles, equipment and suitability in context of India.

Management of plastic waste and E-waste: Sources, generation and characteristics of various e- and plastic wastes generated from various industrial and commercial activities; Waste management practices including onsite handling, storage, collection and transfer. E-waste and plastic waste processing alternatives. E-Waste management rules and Plastic waste management rules, 2016 and their subsequent amendments.

Text Books:

1. Bharucha, Erach (2004). Textbook for Environmental Studies for Undergraduate Courses of all Branches of Higher Education, University Grants Commission, New Delhi.
2. Basu, M., Xavier, S. (2016). Fundamentals of Environmental Studies, Cambridge University Press, India
3. Masters, G. M., & Ela, W. P. (1991). Introduction to environmental engineering and science. Englewood Cliffs, NJ: Prentice Hall.
4. Enger, E. and Smith, B., Environmental Science: A Study of Interrelationships, Publisher: McGraw-Hill Higher Education; 12th edition, 2010.

Reference Books:

1. Sharma, P. D., & Sharma, P. D. (2005). Ecology and environment. Rastogi Publications
2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
3. Clark R.S. (2001). Marine Pollution, Clanderson Press Oxford (TB)
4. Jadhav, H & Bhosale, V.M. (1995). Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
5. MoEF&CC, Govt. of India, CPCB: E-waste management rules, 2016 and its amendments 2018.
6. MoEF&CC, Govt. of India, CPCB: Plastic waste management rules, 2016.

B.Tech (IT) II Year – I Semester

(w.e.f. 2020-21 admitted batch)

Course Credits code	Category	Course Title	Hours per week			Internal Marks	External Marks	Total Marks	
			L	T	P				
IT2101	BS	ELEMENTS OF ELECTRONICS ENGINEERING	3	1	0	30	70	100	3
IT2102	PC	COMPUTER ORGANIZATION AND ARCHITECTURE	3	1	0	30	70	100	3
IT2103	PC	SYSTEMS PROGRAMMING	3	1	0	30	70	100	3
IT2104	PC	INTERNET CONCEPTS AND JAVA PROGRAMMING	3	1	0	30	70	100	3
IT2105	PC	PYTHON PROGRAMMING	3	1	0	30	70	100	3
IT2106	PC	COMPUTER ORGANIZATION LAB	0	0	3	50	50	100	1.5
IT2107	PC	INTERNET CONCEPTS AND JAVA PROGRAMMING LAB	0	0	3	50	50	100	1.5
IT2108	PC	PYTHON PROGRAMMING LAB	0	0	3	50	50	100	1.5
IT2109	SC	EMBEDDED SYSTEM DESIGN USING ARDUINO	1	0	2	50	50	100	2
IT2110	MC	ENVIRONMENTAL SCIENCE	0	0	0	-	100	100	0
Total credits									21.5

B.Tech (IT) II Year – II Semester

Course Credits code	Category	Course Title	Hours per week			Internal Marks	External Marks	Total Marks	
			L	T	P				
IT2201	BS	FORMAL LANGUAGES AND AUTOMATA THEORY	3	1	0	30	70	100	3
IT2202	PC	OPERATING SYSTEMS	3	1	0	30	70	100	3
IT2203	PC	DATABASE MANAGEMENT SYSTEMS	3	1	0	30	70	100	3
IT2204	PC	PROBABILITY, STATISTICS AND QUEUEING THEORY	3	1	0	30	70	100	3
IT2205	HSS	MANAGERIAL ECONOMICS	3	1	0	30	70	100	3
IT2206	PC	OPERATING SYSTEMS LAB	0	0	3	50	50	100	1.5
IT2207	PC	DATABASE MANAGEMENT SYSTEMS LAB	0	0	3	50	50	100	1.5
IT2208	SC	INTELLECTUAL PROPERTY RIGHTS	1	0	2	50	50	100	2
IT2209	MC	PROFESSIONAL ETHICS AND UNIVERSAL HUMAN VALUES	0	0	0	-	100	100	0
IT2210	MC	NSS / NCC	0	0	2	-	-	-	0
Total credits									20

Summer Internship (Community Service)

B.Tech (IT) II Year – I Semester

(w.e.f. 2020-21 admitted batch)

Course Credits code	Category	Course Title	Hours per week			Internal Marks	External Marks	Total Marks	
			L	T	P				
IT2101	BS	ELEMENTS OF ELECTRONICS ENGINEERING	3	1	0	30	70	100	3
IT2101	BS	ELEMENTS OF ELECTRONICS ENGINEERING	3	1	0	30	70	100	3
IT2102	PC	COMPUTER ORGANIZATION AND ARCHITECTURE	3	1	0	30	70	100	3
IT2103	PC	SYSTEMS PROGRAMMING	3	1	0	30	70	100	3
IT2104	PC	INTERNET CONCEPTS AND JAVA PROGRAMMING	3	1	0	30	70	100	3
IT2105	PC	PYTHON PROGRAMMING	3	1	0	30	70	100	3
IT2106	PC	COMPUTER ORGANIZATION LAB	0	0	3	50	50	100	1.5
IT2107	PC	INTERNET CONCEPTS AND JAVA PROGRAMMING LAB	0	0	3	50	50	100	1.5
IT2108	PC	PYTHON PROGRAMMING LAB	0	0	3	50	50	100	1.5
IT2109	SC	EMBEDDED SYSTEM DESIGN USING ARDUINO	1	0	2	50	50	100	2
IT2110	MC	ENVIRONMENTAL SCIENCE	0	0	0	-	100	100	0
Total credits									21.5

IT2101 BS ELEMENTS OF ELECTRONICS ENGINEERING

Instruction: 3 Periods & 1 Tut/week Credits:3

Internal: 30 Marks

University Exam: 70 Marks Total: 100 Marks

Course Objectives

1. Introduce students to basics of semiconductors, their classification and properties
2. To provide theory of PN junction diode, its characteristics and applications
3. To introduce basics of rectifying circuits and bipolar junction transistor
4. To provide basics of transistor biasing, transistor amplifiers and field effect transistors

Course Outcomes

By the end of the course, the student should be able to:

1. Explain the basics of semiconductors and their classification
2. Understand the theory of PN junction diode, rectifying circuits and bipolar junction transistor

3. Explain the concepts of transistor biasing, transistor amplifiers and field effect transistors

SYLLABUS

1. Introduction to Electronics and Semiconductors: Energy band theory, Conduction in Insulators, Semiconductors and metals, Electron emission from metals, Classification of semiconductors, Carrier concentration in an intrinsic semiconductor, Properties of intrinsic semiconductor, Drift and diffusion currents.

2. Semi-Conductor Diode: Theory of PN junction diode, Open circuited PN junction, V-I characteristics of a PN diode, Diode current equation, Transition and diffusion capacitances, Break down in PN diode, Applications of PN diodes. Zener diode, Zener regulator, Tunnel diode, Schottky diode.

3. Rectifying circuits: Half wave and full wave rectifiers, Bridge rectifiers, Efficiency, Ripple and regulation of each rectifier, Capacitor filters.

4. Bipolar Junction Transistor :- Introduction, construction, Operation of PNP and NPN Transistors – Transistor Circuit configurations- Characteristics of a CE configurations – h parameters, low frequency small signal equivalent circuit of a Transistor.

5. Transistor Biasing and thermal stabilization: Transistor Biasing, Stabilization, Different methods of transistor biasing – Fixed bias, Collector feedback bias – self bias – Bias compensation.

6. Transistor Amplifiers: CE, CB, CC amplifier configurations – Multistage amplifier – A Two Stage RC coupled amplifier – frequency response curve and bandwidth.

7. Field Effect Transistors: Junction Field Effect Transistors (JFET) – JFET characteristics, JFET Parameters, Small signal equivalent circuit – MOSFETS – Depletion and Enhancement MOSFETS.

Text Book

1. Electronic Device and Circuits by Sanjeev Gupta.

Reference Book

1. Electronic Device and Circuits Theory by Robert L. Boylestad
Electronic Device and Circuits by David. A. Bell

IT2102 : PC COMPUTER ORGANIZATION AND ARCHITECTURE

Instruction: 3 Periods & 1 Tut/week Credits:3

Internal: 30 Marks

University Exam: 70 Marks Total: 100 Marks

Course Objectives

1. To study about structure and functional components of a computer.
2. Understanding the hierarchical organization of a computer system which consists of instruction set of commands.

3. Learn about the architecture of a computer from a programming view.

4. To design a balance system that minimizes performance and utilization of all elements.

Course Outcomes

1. Knowledge about major components of a computer such as processor, memory and I/O modules along with their interconnections internally with outside world.

2. Detailed idea about architecture of central processing unit, functions of control unit, memory, I/O devices and their issues.

3. Simple and multiple processor organization and their issues.

SYLLABUS

1. Register Transfer and Micro operations: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Micro operations, Logic Micro operations, Shift Micro operations, Arithmetic Logic Shift Unit.

2. Basic Computer Organization and Design: Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instructions, Input- Output and Interrupt, Complete Computer Description, Design of Basic Computer, Design of Accumulator Logic.

3. Micro programmed Control: Control Memory, Address Sequencing, Micro program Example, Design of Control Unit.

4. Central Processing Unit: Introduction, General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer (RISC), Architecture and Programming of 8085 Microprocessor

5. Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processors.

6. Input/output Organization: Peripheral Devices, I/O interface, Asynchronous data transfer, Modes of transfer, priority Interrupt, Direct memory access, Input-Output Processor (IOP), Serial Communication.

7. Memory Organization: Memory Hierarchy, Main memory, Auxiliary memory, Associate Memory, Cache Memory, and Virtual memory, Memory Management Hardware.

Text Books

1. Computer System Architecture, M. Morris Mano, Prentice Hall of India Pvt. Ltd., Third Edition, Sept.2008.

2. Computer Architecture and Organization, P.Chakraborty.

3. Microprocessor Architecture, Programming and Applications with the 8085 by Ramesh S Gaonkar

Reference Books

1. Computer Architecture and Organization, William Stallings, PHI Pvt. Ltd., Eastern Economy Edition, Sixth Edition, 2003.

2. Computer Organization and Architecture, Linda Null, Julia Lobur, Narosa Publications ISBN81- 7319-609-5

3. Computer System Architecture", John. P.Hayes.

IT2103 PC SYSTEMS PROGRAMMING

Instruction: 3 Periods & 1 Tut/week Credits:3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives

1. to introduce students to assembly language programming

2. to provide basics of assembler design

3. to understand loaders, their functions, types and design

Course Outcomes

After completion of the course the student should be able to:

1. read and understand basic programs written in assembly language

2. understand the design of assembler and difference between single pass and double pass

3. gain knowledge on the types of macros, design of macro processor, loaders and their design

4. have knowledge on tools such as text editors, interpreters, debug monitors, etc.

SYLLABUS

1. Introduction to Systems Programming: Introduction to Assembly Language Programming - Introduction to Instruction Formats, Data formats - Role of Base Register, Index Register.

2. Introduction to Assembler: databases used in assembler design, Design of Assembler - Single Pass & Double Pass.

3. Introduction to Macros: various types of Macros, Design of Macro Processor - Single Pass & Double Pass.

4. Introduction to Loaders: functions of a loader, types of Loaders, databases used in Loaders, Design of Loaders - Absolute & DLL.

5. Introduction to Software Tools: Text editors, Interpreters, Program Generators, Debug Monitors.

Text Book

1. Systems Programming by Donovan Tata McGraw Hill

Reference Book

1. System Programming by Dhamdhere Tata McGraw Hill, IInd Revised Edition

IT2104 PC INTERNET CONCEPTS AND JAVA PROGRAMMING

Instruction: 3 Periods & 1 Tut/week Credits:3

Internal: 30 Marks

University Exam: 70 Marks Total: 100 Marks

Course Objectives

1. provide fundamental knowledge of HTML and Object Oriented Programming concepts

2. introduce students to Java programming language, its syntax, data types, expressions, control statements, arrays and functions

3. provide basics of classes, interfaces, multi-threading and various packages in Java

4. introduce students to event driven programming and applets

5. provide basics of networking including client/server, sockets, internet addressing, etc.

Course Outcomes

After completion of the course the student should be able to:

1. explain the basic concepts in Object Oriented Programming

2. write Java programs involving control statements, arrays, structures, functions, classes, interfaces and use various packages available in Java

3. develop event driven programs and applets

4. understand the basics of networking including client/server, sockets, internet addressing, etc.

Syllabus

1. Fundamentals: HTML, OOP Concepts, Comparing JAVA with C & C++, JAVA Programming language Syntax, Variables, Data types, statements and expressions

2. Control Statements: If else, for, while, and do while loops, Switch statements.

3. Arrays & Structures: One Dimensional & Two Dimensional Arrays, Named Structures.

4. Functions: Parameter Passing, Static Modifier.

5. Features of JAVA: Classes and Interfaces, Threads and multithreaded programming, Exception handling, Introduction to packages, Math package, Lang package, Util package.

6. Applet Programming: Events, Event driven programming, Events like buttons, mouse, keyboards etc., Applets, Applets package, Fonts, colors, Graphics, images. AWT components, layout managers, writing event driven program using components.

7. Networking: Networking Basics: Socket overview, Client/Server, Reserved sockets. Proxy servers, Internet addressing; Java and the net, Inet address, TCP/IP client sockets, URL, URL connection, TCP/IP server sockets, Data grams.

Text Books

1. Introduction to Java programming, a primar , Balaguruswamy.
2. Java Complete Reference, Herbt Schild.

Reference Books

1. Introduction to Java programming , Daneal/Young PHI

IT2105 PC PYTHON PROGRAMMING

Instruction: 3 Periods & 1 Tut/week Credits:3

Internal: 30 Marks

University Exam: 70 Marks Total: 100 Marks

Course Objectives

1. To develop skills on procedural oriented and object oriented programming in Python
2. To understand and apply different data wrangling techniques using Python.
3. To perform data analysis using python libraries like NumPy, Pandas and exploratory data analysis using Matplotlib

Course Outcomes

At the end of the course, a student should be able to:

1. acquire programming knowledge on Basics of Python
2. acquire programming knowledge on Text and File Handling
3. develop Python programs to Mean, Median, Mode, Correlation
4. acquire programming knowledge on NumPy, Pandas Library
5. acquire programming knowledge on Graph Visualizations in Python and Data Analysis using Python

SYLLABUS

1. Introduction to Python: Rapid Introduction to Procedural Programming, Data Types: Identifiers and Keywords, Integral Types, Floating Point Types

Strings: Strings, Comparing Strings, Slicing and Striding Strings, String Operators and Methods, String formatting with str.format

Collections Data Types: Tuples, Lists, Sets, dictionaries, Iterating and copying collections

2. Python Control Structures, Functions and OOP:Control Structures and Functions: Conditional Branching, Looping, Exception Handling, Custom Fuctions

Python Library Modules: random, math, time, os, shutil, sys, glob, re, statistics,creating a custom module

Object Oriented Programming:Object Oriented Concepts and Terminology, Custom Classes, Attributes and Methods, Inheritance and Polymorphism, Using Properties to Control Attribute Access

File Handling: Writing and Reading Binary Data, Writing and Parsing Text Files

3. NumPy Arrays and Vectorized Computation: NumPy arrays, Array creation, Indexing and slicing, Fancy indexing, Numerical operations on arrays, Array functions, Data processing using arrays, Loading and saving data, Saving an array, Loading an array, Linear algebra with NumPy, NumPy random numbers

4. Data Analysis with Pandas: An overview of the Pandas package, The Pandas data structure-Series, The DataFrame, The Essential Basic Functionality: Reindexing and altering labels , Head and tail, Binary operations, Functional statistics , Function application Sorting, Indexing and selecting data, Computational tools, Working with Missing Data, Advanced Uses of Pandas for Data Analysis - Hierarchical indexing, The Panel data

5. Data Analysis Application Examples: Data munging,Cleaning data, Filtering, Merging data, Reshaping data, Data aggregation, Grouping data

6. Data Visualization: The matplotlib API primer-Line properties, Figures and subplots, Exploring plot types-Scatter plots, Bar plots, Histogram plots, Legends and annotations, Plotting functions with Pandas

Text Books

1. Programming in Python 3: A Complete Introduction to Python Language, Mark Summerfield, Second Edition, Addison-Wesley Publications

2. Python: End-to-End Data Analysis Learning Path, Module 1: Getting Started with Python Data Analysis , Phuong VothiHong , Martin Czygan, , Packt Publishing Ltd

Reference Books

1. Learning Python, 5th Edition, Mark Lutz, Orielly Publications
2. Python for Data Analysis, Wes McKinney, Orielly Publications
3. How to Think Like a Computer Scientist: Learning with Python 3 Documentation 3rd Edition, Peter Wentworth, Jeffrey Elkner, Allen B. Downey, Chris Meyers

4. Core Python Programming, Second Edition, Wesley J. Chun, Prentice Hall

5. Python Cookbook – Recipes for Mastering Python 3, 3rd Edition, David Beazley, Brian K. Jones, O'Reilly

IT 2106 PC COMPUTER ORGANIZATION LAB

Instruction: 3 Periods/week Credits: 1.5

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

Course Objectives

1. to design and analyze the operational behavior of IC gates, multiplexers, decoders, flip-flops, counters, shift registers, binary adders and subtractors and ALU
2. to implement assembly language programming using various trainers
3. to make students familiar with Pentium class PC architecture

Course Outcomes

After completion of the course the student should be able to:

1. analyze the operational behavior of various digital logic units such as multiplexers, decoders, flip-flops, counters, shift registers, binary adders and subtractors and ALU
2. write assembly language code using various trainers
3. understand Pentium class PC architecture.

SYLLABUS

I - Cycle: Digital Logic Design Experiments

TTL Characteristics and TTL IC Gates

Multiplexers & Decoders

Flip-Flops

Counters

Shift Registers

Binary Adders & Subtractors

ALU

II - CYCLE: 8085 Assembly Language Programming

8085 Assembly Language Programming according to theory course microprocessors-I using the following trainers:

Keyboard Monitor of 8085µP Trainer

Serial Monitor of 8085µP Trainer with Terminal

8085 Line Assembler of 8085µP Trainer with PC as Terminal

8085 Cross Assembler using In-Circuit Emulator (ICE) with 8085µP Trainer and PC as Terminal

Graded Problems are to be used according to the syllabus of COMPUTER ORGANIZATION

PENTIUM CLASS PC ARCHITECTURE FAMILIARIZATION
HARDWARE & SOFTWARE PARTS DEMONSTRATION

IT2107 PC INTERNET CONCEPTS AND JAVA PROGRAMMING LAB

Instruction: 3 Periods/week Credits: 1.5

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

Course Objectives

1. To expose students to Java programming language and its syntax
 2. to familiarize students with programming concepts of conditional execution, loops, arrays, functions, etc.
 3. to introduce the basics of object oriented programming, concept of classes and interfaces
- Course Outcomes**
1. apply Java language to develop basic programs using classes
 2. able to code in Java by accepting input from command line, write output to a file
 3. develop applet programs in Java

SYLLABUS

Lab experiments:

1. (a) Program to display the area of a rectangle.
(b) Program to find Sum of series $1+x+x^2+x^3+\dots$
2. (a) Write a class to display the area of rectangle and inherit this class into other class which is displaying perimeter of a rectangle and implement.
(b) Write a class to add three no's inherit this class into other class to add five no's and implement it.
3. (a) Write a program to print the path, filename and extension for a given path of a file.
(b) Write a program to receive two command line arguments check whether they are equal or not.
4. (a) A program to take two arguments and divide the first argument with second argument and display the result. Display the error message if divide by zero without abnormal exit.
(b) A program to accept more than one string and arrange them in alphabetical order.

(c) Write a program to display simultaneously output of even and odd numbers starting from one to specified number.

5. Write a program to accept data from keyboard and write it into a file.

6. Write a java program to implement stack & Queue operations.

7. Write a program to draw line and circle using mouse.

8. Write an applet program for drawing the bar chart.

9. Write an applet program to design a calculator for implementing basic functions like +, -, *, /.

10. Write a program to check active ports in system.

IT2108 PC PYTHON PROGRAMMING LAB

Instruction: 3 Periods/week Credits:1.5

Internal: 50 Marks

University Exam: 50 Marks Total: 100 Marks

Course Objectives

1. familiarize students with key data structures in Python including lists and dictionaries and apply them in context of searching, sorting, text and file handling

2. introduce students to calculation of statistical measures using Python such as measures of central tendency, correlation

3. familiarize students with important Python data related libraries such as Numpy and Pandas and use them to manipulate arrays and dataframes

4. introduce students to data visualization in Python through creation of line plots, histograms, scatter plots, box plots and others

5. implementation of basic machine learning tasks in Python including pre-processing data, dimensionality reduction of data using PCA, clustering, classification and cross-validation.

Course Outcomes

After completion of the course the student should be able to:

1. implement searching, sorting and handle text and files using Python data structures such as lists and dictionaries

2. calculate statistical measures using Python such as measures of central tendency, correlation

3. use Python data related libraries such as Numpy and Pandas and create data visualizations

4. implement basic machine learning tasks pre-processing data, compressing data, clustering, classification and cross-validation.

SYLLABUS

1. Python Programs on lists & Dictionaries

2. Python Programs on Searching and sorting

3. Python Programs on Text Handling

4. Python Programs on File Handling

5. Python Programs for calculating Mean, Mode, Median, Variance, Standard Deviation

6. Python Programs for Karl Pearson Coefficient of Correlation, Rank Correlation

7. Python Programs on NumPy Arrays, Linear algebra with NumPy

8. Python Programs for creation and manipulation of DataFrames using Pandas Library

9. Write a Python program for the following.

- Simple Line Plots,

- Adjusting the Plot: Line Colors and Styles, Axes Limits, Labeling Plots,

- Simple Scatter Plots,

- Histograms,

- Customizing Plot Legends,

- Choosing Elements for the Legend,

- Boxplot

- Multiple Legends,

- Customizing Colorbars,

- Multiple Subplots,

- Text and Annotation,

- Customizing Ticks

10. Python Programs for Data preprocessing: Handling missing values, handling categorical data, bringing features to same scale, selecting meaningful features

11. Python Program for Compressing data via dimensionality reduction: PCA

12. Python Programs for Data Clustering

13. Python Programs for Classification

14. Python Programs for Model Evaluation: K-fold cross validation

Reference Books

1. Core Python Programming, Second Edition, Wesley J. Chun, Prentice Hall

2. Chris Albon, "Machine Learning with Python Cookbook-practical solutions from preprocessing to Deep learning", O'REILLY Publisher, 2018
3. Mark Summerfield, Programming in Python 3—A Complete Introduction to the Python Language, Second Edition, Addison Wesley
4. Phuong Vo.T.H, Martin Czygan, Getting Started with Python Data Analysis, Packt Publishing Ltd
5. Armando Fandango, Python Data Analysis, Packt Publishing Ltd
6. Magnus Vilhelm Persson and Luiz Felipe Martins, Mastering Python Data Analysis, Packt Publishing Ltd
7. Sebastian Raschka & Vahid Mirjalili, "Python Machine Learning", Packt Publisher, 2017

IT2109 SC EMBEDDED SYSTEM DESIGN USING ARDUINO

Instruction: 1L + 2P /week Credits:2

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

Course Objectives

1. To introduce basics of electronics and reading electronics diagrams
2. To introduce students to basics of Arduino programming language and IDE
3. To provide students knowledge on how to build prototype circuits, connect them to the Arduino and program the Arduino microcontroller

Course Outcomes

At the end of this course, students will:

1. Learn the basics of electronics, including reading schematics (electronics diagrams) and how to prototype circuits with a breadboard.
2. Learn the Arduino programming language and IDE
3. Acquire knowledge on how to program basic Arduino examples, build prototype circuits, connect them to the Arduino, program the Arduino microcontroller to make the circuits work and connect the Arduino microcontroller to a serial terminal to understand communication and stand-alone use.
4. Explore online resources for extending knowledge about the capabilities of the Arduino microcontroller.

SYLLABUS

1. Embedded Systems Introduction, Different Microcontroller Architectures (CISC, RISC, ARISC). Internal Resources & Hardware Chips in Details. History of AVR Microcontrollers and Features, Memory Architectures (RAM/ROM). 8051 Architecture and programming.

2. Introduction to ARDUINO, ARDUINO History and Family Programming in Embedded -C, Concepts of C language.

3. Hardware Interfacing with 8051/Arduino

- a. LEDs and Switches,
- b. Seven Segment Display and Multi Segment Display,
- c. Relays (AC Appliance Control)
- d. LCD, Buzzer,
- e. IR Sensors and other digital sensors,
- f. Matrix Keypad

- g. UART Communication (MCU to PC) UART Communication (MCU to MCU)

- h. Graphical LCD

- i. RTC Based Real Time Clock

- j. Sensor Interfacing: Accelerometer/Gyro/Tilt Sensor, Analogue Sensors (Temperature, Gas & Alcohol) UART Based Sensors (Colour Sensor, Humidity Sensor).

4. Software Programming/Assembly Language Programming for above HW interfacing experiments with development kits or Simulation environment.

Text Book

1. Designing Embedded Systems with Arduino A Fundamental Technology for Makers, Pan, Tianhong, Zhu, Yi, Springer Publications

IT2110 MC ENVIRONMENTAL SCIENCE

Instruction: - Credits:0

Internal: - University Exam: 100 Marks Total: 100 Marks

Course Objectives

The objectives of the Environmental Science course are to

- Familiarize the fundamental aspects of environment and the environmental management
- Provide information of some of the important international conventions which will be useful during the future endeavors after graduation.
- Make realize the importance of natural resources management for the sustenance of the life and the society.
- Apprise the impact of pollution getting generated through the anthropogenic activities on the environment
- Provide the concept of Sustainable Development, energy and environmental management

- Impart knowledge on the new generation waste like e-waste and plastic waste

Course Outcomes

After completion of the course the students will have

- Knowledge on the fundamental aspects of environment and the environmental management
- The knowledge on the salient features of the important international conventions
- Understanding of the importance of natural resources management for the sustenance of the life and the society.
- Familiarity on various forms of pollution and its impact on the environment.
- Understand the elements of Sustainable Development, energy and environmental management
- Knowledge on the new generation waste like e-waste and plastic waste

SYLLABUS

Introduction: Structure and functions of Ecosystems-Ecosystems and its Dynamics-Value of Biodiversity-impact of loss of biodiversity, Conservation of bio-diversity. Environmental indicators - Global environmental issues and their impact on the ecosystems.

Salient features of International conventions on Environment: Montreal Protocol, Kyoto protocol, Ramsar Convention on Wetlands, Stockholm Convention on Persistent Organic Pollutants, United Nations Framework Convention on Climate Change (UNFCCC),

Natural Resources Management: Importance of natural resources management-Land as resource, Land degradation, Soil erosion and desertification, Effects of usage of fertilizer, herbicides and pesticide-watershed management.

Forest resources: Use and over-exploitation, Mining and dams – their effects on forest ecosystems and the living beings.

Water resources: Exploitation of surface and groundwater, Floods, droughts, Dams:benefits and costs.

Mineral Resources: Impact of mining on the environment and possible environmental management options in mining and processing of the minerals.

Sustainable resource management (land, water, and energy), and resilient design under the changing environment.

Environmental Pollution: Local and Global Issues. Causes, effects and control measures. Engineering aspects of environmental pollution control systems.

Air pollution: impacts of ambient and indoor air pollution on human health. Water pollution: impacts water pollution on human health and loss of fresh water resources. Soil pollution and its impact on environment. Marine pollution and its impact on blue economy. Noise pollution.

Solid waste management: Important elements in solid waste management- Waste to energy concepts. Air (prevention and control of pollution) Act, Water (prevention and control of pollution) Act and their amendments. Salient features of Environmental protection Act, 1986.

Sustainable Development: Fundamentals of Sustainable Development– Sustainability Strategies and Barriers – Industrialization and sustainable development. Circular economy concepts in waste (solid and fluid) management.

Energy and Environment: Environmental Benefits and challenges, Availability and need of conventional energy resources, major environmental problems related to the conventional energy resources, future possibilities of energy need and availability. Solar Energy: process of photovoltaic energy conversion, solar energy conversion technologies and devices, their principles, working and applications, disposal of solar panel after their usage. Biomass energy: Concept of biomass energy utilization, types of biomass energy, conversion processes, Wind Energy, energy conversion technologies, their principles, equipment and suitability in context of India.

Management of plastic waste and E-waste: Sources, generation and characteristics of various e- and plastic wastes generated from various industrial and commercial activities; Waste management practices including onsite handling, storage, collection and transfer. E-waste and plastic waste processing alternatives. E-Waste management rules and Plastic waste management rules, 2016 and their subsequent amendments.

Text Books

1. Bharucha, Erach (2004). Textbook for Environmental Studies for Undergraduate Courses of all Branches of Higher Education, University Grants Commission, New Delhi
2. Basu, M., Xavier, S. (2016). Fundamentals of Environmental Studies, Cambridge University Press, India
3. Masters, G. M., & Ela, W. P. (1991). Introduction to environmental engineering and science. Englewood Cliffs, NJ: Prentice Hall.

4. Enger, E. and Smith, B., Environmental Science: A Study of Interrelationships, Publisher: McGraw-Hill Higher Education; 12th edition, 2010

Reference Books

1. Sharma, P. D., & Sharma, P. D. (2005). Ecology and environment. Rastogi Publications

2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.

3. Clark R.S. (2001). Marine Pollution, Clanderson Press Oxford (TB)

4. Jadhav, H & Bhosale, V.M. (1995). Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.

5. MoEF&CC, Govt. of India, CPCB: E-waste management rules, 2016 and its amendments 2018.

6. MoEF&CC, Govt. of India, CPCB: Plastic waste management rules, 2016

B.Tech (IT) II Year – II Semester

(w.e.f. 2020-21 admitted batch)

Course Credits code	Category	Course Title	Hours per week			Internal Marks	External Marks	Total Marks	
			L	T	P				
IT2201	BS	FORMAL LANGUAGES AND AUTOMATA THEORY	3	1	0	30	70	100	3
IT2202	PC	OPERATING SYSTEMS	3	1	0	30	70	100	3
IT2203	PC	DATABASE MANAGEMENT SYSTEMS	3	1	0	30	70	100	3
IT2204	PC	PROBABILITY, STATISTICS AND QUEUEING THEORY	3	1	0	30	70	100	3
IT2205	HSS	MANAGERIAL ECONOMICS	3	1	0	30	70	100	3
IT2206	PC	OPERATING SYSTEMS LAB	0	0	3	50	50	100	1.5
IT2207	PC	DATABASE MANAGEMENT SYSTEMS LAB	0	0	3	50	50	100	1.5
IT2208	SC	INTELLECTUAL PROPERTY RIGHTS	1	0	2	50	50	100	2
IT2209	MC	PROFESSIONAL ETHICS AND UNIVERSAL HUMAN VALUES	0	0	0	-	100	100	0
IT2210	MC	NSS / NCC	0	0	2	-	-	-	0
Total credits									20

Summer Internship (Community Service)

IT2201 BS FORMAL LANGUAGES AND AUTOMATA THEORY

Instruction: 3 Periods & 1 Tut/week Credits:3

Internal: 30 Marks

University Exam: 70 Marks Total: 100 Marks

Course Objectives

1. To introduce the concepts in automata theory and theory of computation to design grammars and recognizers for different formal languages.

2. To employ finite state machines to solve problems in computing.

3. To introduce finite state machines, context free grammars and Turing Machines and their properties as the basis for the formal expressivity of computer languages for solving linguistic decision problems.

4. To understand the concepts of tractability and decidability, the concepts of NP-completeness and NP-hard problem and also the challenges for Theoretical Computer Science and its contribution to other sciences.

Course Outcomes

1. Ability to think analytically and intuitively for problem solving situations in related areas of theory in computer science

2. Ability to describe the language accepted by an automata or generated by a regular expression or a context-free grammar;

3. Ability to Understand the functioning of Finite-State Machines, Deterministic Finite-State Automata, Nondeterministic Finite-State Automata and Pushdown Automata and Turing Machines.

SYLLABUS

1. Definitions of alphabet, strings, language, grammar, types of grammar, types of machines, generation of languages from grammar, construction of grammar from the given description of languages.

2. Definition of finite state machine, Definite state machine, indefinite state machine, representations in mathematical diagram, tabular etc., id of finite state machine's, design of finite state machine from the given description, elimination of λ -transitions, indefinite state machine to definite state machine, optimization of finite state machine.

3. Conversion of regular grammar to finite state machine, finite state machine to regular grammar, discussion of pumping lemma, systematic way of construction of finite state machine.

4. Definition of regular expression, regular algebra, minimization of regular expressions, closure properties, construction of regular expression from the given description, regular expression to finite state machine, finite state machine to regular expression, construction of regular expression for the given finite state machine- a systematic way using Arden's theorem

5. Definition of push down machine, push down machine, types of push down machine's, push down machine to context free grammar, context free grammar to push down machine, design methodology of various push

down machine's, push down machine by empty stack, push down machine by final states, conversion from one type to other type, applications of push down machine's.

6. Parsing tree, bottom-up parsing, top-down parsing, types of context free grammar's, left-most and right most derivations, productions, reductions, optimization of context free grammar's, elimination of ϵ productions, unit productions, normal forms- cnf, gnf.

7. Definition of Turing machine, ways of representing Turing machine's- tabular form, diagram, mathematical form, quintuples etc., design of Turing machine, id of Turing machine, types of Turing machine, halting problem, church's thesis, universal Turing machine, Gödel number, definitions of recursive functions- prf, rf, decidability.

NOTE: Theorem proofs are eliminated

Text Books

1. Introduction to automata theory, languages and computation, John.E.H.P croft/ Rajeev Motwani& JD Ullman—pearson education- III edition

2. Theory of computation, K.L.P.Mishra and N.Chandrasekhar, PHI

Reference Books

1. Theory of computation, formal languages and automata theory, G P SaradhiVarma, B.ThirupathiRao –Sci Tech publications.

IT2202 PC OPERATING SYSTEMS

Instruction: 3 Periods & 1 Tut/week Credits:3

Internal: 30 Marks

University Exam: 70 Marks Total: 100 Marks

Course Objectives

1. To understand evolution of Operating System.
2. To understand operating system as a layer of abstraction above physical hardware that facilitates usage convenience and efficient resource management of computer system resources.
3. To learn design and implementation of policies and mechanisms for OS subsystem.
4. To investigate case studies to understand the design philosophies / paradigm for popular multiuser or single user operating system.

Course Outcomes

1. The student understands OS evolution, its structure and services provided by it.
2. Learn process life cycle, process scheduling objectives, policies and mechanisms, process synchronization; inter process communication, deadlocks and other process subsystem related concepts.

3. Learn memory hierarchy, allocation and deallocation policies and mechanism for main and auxiliary memory; file system design and implementation issues.

4. Investigate UNIX/ LINUX and Windows OS platforms w.r.t similarities and differences in design philosophies.

SYLLABUS

1. Introduction to Operating Systems: Over View of Operating Systems, Types of Operating Systems, Operating System Structures, Operating System Services, System Calls, Virtual Machines, Operating System Design and Implementation.

2. Process Management: Process Concepts, Operations on Processes, Cooperating Processes, Threads, Inter Process Communication, Process Scheduling, Scheduling Algorithms, Multiple- Processor Scheduling, Thread Scheduling.

3. Process Synchronization: The Critical Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classical Problems of Synchronization, Critical Regions, Monitors.

4. Deadlocks: System Model, Deadlock Characterization, Methods For Handling Deadlocks, Deadlock Prevention, Avoidance, Deadlock Detection, Recovery from Deadlocks

5. Memory Management: Logical versus Physical Address, Swapping, contiguous memory allocation, paging, structure of the page table , segmentation, Virtual Memory, Demand Paging, Page Replacement, Allocation of Frames, Thrashing, Memory-Mapped files

6. File Systems, Implementation, and Secondary-storage Structure: Concept of a file, Access Methods, Directory Structure, Protection, File System Structure, Allocation Methods, Free Space Management, Directory Management, Device Drivers, overview of Mass-storage structure, Disk structure, disk attachment, disk scheduling, swap-space management.

7. Case study: Overview of LINUX, Windows Operating systems

Text Books

1. Operating Systems, Abraham Silbers chatz, Peter Baer Galvin, and Greg Gagne, John Wiley Publ., Seventh Edition.

2. Operating Systems; A Practical Approach. Rajiv Chopra

Reference Books

1. Modern Operating Systems, Andrew S. Tanenbaum, 2nd edition, 1995, PHI.

2. Operating Systems, William Stallings 5th Edition -PHI
3. Operating Systems: A Design-Oriented Approach', Charles Crowley, 'Tata Hill Co., 1998 edition.

IT2203 PC DATABASE MANAGEMENT SYSTEMS

Instruction: 3 Periods & 1 Tut/week Credits:3

Internal: 30 Marks

University Exam: 70 Marks Total: 100 Marks

Course Objectives

1. To learn the evolution of DBMS Versus File systems, data models, and layers of abstraction.
2. To understand conceptual and physical aspects of database design.
3. To learn formal and commercial query language specifications.
4. To understand concurrency control, recovery management, and other related issues.

Course Outcomes

1. The student will understand ER-modeling for conceptual database design and relational model.
2. The student is introduced to formal and commercial query languages: Relational Algebra, calculus and SQL.
3. The student will learn schema refinement and normalization.
4. The Student understands locking protocols concurrency control, and crash recovery methods.

SYLLABUS

1. Introduction: File system versus a DBMS, Advantages of a DBMS, Describing and Storing Data in a DBMS, The Relational model, Levels of abstraction, Data Independence, Transaction management, Structure of a DBMS.

2. Introduction to Database Design and The Relational Model: Database Design and ER Diagrams, Entities, Attributes and Entity Sets, Relationships & Relationship Sets, Additional Features of the ER Model, Conceptual Design with ER Model, Introduction to the Relational Model, Integrity Constraints over Relations, Enforcing Integrity Constraints, Querying Relational Data, Logical Database Design: ER to Relational, Introduction to Views, Destroying/ Altering Tables and Views.

3. Relational Algebra and SQL: Preliminaries, Relational Algebra, The form of a Basic SQL Query, UNION, INTERSECT and EXCEPT, Nested Queries, Aggregate Operators, Null Values, Complex Integrity Constraints in SQL, Triggers and Active Databases, Embedded SQL, Dynamic SQL, JDBC.

4. Database Design: Schema Refinement and Normal Forms, Introduction to Schema Refinement, Functional Dependencies, Reasoning about FD's, Normal Forms, Properties of Decomposition, Normalization, Other kinds of Dependencies.

5. Transaction Management: The ACID Properties, Transactions & Schedules, Concurrent Execution of Transactions, Lock-Based Concurrency Control.

6. Concurrency Control: 2PL, Serializability and Recoverability, Introduction to Lock Management, Lock Conversions, Dealing with Deadlocks, Specialized Locking Techniques, Concurrency Control without Locking.

7. Crash Recovery: Introduction to ARIES, The Log, Other Recovery-Related Structures, The Write-Ahead Log Protocol, Check pointing, recovering from a System Crash, Media Recovery.

Text Books

1. Database Management Systems; Raghu Ramakrishnan, Johannes Gehrke 4th Edition, McGraw-Hill
2. Database Management Systems; Raghu RamaKrishnan, Johannes Gehrke.

Reference Books

1. Database System Concepts; A. Silberschatz, H. Korth 5th Edition, McGraw-Hill

IT2204 PC PROBABILITY, STATISTICS AND QUEUING THEORY

Instruction: 3 Periods & 1 Tut/week Credits:3

Internal: 30 Marks

University Exam: 70 Marks Total: 100 Marks

Course Objectives

1. to provide foundations of probabilistic and statistical analysis
2. to provide an understanding on concepts of probability, random variables, probability distributions, sampling, estimation, hypothesis testing, regression, correlation, multiple regression, hypothesis testing, sample test, queuing methods
3. to explore applications of probabilistic and statistical tools to solve real world problems.

Course Outcomes

1. After completion of the course the student should be able to:
2. define and explain basic concepts in probability theory and how to translate real-world problems into probability models
3. solve standard problems that include random variables, discrete and continuous probability distributions

4. perform Test of Hypothesis and construct a confidence interval to estimate population parameters
5. compute and interpret the results of Correlation Analysis, Multivariate Regression, Chi-Square test for Independence and Goodness of Fit
6. explain basic concepts in Markov processes, M/M/1 and M/M/C queueing systems.

SYLLABUS

1. Probability: Definitions of probability, Addition theorem, Conditional probability, Multiplication theorem, Bayes' Theorem of Probability and Geometric Probability.
2. Random variables and their properties: Discrete Random Variable, Continuous Random Variable, Probability Distribution, Joint Probability Distributions their Properties, Transformation Variables, Mathematical Expectations, Probability Generating Functions.
3. Probability Distributions: Discrete Distributions : Binomial, Poisson Negative Binomial Distributions And Their Properties; Continuous Distributions : Uniform, Normal, Exponential Distributions And Their Properties.
4. Multivariate Analysis : Correlation, Correlation Coefficient, Rank Correlation, Regression Analysis, Multiple Regression, Attributes, Coefficient Of Association, Chi Square Test For Goodness Of Fit, Test For Independence.
5. Estimation: Sample, Populations, Statistic, Parameter, Sampling Distribution, Standard Error, Un-biasedness, Efficiency, Maximum Likelihood Estimator, Notion & Interval Estimation.
6. Testing of Hypothesis: Formulation of Null hypothesis, critical region, level of significance, power of the test;
7. Sample Tests: Small Sample Tests : Testing equality of means, testing equality of variances, test of correlation coefficient, test for Regression Coefficient; Large Sample tests: Tests based on normal distribution
8. Queuing Theory : Queue description, characteristics of a queuing model, study state solutions of M/M/1: Model, M/M/1 ; N Model, M/M/C: Model, M/M/C: N Model , Casestudies

Text Books

1. Probability & Statistics for Engineers and Scientists, Walpole, Myers, Myers, Ye. Pearson Education.
2. Probability, Statistics and Random Processes T.Veerarajan Tata McGraw – Hill

Reference Books

1. Probability & Statistics with Reliability, Queuing and Computer Applications, Kishor S. Trivedi, Prentice Hall of India ,1999

IT2205 HSS MANAGERIAL ECONOMICS

Instruction: 3 Periods & 1 Tut/week Credits:3

Internal: 30 Marks

University Exam: 70 Marks Total: 100 Marks

Course Objectives

- To bring about an awareness about the nature of Managerial Economics and its linkages with other disciplines.
- To understand the Micro and Macro Environment of Business.
- To familiarize the prospective engineers with the concepts and tools of Managerial Economics with an objective to understand the real world of business

Course Outcomes

After completion of the course, student will be able to:

- Understand the various economic activities in business and industry.
- Analyse the real world business problems.
- Make optimal business decisions for the effective and efficient management of Organisations

SYLLABUS

Significance of Economics and Managerial Economics: Economics: Definitions of Economics- Wealth, Welfare and Scarcity definitions Classification of Economics- Micro and Macro Economics.

Managerial Economics: Definition, Nature and Scope of Managerial Economics, Differences between Economics and Managerial Economics, Main areas of Managerial Economics, Managerial Economics with other disciplines.

Demand and Utility Analysis: Demand - Definition, Meaning, Nature and types of demand, Demand function, Law of demand - Assumptions and limitations. Exceptional demand curve.

Elasticity of demand - Definition, Measurement of elasticity, Types of Elasticity (Price, Income, Cross and Advertisement), Practical importance of Price elasticity of demand, Role of income elasticity in business decisions, Factors governing Price Elasticity of demand.

Utility Analysis: Utility- Meaning, Types of Economic Utilities, Cardinal and Ordinal Utility, Total Utility, Marginal Utility, The law of Diminishing Marginal Utility and its Limitations.

Theory of Production and Cost analysis: Production - Meaning, Production function and its assumptions, use of production function in decision making;

Cost analysis - Nature of cost, Classification of costs - Fixed vs. Variable costs, Marginal cost, Controllable vs. Non - Controllable costs, Opportunity cost, Incremental vs. Sunk costs, Explicit vs. Implicit costs, Replacement costs, Historical costs, Urgent vs. Postponable costs, Escapable vs. Unavoidable costs, Economies and Diseconomies of scale.

Market Structures : Definition of Market, Classification of markets; Salient features or conditions of different markets - Perfect Competition, Monopoly, Duopoly , Oligopoly, Importance of kinked demand curve ;Monopolistic Competition.

Pricing and Business Cycles: Pricing Analysis : Pricing – Significance; Different Pricing methods- Cost plus pricing, Target pricing, Marginal cost pricing, Going -rate pricing, Average cost pricing, Peak load pricing , Pricing of joint Products, Pricing over the life cycle of a Product, Skimming pricing Penetration pricing, Mark- up and Mark- down pricing of retailers.

Business cycles - Definition, Characteristics, Phases, Causes and Consequences; Measures to solve problems arising from Business cycles.

Text Books

1. Sankaran,S., Managerial Economics, Marghan Publications, 2015, Chennai.
2. Aryasri, A.R., Managerial Economics and Financial Analysis, MC Graw Hill Education, New Delhi, 2015

Reference Books

1. Dwivedi, D.N., Managerial Economics, Vikhas Publishing House Pvt. Ltd. 6th Edition, New Delhi, 2004.
2. Dewett, K.K., Modern Economic Theory, S.Chand & Company Ltd., New Delhi, 2005

IT2206 PC OPERATING SYSTEMS LAB

Instruction: 3 Periods/week Credits:1.5

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

Course Objectives

1. To learn about UNIX/LINUX operating system, its intervals.
2. To learn system programming for UNIX/LINUX Operating System.
3. To understand UNIX/LINUX shell and its programming.
4. To understand resource management policies and mechanisms and their performance evaluation.

Course Outcomes

1. The student practices UNIX commands, Vi editor, shell commands.
2. The student develops skill in writing C programs using system calls for process management, inter process communication and other aspects.
3. The student learns shell programming and develops skill for writing scripts for batch level tasks.
4. The student learns to simulate OS resource management aspects like process scheduling, page replacement and others to evaluate performance.

SYLLABUS

Module I

1. OS lab familiarization, Home Assignment on Unix commands, Vi editor
2. Simple C programs using command line arguments, system calls, library function calls, make utility
3. C programs using fork system call to create processes and study parent, child process mechanism
4. C programs to create process chaining, spawning
5. C programs to handle errors using errno, perror() function
6. C programs to use pipe system call for inter process communication

Module II

1. Familiarization of Unix shell programming
2. Simple shell programming exercises
3. Shell programming using decision making constructs
4. Shell programming using loop constructs
5. Shell programming for file and directory manipulation

Module III

1. C programs to study process scheduling implementing FCFS, Shortest Job First, and Round Robin algorithms
2. C programs to study page replacement implementing FIFO, Optimal, and LRU page replacement algorithms
3. C programs to study deadlock avoidance and detection
4. C Programs to simulate free space management

Reference Books

1. UNIX concepts and applications by Sumitabha Das, TMH Publications.
2. UNIX programming by Stevens, Pearson Education.

3. Shell programming by Yashwanth Kanetkar.
4. Operating System Concepts by Silberschatz, and Peter Galvin.

IT2207 PC DATABASE MANAGEMENT SYSTEMS LAB

Instruction: 3 Periods/week Credits:1.5

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

Course Objectives

1. To introduce to a commercial DBMS such as ORACLE.
2. To learn and practice SQL commands for schema creation, data manipulation.
3. To learn conceptual and physical database design based on a case study.
4. To apply database design stages by studying a case study.

Course Outcomes

1. The student is exposed to a commercial RDBMS environment such as ORACLE.
2. The student will learn SQL commands for data definition and manipulation.
3. The student understands conceptual through physical data base design.
4. The student takes up a case study and applies the design steps.

SYLLABUS

Features of a commercial RDBMS package such as ORACLE/DB2, MS Access, MYSQL & Structured Query Language (SQL) used with the RDBMS.

- I. Laboratory Exercises Should Include:
 - a. Defining Schemas for Applications,
 - b. Creation of Database,
 - c. Writing SQL Queries,
 - d. Retrieve Information from Database,
 - e. Creating Views
 - f. Creating Triggers
 - g. Normalization up to Third Normal Form
 - h. Use of Host Languages,
 - i. Interface with Embedded SQL,
 - j. Use of Forms
 - k. Report Writing
- II. Some sample applications are given below:
 1. Accounting Package for Shops,

2. Database Manager for Magazine Agency or News paper Agency,
3. Ticket Booking for Performances,
4. Preparing Greeting Cards & Birthday Cards
5. Personal Accounts - Insurance, Loans, Mortgage Payments, Etc.,
6. Doctor's Diary & Billing System
7. Personal Bank Account
8. Class Marks Management
9. Hostel Accounting
10. Video Tape Library,
11. History of Cricket Scores,
12. Cable TV Transmission Program Manager,
13. Personal Library.
14. Sailors Database
15. Suppliers and Parts Database

IT2108 SC INTELLECTUAL PROPERTY RIGHTS

Instruction: 1L + 2P /week Credits:2

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

Course Objectives

1. To introduce the students to Intellectual Property Rights (IPR) which is a key component in modern knowledge management processes
2. To create consciousness on IPR in students at an early stage of their education so that they develop an appreciation for ethical and rightful use of existing knowledge
3. To make them understand how to take ownership of knowledge they may develop as a result of their creative innovations, take ownership and either drive themselves in becoming entrepreneurs or become responsible knowledge users in society
4. To expose students some of the recent debates on the societal implications of IPR and its role in national/international trade and socio-economic development.

Course Outcomes

Learners will be able to

1. identify the types of intellectual property protection available for their research outcome
2. conduct patent search and analyze patentability of the invention
3. understand the basic structure of Patent document
4. understand the registration and prosecution of different IPs
5. understand the basics of IP commercialization and techno/commercial/legal issues in IPR commercialization

SYLLABUS

1. Introduction: Concept of property, Intellectual Property (IP) and Intellectual Property Rights (IPR), Importance of IP, Value creation through IP, Advantages of IP protection, Competitive advantage, Promotion of social good, Prevention of duplicates, counterfeit products and IP

2. Evolution of IP system: Historical view of IP system in India and abroad, Legal basis and rationale behind development of IP system, WTO and TRIPS agreement, Role of WIPO

3. Types of IPR: Major forms of IP in India and globally, Acts enacted in India related to IP

4. Patent: Concept, Life of patent, Rights of Patentee, Criteria of patentability- novelty, non-obviousness, and utility, Non-patentable inventions

5. Patent filing and prosecution: Prior art search, Process of obtaining a patent in India, Provisional and complete specification, Convention application, Patent Cooperation Treaty (PCT), Patent Infringement and Enforcement

6. Trademark: Types of trademarks, Trademark and Brand, Trademark Registration, Trademark Infringement

7. Copyright: Copyrights and related rights, Copyright registration, Copyright infringement, Section 52 of Indian Copyright Act

8. Industrial Design: What is Industrial design, Design registration, Design infringement

9. Trade Secret: What are Trade Secrets, How trade secrets are maintained in trade and business

10. Other forms of IP: Semiconductor Integrated Circuits Layout Design, Geographical Indications, Protection of Plant Varieties & Farmers' right, Traditional knowledge

11. IP commercialization: Licensing & Royalty; Technology Transfer; IP assignment, Compulsory License

12. Emerging areas : Patinformatics, IP and bank loan, IP insurance, IP audit, IP valuation, IP management, Use of artificial intelligence in IP enforcement, Open innovation

Text Books

1. Ganguli Prabuddha, Gearing up for Patents The Indian Scenario", Universities Press (1998)

2. Ganguli Prahuddha "Intellectual Property Rights-Unleashing the Knowledge Economy". Tata McGraw Hill (2001)

3. Geographical Indications of Goods Act 1990 Ganguli Piabaddha "Geographical Indications-its evolving contours accessible in http://ips.nminsoda/files/2012/05/main_book_pdf (2009)

Reference Books

1. Ganguli Prabuddha and Jahade Siddharth, "Nanotechnology Intellectual Property Rights Research, Design, and Commercialisation", CRC Press, Taylor and Francis Group, USA (2012)

2. Beyond Intellectual Property: Toward Traditional Resource Rights for Indigenous Peoples and Local Communities [Paperback J,Darrell A. Posey and Graham Dotfield, IDRC Books; annotated edition (June 1996)

3. Netancl Neil Weinstock, Copyright's Paradox, Oxford University Press (2010)

4. The Indian Patents Act 1970 (as amended in 2005)

5. The Indian Copyright Act 1950 as amended in 2017)

6. Indian Trademarks Act 1999

7. The Indian Industrial Designs Act 2000

8. The Protection of Plant Varieties and Farmers' Right Act 2001

9. Inventing the Future: An Introduction to Patents for small and medium sized enterprises, WIPOpublication No 917 www.wipo.int/ebookshop

10. Looking Good: An Introduction to Industrial Designs for Small and Medium sized Enterprises; WIPOpublication No.498 www.wipo.int/ebookshop

IT2209 MC PROFESSIONAL ETHICS AND UNIVERSAL HUMAN VALUES

Instruction: - Credits:0

Internal: - University Exam: 100 Marks Total: 100 Marks

Course Objectives

The objective of the course is Six fold:

·Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.

·This course will illuminate the students in the concepts of laws and its applicability to engineers

·Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence

·Strengthening of self-reflection, Development of commitment and courage to act and also enable the students to imbibe and internalize the Values and Ethical Behaviour in the personal and professional lives

- To enable the students to imbibe the Values and Ethical Behavior in the personal and Professional lives

- The students will learn the rights and responsibilities Individual, employee, team member and a global citizen

Course Outcomes

By the end of the course Student will be able to:

- Grasp the meaning of the concept – Law and also Get an overview of the laws relating to Engineers and also Apprehend the importance of being a law abiding person and They would have better critical ability

- Self-explore by using different techniques to live in harmony at various levels

- Analyze themselves and understand their position with respect to the moral and ethical character needed for a successful and satisfactory work life

- Students are expected to become more aware of themselves and their surroundings (family, society, nature)

- They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.

- They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society)

SYLLABUS

Need, Basic Guidelines, Content and Process for Value Education

Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation - as the process for self-exploration, Continuous Happiness and Prosperity - A look at basic Human Aspirations, Right understanding, Relationship and Physical Facility - the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels. Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking, Include practice sessions and case studies.

Understanding Harmony in the Human Being - Harmony in Myself!

- Understanding human being as: a co-existence of the sentient 'I' and the material 'Body', the needs of Self ('I') and 'Body' - happiness and physical facility, the Body as an instrument of 'I' (I being the doer, seer and enjoyer), the characteristics and activities of 'I' and harmony in 'I', the

harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail, P to ensure Sanyam and Health, Include practice sessions and case studies.

Understanding Harmony in the Family and Society - Harmony in Human – Human Relationship

- Understanding values in human-human relationship: meaning of Justice (nine universal

values in relationships) and program for its fulfillment to ensure mutual happiness; Trust

and Respect as the foundational values of relationship, the meaning of Trust; Difference between intention and competence, the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship, the harmony in the society (society being an extension of family), Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society, Universal Order from family to world family, Include practice sessions and case studies. Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

- Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature recyclability and self-regulation in nature, Understanding Existence as Co-existence of mutually interacting units in all – pervasive space, Holistic perception of harmony at all levels of existence, Include practice sessions and case studies.

Concept of Law and Law of Torts : Understanding Essentials of a Valid Contract and the basics of contract law protecting rights and obligations, Introduction to the Law of Torts and the basics to protect oneself and the company Law affecting the Workplace Employers Responsibilities/Duties Hiring Practices, Introduction to Intellectual Property Law, Professional Code of Conduct for Engineers, Relationship between Law and Ethics, Include practice sessions and case studies.

Implications of the above Holistic Understanding of Harmony on Professional Ethics

- Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually

enriching institutions and organizations, Include practice sessions and case studies.

Text Books

1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1

2. R R Gaur, R Asthana, G P Bagaria, "Teachers' Manual for A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

3. R. Subramanian, "Professional Ethics", Oxford University Press.

4. S.B. Srivastha, "Professional Ethics & Human Values", SciTech Publications (India) Pvt. Ltd. New Delhi.

5. D.R. Kiran, "Professional Ethics & Human Values", TATA Mc Graw Hill Education.

6. Saroj Kumar, "Business Law" and Avtar Singh, "Law of Contract"

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantik, 1999.

2. A. N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, 2004.

3. The Story of Stuff (Book), Mohandas Karamchand Gandhi "The Story of My Experiments with Truth", E. F.Schumacher. "Small is Beautiful", Slow is Beautiful –Cecile Andrews, J C Kumarappa "Economy of Permanence", Pandit Sunderlal "Bharat Mein Angreji Raj" and Dharampal, "Rediscovering India

4. G K Kapoor, "Business Law" and Sen & Mitra, "Business & Commercial Laws" and Calvin Frank Allen, "Business law for Engineers"

5. Hilgard, E. R.; Atkinson, R. C. & Atkinson, R.L. (1975). *Introduction to Psychology*. 6th Edition. New Delhi: Oxford and IBH Publishing Co. Pvt. Ltd.

6. Govindarajan, M; Natarajan, G. M. & Senthilkumar, V.S. (2013). *Professional Ethics & Human Values*. Prentice Hall: New Delhi

7. Gogate, S. B. (2011). Human Values & Professional Ethics. Vikas Publishing: New Delhi.

8. Charles E Harris Jr., Michael S Pritchard, Michael J Rabins, "Engineering Ethics, Concepts Cases: 4e, Cengage learning, 2015.

9. Caroline Whitbec, " Ethics in Engineering Practice & Research: 2e, Cambridge University Press 2015.

ARCHITECTURE

College of Engineering (A) : Bachelor of Architecture

5-year Undergraduate Degree Course

(With Effective from 2020-2021 Admitted Batch and onwards)

SCHEME OF SYLLABUS Note: Induction Training: In the first year three weeks of the course, an induction training program is mandatory before the start of formal classes, to orient the students towards architectural aptitude, education and career.

1/5 B.ARCH 1st SEMESTER

Code Exam	Category	Course Title	Hours per week			IA	EE/ EJ	Total	Credits	
			L	S	W				EJ	Marks (Hrs.)
ARC1101	PC	Basic Design & Visual Arts	2	5	-	50	50	100	8	5 Hrs.
ARC1102	PC	Architectural Drawing & Graphics-I	1	4	-	50	50	100	6	5 Hrs.
ARC1103	PC	Introduction to Architecture, Art & Culture	3	-	-	30	70	100	3	3 Hrs.
ARC1104	BS&AE	Building Materials & Construction-I	2	3	-	50	50	100	5	3 Hrs.
ARC1105	BS&AE	Structural Mechanics-I	3	-	-	30	70	100	3	3Hrs.
ARC1106	BS&AE	Survey & Site Studies	1	-	3	50	50	100	3	VV
ARC1107	SEC	English (Life Skill Courses)	3	-	-	30	70	100	2	3Hrs.
Sub-Total			15	12	3	290	410	700	30	--

1/5 B.ARCH 2nd SEMESTER

Code Exam	Category	Course Title	Hours per week			IA	EE/ EJ	Total	Credits	
			L	S	W				EJ	Marks
ARC1101	PC	Basic Design & Visual Arts	2	5	-	50	50	100	8	5 Hrs.
ARC1201	PC	Architectural Design-I	2	5	-	50	50	100	9	5 Hrs
ARC1202	PC	Architectural Drawing & Graphics-II	1	4	-	50	50	100	6	5 Hrs
ARC1203	PC	History of Architecture –I	3	-	-	30	70	100	3	3 Hrs.
ARC1204	PC	Carpentry and Model Making Workshop	—	-	3	50	50	100	2	VV
ARC1205	BS&AE	Building Materials- & Construction-II	2	3	-	50	50	100	5	3 Hrs.
ARC1206	BS&AE	Structural Mechanics-II	3	-	-	30	70	100	3	3 Hrs.
ARC1207	SEC	English Language Lab (Life Skill Courses)	—	—	2	50	50	100	2	VV
		Universal Human Values	2	—	—	Self-Learning				
		NCC, NSS, NSO	2							
Sub-Total			13	12	5	310	390	700	30	--

L- Lectures S- Studio W-Workshop

EE/EJ : End Exam / External Jury A: Internal Assessment VV: Viva-Voce

Category	Credits
PC – Professional Core	37
BS&AE – Basic Sciences and Applied Engg.	19
Skill Enhancement Courses / Life Skill Courses	4
Mandatory AICTE Non Credit Course	0
Total Credits of 1st Year	60
5-year B.Arch. Undergraduate Degree Course, (With Effective from 2020-2021 Admitted Batch and onwards)	

2/5 B.ARCH 1st SEMESTER

Code Exam	Category	Course Title	Hours per week			IA	EE/ EJ	Total	Credits	
			L	S	W					(Hrs.)
ARC1101	PC	Basic Design & Visual Arts	2	5	-	50	50	100	8	5 Hrs.
ARC2101	PC	Architecture Design-II	2	6	-	50	50	100	10	10 Hrs.
ARC2102	PC	History of Architecture-II	3	-	-	30	70	100	3	3Hrs.
ARC2103	BS&AE	Building Materials & Construction-III	2	3	-	50	50	100	5	3Hrs.
ARC2104	BS&AE	Building Services-I (Water supply & Sanitary Engg.)	3	-	-	30	70	100	3	3Hrs.
ARC2105	BS&AE	Climatology-I	3	-	-	30	70	100	3	3Hrs.
ARC2106	BS&AE	Structural Mechanics-III	3	-	-	30	70	100	3	3Hrs.
ARC2107	SEC	Computer Applications-I (Skill advanced course)	—	—	3	50	50	100	3	VV
		Ethics	2			Self-Learning				
		NCC, NSS, NSO	2							
Sub-Total			18	9	3	270	430	700	30	--

2/5 B.ARCH 2nd SEMESTER

Code Exam	Category	Course Title	Hours per week			IA	EE/ EJ	Total	Credits	
			L	S	W					(Hrs.)
ARC2201	PC	Architectural Design-III	2	6	-	50	50	100	9	10 Hrs.
ARC2202	PC	History of Architecture-III	3	-	-	30	70	100	3	3 Hrs.
ARC2203	BS&AE	Building Materials & Construction-IV	2	3	-	50	50	100	5	3 Hrs.
ARC2204	BS&AE	Building Services-II (Acoustics)	3	-	-	30	70	100	3	3 Hrs.
ARC2205	BS&AE	Climatology-II	3	-	-	30	70	100	3	3 Hrs.
ARC2206	BS&AE	Design of Structures-I	3	-	-	30	70	100	3	3 Hrs.
ARC2207	BS & AE	Environmental Science for Architecture	3	-	-	30	70	100	3	3 Hrs.
		Indian Traditional Knowledge	2			Self-Learning				
Sub-Total			21	9	—	250	450	700	29	--

Summer Internship 8 weeks: Every student must complete a mandatory 8-week Summer Internship at any local architectural firm (chief architect of the firm shall have at least 2 years of professional experience) during the summer vacation, and the completion certificate along with portfolio must be submitted in the department at the beginning of the 3rd year of the 1st Semester for oral presentation by the student and evaluation through the departmental committee for awarding a credit.

L- Lectures S- Studio W-Workshop
 EE/EJ : End Exam / External Jury A: Internal Assessment VV: Viva-Voce

Category	Credits
PC – Professional Core	25
BS&AE – Basic Sciences and Applied Engg.	31
Skill Enhancement Courses / Skill advanced course*	3
Mandatory AICTE Non Credit Course	0
Total Credits of 2nd Year	59

5-year B.Arch. Undergraduate Degree Course, (With Effective from 2020-2021 Admitted Batch and onwards)

3/5 B.ARCH 1st SEMESTER

Code Exam	Category	Course Title	Hours per week			IA	EE/ EJ	Total	Credits	
			L	S	W					(Hrs.)
ARC1101	PC	Basic Design & Visual Arts	2	5	-	50	50	100	8	5 Hrs.
ARC3101	PC	Architecture Design-IV	2	6	-	50	50	100	10	VV
ARC3102	PC	Human Settlements & Town Planning	3	-	-	30	70	100	3	3Hrs.
ARC3103	PC	Landscape Design & Site Planning	3	-	-	30	70	100	3	3Hrs.
ARC3104	BS&AE	Building Materials & Construction-V	2	3	-	50	50	100	5	3 Hrs.
ARC3105	BS&AE	Building Services-III (Electrical and HVAC Services)	3	-	-	30	70	100	3	3 Hrs.
ARC3106	BS&AE	Design of Structures- II	3	-	-	30	70	100	3	3Hrs.
ARC3107	*OE-II	*Open Elective-I	3	—	—	30	70	100	2	3Hrs.
		Summer Internship 8 Weeks (Mandatory) after second year (to be evaluated during V semester)	1	VV						
		Personality Development	2	—		Self-Learning				
Sub-Total			21	9	—	250	450	700	30	--

*All Open Electives are offered to students of all branches in general. Student shall choose an open Elective from the list in such a manner that he/she has not studied the same course in any form during the Programme.

^^Community Service Project like botanical survey and documentation should be an integral part of the Landscape Design as an assignment.

3/5 B.ARCH 2nd SEMESTER

Code Exam	Category	Course Title	Hours per week			IA	EE/ EJ	Total Credits	
			L	S	W			Marks	(Hrs.)
ARC1101	PC	Basic Design & Visual Arts	2	5	-	50	50	100	8 5 Hrs.
ARC3201	PC	Architectural Design-V	2	6	-	50	50	100	10 VV
ARC3202	PC	Working Drawings-I	2	4	-	50	50	100	5 VV
ARC3203	PC	Specification, Estimation & Costing	3	-	-	30	70	100	4 3Hrs.
ARC3204	BS&AE	Building Repairs and Maintenance Services	3	—	30	70	100	3	3Hrs
ARC3205	BS&AE	Design of Structures- III	3	-	-	30	70	100	3 3Hrs.
ARC3206	SEC	Computer Applications-II (Skill advanced course)	3	—	—	30	70	100	3 3Hrs.
ARC3207	*OE-II	*Open Elective-II	3	—	—	30	70	100	2 3Hrs.
		Indian Constitution	1				Self-Learning		
Sub-Total			20	10	—	250	450	700	30 —

Summer Internship 8 weeks: Every student must complete a mandatory 8-week Summer Internship at any local architectural firm (chief architect of the firm shall have at least 4 years of professional experience) during the summer vacation, and the completion certificate along with portfolio must be submitted in the department at the beginning of the 4th year of the 1st Semester for oral presentation by the student and evaluation through the departmental committee.

*All Open Electives are offered to students of all branches in general. Student shall choose an open Elective from the list in such a manner that he/she has not studied the same course in any form during the Programme.

L- Lectures S- Studio W-Workshop

EE/EJ : End Exam / External Jury A: Internal Assessment VV: Viva-Voce

5-year B.Arch. Undergraduate Degree Course, (With Effective from 2020-2021 Admitted Batch and onwards)

Category	Credits
PC – Professional Core	35
BS&AE – Basic Sciences and Applied Engg.	17
Skill Enhancement Courses / Skill advanced course*	3
Open Elective Course	4
Summer Internship	1
Mandatory AICTE Non Credit Course	0

Total Credits of 3rd Year

60

4/5 B.ARCH 1st SEMESTER

Code Exam	Category	Course Title	Hours per week			IA	EE/ EJ	Total Credits	
			L	S	W			Marks	(Hrs.)
ARC4101	PC	*Architecture Design-VI	2	6	—	50	50	100	10 VV
ARC4102	PC	Working Drawings-II	2	4	—	50	50	100	5 VV
ARC4103	PC	Urban Design	4	—	—	30	70	100	3 3 Hrs.
ARC4104	BS&AE	Building Services-IV (Advanced Services)	3	—	—	30	70	100	3 3 Hrs.
ARC4105	BS&AE	Structures Design Project	3	—	—	50	50	100	3 VV
ARC4106	PE	Elective-I	3	—	—	30	70	100	3 3Hrs.
		a) Architectural Conservation							
		b) Barrier free Architecture							
ARC4107	SEC	Soft Skills (Skill advanced course)	2		-	50	50	100	2 VV
		Summer Internship 8 Weeks (Mandatory) after third year (to be evaluated during VII semester)							1 VV
	*MOO CS-I	Skill Enhancement Certificate Programs							
Sub-Total			19	10	—	290	410	700	30 —

*Community Service Project should be an integral part of the Architecture Design-VI Major Design Project.

^ Students should choose one **MOOC Certificate Course** only from the organizations/agencies approved by the BoS. Each of the courses must be of minimum 12 weeks in duration. Students should submit certificate of the course to the department.

4/5 B.ARCH 2nd SEMESTER

Code Exam	Category	Course Title	Hours per week			IA	EE/ EJ	Total Credits	
			L	S	W			Marks	(Hrs.)
ARC4201	PAECC	Practical Training	—	—	—	50	50	100	26 VV
Sub-Total			—	—	—	50	50	100	26 —

Note: 24 weeks of Practical Training in an Architectural Firm Every student must complete a mandatory 24 weeks Internship at any architectural firm (chief architect of the firm shall have at least 5 years of professional experience).

L- Lectures S- Studio W-Workshop

EE/EJ : End Exam / External Jury A: Internal Assessment VV: Viva-Voce

Category	Credits
PC – Professional Core	18
BS&AE – Basic Sciences and Applied Engg.	6
Skill Enhancement Courses / Skill advanced course*	2
Professional Elective Course	3
Professional ability Enhancement Compulsory Course / Job Oriented Course	26
Summer Internship	1
Total Credits of 4th Year	56

5/5 B.ARCH 1st SEMESTER

Code	Category	Course Title	Hours per week			IA	EE/	Total	Credits	
Exam			L	S	W		EJ	Marks	(Hrs.)	
ARC1101	PC	Basic Design & Visual Arts	2	5	-	50	50	100	8	5 Hrs.
ARC5101	PC	Architecture Design-VII	2	6	—	50	50	100	10	VV
ARC5102	PC	Design Workshop	—	—	3	100	—	100	3	VV
ARC5103	PAECC	Project Management	3	—	—	30	70	100	3	3 Hrs.
ARC5104	PAECC	Architectural Dissertation	—	—	6	50	50	100	6	VV
ARC5105	PE	Elective-II	3	—	30	70	100	3	3Hrs	
		a) Green Buildings & Rating Systems, ECBC & Bldg. bye-laws								
		b) Spatial Cognition-I								
ARC5106	PE	Elective-III	3	—	30	70	100	3	3Hrs	
		a) Architectural Research Methodology								
		b) Disaster Resistant Buildings and Management								
ARC5107	SEC	Entrepreneurship Skills for Architects / Skill Oriented Course	3	—	—	30	70	100	2	3Hrs
	^MOO CS-II	Skill Enhancement Certificate Programs								
Sub-Total			14	6	9	320	380	700	30	—

^Students should choose one **MOOC Certificate Course** only from the organizations/agencies approved by the BoS. Each of the courses must be of minimum 12 weeks in duration. Students should submit certificate of the course to the department.

5/5 B.ARCH 2nd SEMESTER

Code	Category	Course Title	Hours per week			IA	EE/	Total	Credits	
Exam			L	S	W		EJ	Marks	(Hrs.)	
ARC5201	PC	Architecture Design Thesis	3	15	—	50	50	100	21	VV
ARC5202	PAECC	Professional Practice & Legislation	3	—	—	30	70	100	3	3Hrs

ARC5203	PE	Elective-IV	3	—	—	30	70	100	3	3Hrs
		a) Spatial Cognition-II								
		b) Appropriate Technology								
ARC5204	PE	Elective-V	3	—	—	30	70	100	3	3Hrs
		a) Vernacular Architecture								
		b) Environmental Planning								
Sub-Total			12	15	—	140	260	400	30	—

Lectures	S- Studio	W-Workshop		
EE/EJ : End Exam / External Jury	A: Internal Assessment	VV: Viva-		
Voce				

Category	Credits
PC – Professional Core	34
Skill Enhancement Courses / Skill Oriented Course	2
Professional Elective Course	12
Professional ability Enhancement Compulsory Course / Job Oriented Course	12
Total Credits of 5th Year	60

S.No	Category	Code	No. of Credits	% of Credits	Suggested Breakup % Credits by CoA, 2020 Guidelines
1	Professional Core	PC	149	50.50	50
2	Basic Sciences and Applied Engineering	BS&AE	73	24.50	20
3	Professional Elective	PE	15	5.10	10
4	Open Elective	OE	4	1.40	5
5	Professional ability Enhancement Compulsory Course	PAECC	40	13.70	10
6	Skill Enhancement Courses/Life Skill Courses/Skill Oriented Courses	SEC	14	4.80	5
Total			295	100	100

S.No	Category	No. of Courses offered in the Whole Program
1	Open Electives	2 Nos. (As per the University Program and other than architecture discipline)
2	Professional Electives	5 Nos.
3	Life Skill Courses / Skill Oriented Courses	2 Nos.
4	Skill advanced Courses	3 Nos.
5	Summer Internship 8 weeks Each (Mandatory Internships)	2 Nos. (Total 4 Months)
6	Practical Training Internship - 25 weeks (Mandatory Internship)	1 No. (6 Months Duration)
7	Skill Enhancement Certificate Programs	2 Nos.
8	Community Service Project	2 Nos.
9	Environmental Science for Architecture	1 No.

Architecture
Bachelor of Architecture
5-year Undergraduate Degree Course
 (With Effective from **2020-2021** Admitted Batch and onwards)

SYLLABUS

Induction Training : Students entering an institution have diverse thoughts, backgrounds and preparations. It is important to help them adjust to the new environment and inculcate in them the ethos of the institution with a sense of larger purpose. In this context, in the beginning of the first semester a three-week long induction program is proposed for the students. Regular classes would start after the completion of the induction program. Its purpose is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature. Introduction of faculty members, discussion with faculty members, visits to various spaces in the department/school, such as climatology lab, computer center, material museum, construction yard, students' works exhibition, etc. The Induction Program is also used to rectify some critical lacuna, like deficiency in comprehension of English language by many students. The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program

Physical Activity : This would involve a daily routine of physical activity with games and sports. It would start with all students coming to the field for light physical exercise or yoga in the morning. There would also be games in the evening or at other suitable times according to the local climate. These would help develop team work. Each student should pick one game and learn it for three weeks. There could also be gardening or other suitably designed activity where labour yields fruits from nature.

Creative Arts : Every student would choose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it every day for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, flow into architectural design later.

Universal Human Values : It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and

supporting staff in the hostel and department, be sensitive to others, etc. Need for character building has been underlined 2

earlier. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do's and don'ts, but by getting students to explore and think and by engaging them in a dialogue. It is best learnt through group discussions and real life activities rather than lecturing. The role of group discussions, however, with clarity of thought of the teachers cannot be over emphasized. It is essential for giving exposure, guiding thoughts, and realizing values. The teachers must be from within the institute and also from outside of the Institute. Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It is to open thinking towards the self. Universal Human Values discussions and activities could even continue for rest of the semester, and not stop with the induction program. Besides drawing the attention of the student to larger issues of life, it would build relationships between teachers and students which last for their entire 5-year stay and possibly beyond.

Lectures by Eminent People : Lectures by eminent people, say, once a week would give the students exposure to people who are socially active or are in public life. They could be from any field well known for their integrity.

Visits to Local Area : A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize the students with their city as well as expose them to the world of under privileged.

Familiarization : The students should be told about different methods of teaching and learning being used in the institute and how it is different as compared to school education or coaching. They should also be shown the laboratories, workshops & other facilities and also be introduced to the faculty, administrative staff etc. and whom they should approach for a specific need or issue. They should be told about what becoming an architect means and the importance of the role of architect in society, and in nation building. 3

ARC1101

BASIC DESIGN AND VISUAL ARTS

Course Objective:

Basic Design provides the framework for understanding design as a new language by sensitizing students to the conceptual, visual and perceptual issues involved in the design process.

The Course provides with knowledge of the principles of design and design elements.

Exercises complement the lectures and ensure that the students learn to develop a series of compositions in two and three dimension.

Course Outcome:

The student will gain an understanding into the fundamental issues in architectural design and develop the skill to create architectural solutions for simple problems

SYLLABUS

(Freehand drawing) : Introduction to fundamentals of drawings and its practice. Free hand line sketching and drawing of natural and man-made scenes. Study of shades and shadows. Object drawing, simple, natural and geometric forms. Outdoor Sketching of Historic or new built up structures of Architectural importance using different mediums.

(Elements of Design) : Introduction to design: Meaning of design, importance of design. Fundamental elements of design and their definitions-point, line, shape, form, space, texture, colour. Study historic examples.

(Principles of design) : Introduction to the principles of design – Axis , Symmetry , Balance, Contrast, Focus, Emphasis, Hierarchy, Rhythm, Harmony, Datum, Unity, Scale & Proportion, etc. Study of Historic Examples. Application of the Principles in compositions.

(Colour) : Colour theory, colour wheel, primary, secondary, tertiary colours, colour schemes, colour value & intensity.

(Principles of Perception) : Proximity, Similarity, Closure (Gestalt type). Optical illusion

(Form and space) : Understanding properties of form, Articulation and Transformation of form – additive, subtractive and dimensional transformations. Form defining space.

(Visual arts) : Present day trends in visual arts and architecture. 4

Note: Sketches and Models to understand basic design principles, elements and their expressive qualities. Creative Exercises of 2D to 3D compositions. Exercise related to positive and negative spaces; Mural, ideogram, 3D Abstract models

Assessment: Two mid examinations (Maximum 20 Marks each) are to be conducted and average of the both are to be taken for 20M, and 30 Marks for continuous assessment (portfolio) i.e. total marks of (20M+30M)=50M.

TEXT BOOKS:

- 1) Form Space & Order by Francis, D.K.Ching

REFERENCES:

- 1) Principles of two dimensional designs by Wong Wucius –
- 2) Designer s Guide to Colour by Ikuyoshi Shibikawa and Yumi Takahashi
- 3) Elements of architecture by Von Mesis

- 4) Architectural Composition by Robkrier –

- 5) Design & Form by Johannes Itten

- 6) Architecture Drafting & Design by Donald E. Helper, Paul I. Wallach

- 7) The Decorative Design of Frank Lloyd Wright by David A. Hanks

- 8) Principles of Design in Architecture by K.W.Smithies

- 9) Drawing for 3 – dimensional design by Alan pipes

ARC1102**ARCHITECTURAL DRAWING & GRAPHICS –I****Course Objective:**

The course introduces students to fundamental techniques of architectural drawing and develops the appropriate skills for representation.

Course Outcome:

Students learn to develop drafting skills to facilitate effective visual communication.

SYLLABUS

(Introduction to Drawing) : Introduction to drawing equipment, familiarization, use and handling. Drawing sheet sizes, layouts and composition. Simple exercises in drafting, line types, line weights; dimensioning. Lettering Styles: Roman and Gothic style lettering; freehand lettering, title panels and legends.

(Simple Geometrical Construction) : Constructing simple and complex geometrical shapes involving various drafting technique drawing regular shapes; Special methods of drawing regular polygons; Regular polygons inscribed in a Circle. 5

(Projections and section of Solids) : Solids of revolution, solids in simple position, Axis perpendicular to a plane, axis parallel to both planes, axis inclined to both planes etc. Section planes, true shape of section, Sections of Prisms, Pyramids, Cylinders, Cones, Spheres etc.

(Advanced geometry) : Intersection of surfaces: Line of intersection, intersection of prism and prism, cylinder and cylinder, cylinder and prism, cone and cylinder, cone and prism, cone and cone, sphere and cylinder or prism. Orthographic Projections-Representation of 3D elements in Plan and Elevations, Study of isometric, axonometric and oblique views, Ionic volute (by Gibbs Rule), Entasis of column, intersection of solids &

(Architectural Symbols) : Representation of building elements, openings, materials, furniture and accessories; human postures; vegetation; vehicles; terminology and abbreviations used in architectural representation.

(Measuring and Drawing to Scale) : Scales and construction of scales, scaled drawings of simple objects, furniture, rooms, doors and windows etc., in plan, elevation and section. Reduction and enlargement of drawings.

Assessment: Two mid examinations (Maximum 20 Marks each) are to be conducted and average of the both are to be taken for 20M, and 30 Marks for continuous assessment (portfolio) i.e. total marks of (20M+30M)=50M

TEXT BOOKS:

1) "Engineering Drawing" – Plane and Solid Geometry by N.D.Bhat, V.M.Panchal

2) A text book of Geometrical Drawing by P.S.gill

3) Architectural Graphics by Francis D K Ching

REFERENCES:

1) "Geometrical drawing for Art students" by Moris.I.H.

2) Hand book of Architectural & Civil Drafting by Nelson J.A

3) Architectural Drafting: Structure & Environment by JohnD.Bies –.

4) – Graphic Science & Design by Thoms. E. French.

5) – Geometry of Construction by T.B.Nichols and Normal keep.

6) Building Drawing by Shah..

7) Drawing architecture by Paul Hagarth

8) Drawings by architects by Claudius Conli

9) Pencil techniques in modern design by Alkin, Urbelleth and Lione

ARC1103

INTRODUCTION TO ARCHITECTURE, ART & CULTURE

Course Objective:

The course creates awareness about fundamental ideas, methodologies and terminologies in art and architecture in different parts of the world, shedding light on what meanings they communicated, and how they are important to our contemporary society.

Course Outcome:

The Course is intended to provide brief background knowledge of Culture and Art in different parts of the world. It is also intended to serve as an introduction to other more advanced courses within the discipline of art history.

SYLLABUS

(Art and Architecture) : Introduction to Art, Culture, Society, Civilization and Architecture.

(Shelter Forms) : Earlier attempts of man for shelter and shelter forms since the prehistoric period with reference to culture, climate, technology and material.

(Architecture Movements) : Understanding the relationships of art, culture and architecture at different time such as: art, arts & crafts movement etc., and periods in the world history.

(Indian Architecture) : Introduction to Indian Art and Architecture.

(Western Architecture) : Introduction to Western Art and Architecture.

(Ornamentation) : Study of ornament in Architectural Design, different types of ornamentation in buildings and study of historic examples.

Assessment: Two mid examinations (Maximum 20 Marks each) are to be conducted and average of the both are to be taken for consideration for 20 and 10 Marks for continuous assessment i.e. total marks will be (20M+10M)=30M.

TEXT BOOKS:

1) G. K. Hiraskar- The Great Ages of World Architecture.

REFERENCES:

1) Indian Art a Concise History by Craven, C. Roy.

2) , Pattern Language, by Christopher Alexander New York: Oxford University Press.

3) Redefining Designing: From to Experience byThomas Mitchell.

4) A history of architecture by Sir Banister Fletcher

5) Introduction to architecture by Stephen Gardner.

6) A chronology of western architecture by Doreen Yarwood.

7) The great ages of architecture by Bodo Lichy.

8) World architecture – an illustrated history by Trewin Copplstone and others

ARC1104

BUILDING MATERIALS & CONSTRUCTION-I

Course Objective:

The objective of the subject is to enable students to understand the building materials and basic structural systems, their properties and applications, and

Their intrinsic relationship to structural systems and environmental performance.

Application of Basic Building Materials in simple situations

Course Outcome:

With the successful completion of the course student should have capability to:

Identify and differentiate types of bricks, stones etc.

Type of foundation and load bearing masonry

Principles behind lintels and arches and their application

Analyze a design decision situation and come up with correct material choice and construction specification

SYLLABUS

(BUILDING MATERIALS) : Study of basic building materials like brick, stone, cement, lime, sand and mortar with respect to their classification, composition and general idea about their chemical properties, physical properties, structural strength, aesthetic qualities, manufacturing processes. Introduction to building materials as described in Indian architectural texts. Emphasis should be on developing understanding about making choice of appropriate building materials in a given situation.

(BRICK CONSTRUCTION) : Elementary construction methods explaining basic principles of load bearing structures. Types of bricks, bats and closers etc. English and Flemish brick bonds, stopped ends, quoins, piers, junctions, jambs for various thicknesses. Jointing, pointing and copings.

(STONE WALLS) : Stone masonry, dressing of stones. Types of rubble masonry walls like Random Rubble, Coursed Rubble, Ashlar, etc., stone coping, jointing and pointing.

(FOUNDATION AND PLINTH) : Need for foundations, preliminary design criteria. Details of brick and stone footings for load bearing walls of various thicknesses. Plinth filling details, Damp Proof Course, timbering to trenches.

(ARCHES AND CORBELLING) : Concept of span and its application in creating openings in masonry walls with lintels and arches. Structural difference in the behaviour of lintel and arches. Elementary principles of arch construction, terminology and types of lintels, corbelling and arches with their materials for construction.

TEXT BOOKS:

- 1) W.B. Mc Kay, Building Construction Volume 1 to 4
- 2) R. Barry, Building Construction Volume 1 to 5
- 3) Francis Ching D.K., Building Construction Illustrated
- 4) S.K. Sharma, Civil Engineering construction Materials
- 5) Sushil Kumar, Building Construction

ARC1105

STRUCTURAL MECHANICS-I

Course Objective:

To study the equilibrium of rigid bodies in static equilibrium and type of forces induced in the members of a truss. Study of basic types of internal forces (stresses) acting in a body and the elastic properties of a material.

Calculate the cross-sectional properties of standard and built up shapes.

Course Outcome:

The student will be in a position to calculate the forces acting on a rigid body in equilibrium and the nature of the force in the members of a truss.

„h To determine the elastic properties of a material and the nature of internal force (stresses) acting in the body and able to calculate the cross-sectional properties of standard and built up shapes.

SYLLABUS

(INTRODUCTION TO STATICS AND FORCES) : Introduction to Statics, Basic Concepts, Scalars and Vectors, Units, Force Systems, External and Internal Effects, Principle Of Transmissibility, Action and Reaction, Free body diagram, Force Classification, Concurrent Forces: Rectangular Components, Moment of a force, Varignon's Theorem. Parallel forces in a plane: Couple, Force-Couple Systems, Transformation of couple; Resolution of force into force and couple. Resultants of Parallel and Concurrent force systems in a Plane.

(EQUILIBRIUM OF GENERAL CASE OF FORCES IN A PLANE) : Composition of Forces in A Plane, Resultant and Line of Action, Equilibrium of Forces in A Plane, Categories of Equilibrium, Two and Three Force Members. Plane Trusses: Introduction, Types of Plane Trusses, Method of Joints, Internal and External Redundancy, Method of Sections.

(CENTRE OF GRAVITY AND MOMENT OF INERTIA) : Centroids and Centre of Gravity: Centre of gravity of parallel forces in a plane, Centroid and Centre of Gravity of composite bodies, Theorems of Pappus (or Guldinus), Moment of Inertia-Definition, Parallel Axis Theorem, Second Moments of Areas by integration, Moment of Inertia of composite bodies, Polar moment of inertia and Section modulus.

(STRESSES AND STRAINS) : Simple stresses and strains, elasticity, stress, strain, property of elasticity, Hooke's Law, Stress-Strain diagram for mild steel, types of stresses, elastic limit, modulus of elasticity, Stresses due to change in temperature, Elastic constants, linear strain, lateral strain, Poisson's ratio, volumetric strain, relation between Young's Modulus, modulus of Rigidity, and Bulk modulus.

(TORSION OF SHAFTS) : Torsion of solid and hollow circular shafts – introduction to the basic equation $TJ = fsR = GJ$. Derivation and Application of the basic equation, Power transmitted.

(SHEAR FORCE AND BENDING MOMENT) : Beams: Types of beams, Types of supports, Types of loads, Shear force and bending moment, Sign convention, Shear force and bending moment diagrams for simply supported beam, cantilever beam and overhanging beams for various loads, Relation between intensity of loading, shear force and bending moment at a section.

Assessment: Two mid examinations (Maximum 20 Marks each) are to be conducted and average of the both are to be taken for consideration for 20 and 10 Marks for continuous assessment i.e. total marks will be $(20M + 10M) = 30M$.

TEXT BOOKS:

6) Analysis of Structures - Analysis, Design and Details of Structures (Vol.1) by V.N. Vazirani and M.M. Ratwani

7) Engineering Mechanics by S.P. Timoshenko & D.H. Young

8) Mechanics of solids by S.S. Bhavikatti

REFERENCES:

1) Elements of strength of materials by S.P. Timoshenko & D.H. Young

2) Applied Mechanics by S. Ramamrutham.

ARC1106

SURVEY & SITE STUDIES

Course Objective: To develop the knowledge and skills related to surveying and understand working principles of survey instruments and types of errors, obstacles encountered in field and calculations.

Course Outcome: The student will be able to learn about basics involved in different types of surveying instruments like tape, compass, levelling and develop surveying skills in measuring of distances, angles, and levelling and to apply error adjustment to the recorded reading to get an accurate surveying output

SYLLABUS

(Basic principles and chain surveying) : Definitions, scales and symbols, sources of error in surveying and theory of probability, measurement of distance, instruments used, ranging of survey lines, chaining a line with examples, chaining on sloping ground, errors in chaining, tape corrections, chain surveying principles, off-sets, field notes, instruments, obstacles in chaining. Plotting chain survey with practical examples.

(Plane table surveying) : Plane table surveying: Introduction-Advantages, Accessories-Working operations such as fixing the table to

tripod, leveling-centering-orientation by back-sighting. Methods of plane tabling-Plane table traversing- two point and three point problems, Errors in plane tabling, exercise in preparation of base map of small areas.

(Compass Survey) : Introduction to compass survey, Definitions of Bearing, Designation of bearing – Whole circle bearing(W.C.B) & Reduced bearing(R.B), Conversion of bearings from one systems to the other, Calculation of angles for bearings and vice versa, Magnetic compass, Prismatic compass, Magnetic dip, Temporary and permanent adjustments of compass, Magnetic Declination, Local attraction, Precautions in using compass, Errors in compass survey.

(Levelling) : Introduction, instruments used, Definition of Back Sight(BS), Intermediate Sight(IS), Fore Sight(FS), Height of Instrument(HI), Turning Point(TP), Booking and reduction of levels, classification of levelling, Uses and adjustments of dumpy level, Temporary and permanent adjustments of a dumpy level, Differential levelling, Profile leveling, Longitudinal section (L.S), Cross section leveling (C.S), Reciprocal levelling. Height of Instrument methods, Rise and fall method, Checks, Problems in leveling, Errors in levelling. Contouring: Definitions, Contour Interval, Characteristics of contours, and methods of locating contours-Direct and indirect methods-interpolation of contours-Contour Gradient-Uses of contour maps.

(Theodolite and Traverse Surveying) : Theodolite, types of theodolites, temporary adjustments, measurements of horizontal angle, method of repetition, method of reiteration, uses of theodolites, errors in theodolite or permanent adjustments of a theodolite, trigonometric levelling, elevation of top of the tower in same plane and different plane. Methods of traversing, checks in closed and open traverse, plotting methods of traverse Survey-Closing error-Balancing the traverse.

(Automated surveying (introduction only) : Introduction to Modern surveying and mapping technologies such as total Station, Photogrammetric surveying, Aerial photogrammetry, Digital maps, Digital elevation modelling (DEM), GIS, GPS, etc. Their advantages and dis-advantages, errors and limitations. Introduction to the use of total station, G.P.S through demonstrations only. 11

Site studies: Site studies: Plot, site, land and regions, size, shape of sites. Analysis of accessibility: topography, climate, landforms, surface drainage, soil, water bodies and vegetation.

Field Work:

1. Finding the distance between two points and area using chain.
2. Preparation of base map of small area and finding the area using Plane table surveying or Chain surveying
3. Profile leveling

4. Longitudinal and cross section leveling.
5. Closed traverse using Compass surveying or Theodolite.
6. Height of remote point using Theodolite.
7. Preparing Contour map of small area.

Note: Field book and record should to be submitted at the end of the semester.

Assessment: Continuous assessment will be conducted for all the field studies mentioned in the syllabi for 50 Marks as internal. Student has to submit Field book and record for external viva-voce. The student should attend a practical Exam and Viva-voce conducted by external examiner.

TEXT BOOKS:

- 1) Surveying –Vol.-I by B.C. Punmia, Laxmi Publishers.
- 2) Surveying –Vol.-II by B.C. Punmia, Laxmi Publishers.
- 3) Text book of Surveying by C. Venkatramaiah, Universitie

ARC1107 : ENGLISH

Course Objectives

To make students understand the explicit and implicit meanings of a text/topic;

To give exposure to new words and phrases, and aid to use them in different contexts;

To apply relevant writing formats to draft essays, letters, emails and presentations; and

To adapt oneself to a given situation and develop a functional approach to finding solutions: adaptability and problem solving.

Course Outcomes:

Students will be able to analyse a given text and discover the various aspects related to language and literature;

Learn the various language structures, parts of speech and figures of speech;

Develop one's reading and writing abilities for enhanced communication; and Learn to apply the topics in real-life situations for creative and critical use.

SYLLABUS

On the conduct of life: William Hazlitt

Life skills: Values and Ethics

If: Rudyard Kipling

The Brook: Alfred Tennyson

Life skills: Self-Improvement

How I Became a Public Speaker: George Bernard Shaw

The Death Trap: Saki

Life skills: Time Management

On saving Time: Seneca

Chindu Yellama

Life skills: Innovation

Muhammad Yunus

Politics and the English Language: George Orwell

Life skills: Motivation

Dancer with a White Parasol: Ranjana Dave

Grammar: Prepositions – Articles – Noun-Pronoun Agreement, Subject-Verb Agreement – Misplaced Modifiers – Clichés, Redundancies.

Vocabulary: Introduction to Word Formation – Root Words from other Languages – Prefixes and Suffixes – Synonyms, Antonyms – Common Abbreviations

Writing: Clauses and Sentences – Punctuation – Principals of Good Writing – Essay Writing – Writing a Summary

Writing: Essay Writing

Life skills: Innovation

Muhammad Yunus

Prescribed Textbook: *Language and Life: A Skills Approach* Board of Editors, Orient Black Swan Publishers, India. 2018.

TEXTBOOK:

1. Language and Life: A Skills Approach Board of Editors, Orient Blackswan Publishers, India. 2018.

REFERENCES:

- 1) Practical English Usage, Michael Swan. OUP. 1995.
- 2) Remedial English Grammar, F.T. Wood. Macmillan.2007
- 3) On Writing Well, William Zinsser. Harper Resource Book. 2001
- 4) Study Writing, Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
- 5) Communication Skills, Sanjay Kumar and PushpLata. Oxford University Press. 2011.
- 6) Exercises in Spoken English, Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

ARC1201

ARCHITECTURAL DESIGN-I

Course objectives:

To study and preparation of measured drawings and design of single unit spaces with emphasis on form including the furniture layout, circulation, clearances, lighting and ventilation, etc.

Course Outcome:

Student will understand principles of design, and develop the ability to translate abstract principles of design into architectural solutions for small problems

SYLLABUS

Organisation of form and space: Spatial relationship and spatial organisation

Circulation: Path space relationship, elements and form of circulation

Proportion and scale: golden section, classical orders, modular, anthropometry, Understanding of human and visual scale. Understanding of basic human functions and their implications for space requirements; Minimum and optimum areas for various functions, User data-Bubble and circulation diagrams.

The list of suggested topics to be covered as design problems including preparation of measured drawings and design of single unit spaces with emphasis on form Detailed study of spaces such as living, dining, bedrooms, kitchen, toilet, etc. including the furniture layout, circulation, clearances, lighting and ventilation, etc.

Application in the design of simple household and street furniture At least two design problems Examples such as Design of Bus shelter/ Milk booth, /Security cabin/ATM centre/ Internet centre/ Gateway

Assessment: Continuous assessment will be conducted for major (30M) and minor (20M) design problems i.e. total marks of (30M+20M) =50M

REFERENCES:

- 1) Time Savers Standards by Joseph De Chiara & John Callender, McGraw-Hill International Edition
- 2) Architect's Data by Ernst Neufert, 3rd edition
- 3) Architects Handbook: Ready Reckoner by Charanjit Shah, Galgotia Publishing Company.
- 4) Architecture: Form Space & order by Francis D. K. Ching, John Wiley & Sons

ARC1202

ARCHITECTURAL DRAWING & GRAPHICS –II

Course Objective:

The course introduces students to fundamental techniques of architectural documentation and develops the appropriate skills for visual representation by Perspective, sciography and rendering techniques.

Course Outcome:

Students learn in developing drafting and documentation skills and understanding study of shade and shadows of different geometrical forms and improve in rendering skills to facilitate effective visual communication and architectural presentation.

SYLLABUS

(Perspective) : Introduction to Perspective in one point or parallel perspective, two point or angular perspective, introduction to three-point perspective of different geometrical form, built forms.

(Sciography) : Introduction to Sciography in the study of shade and shadows, points, lines, surfaces, geometrical solids of various forms and groups of forms leading to advanced examples of shades and shadows on buildings or parts of buildings.

(Rendering) : Introduction to the rules of composition and perspective in architectural rendering, color study, values, tones and general approach to rendering. Various colour schemes, water colour and poster colour rendering, pencil rendering and monochrome and wash rendering etc. treatment of sky, clouds, landscape elements, human figures, foreground and surroundings, shadow projections in renderings

(Architectural Documentation) : Detailed measured drawing and documentation of any interesting building – preparation of maps, plans, elevations, sections, views etc.

Assessment : Two mid examinations (Maximum 20 Marks each) are to be conducted and average of the both are to be taken for 20M, and 30 Marks for continuous assessment (portfolio) i.e. total marks of (20M+30M)=50M

TEXT BOOKS:

- 1) "Engineering Drawing" – Plane and Solid Geometry by N.D.Bhat, V.M.Panchal.
- 2) Architectural Graphics by Francis D K Ching.

REFERENCES:

- 1) Perspective – space and design by Lance Bowen Bellings.
- 2) "Geometrical drawing for Art students". byMoris.I.H.

- 3) Hand book of Architectural & Civil Drafting by Nelson J.A.
- 4) A text book of Geometrical Drawing by P.S.gill
- 5) Architectural Drafting: Structure & Environment by JohnD.Bies.
- 6) Graphic Science & Design by Thoms. E. French.
- 7) Geometry of Construction by T.B.Nichols and Normal keep.
- 8) Building Drawing by Shah.
- 9) Drawing architecture by Paul Hagarth
- 10) Drawings by architects by Claudius Conli
- 11) Perspective by H. Pranchlay
- 12) Pencil techniques in modern design by Alkin, Urbelleth and Lione
- 13) Perspective: space and design by Lance Bowen Bellings.

ARC1203

HISTORY OF ARCHITECTURE-I

Course Objectives:

To study development of building forms, ornamentation, structural solutions, construction methods, plans and building facade, organization in relation to aesthetic/ religious/social philosophy and environmental factors in history. The study should focus only on the general trends.

Course Outcome:

Acquire knowledge to identify the common characteristics among the monuments of a particular style. Acquire graphic skills to present a building, analyse its elements and explain the composition. Acquire knowledge on good practices of architecture in the past.

SYLLABUS

(The Ancient Civilizations) : Architectural development in the ancient civilizations in Egypt and Mesopotamia, study of pyramids, temples, mastabas, ziggurats, etc.

(Classical Period) : Architecture in the classic Greek and roman periods, temples, agoras gateways, circuses, amphitheatres, basilicas, etc.

(Early Christianity) : Architecture in the early Christian, Byzantine.

(The Age of Church Building) : Romanesque, gothic periods in Europe and rest of the world excluding Asia.

Assessment: Two mid examinations (Maximum 20 Marks each) are to be conducted and average of the both are to be taken for consideration for 20 and 10 Marks for continuous assessment i.e. total marks will be (20M+10M)=30M.

TEXT BOOKS:

- 1) A History of Architecture by Sir Banister Fletcher, CBS; 20 edition (2002)

REFERENCES:

- 1) World architecture – an illustrated history by Trewin Copplstone and others
- 2) Introduction to architecture by Stephen Gardner.
- 3) A chronology of western architecture by Doreen Yarwood
- 4) The great ages of architecture by BodoLichy
- 5) Meaning in western architecture by Christian Noberg Schulz

ARC1204

CARPENTRY AND MODEL MAKING WORKSHOP

Course Objective:

To Train the students in basic skills of carpentry work and to develop ability to appreciate the three dimensional.

To prepare the students for better eye- mind- hand coordination and equip them with various model making techniques.

Course Outcome:

With the successful completion of the course student will be able to

Review various tools and techniques for model making and design model for real life situation

SYLLABUS

(BUILDING MODELS AND CARPENTRY) : Introduction to model making and its need. Role of scale-models in design. Essentials of model making such as understanding of various tools and machines employed. Survey of various materials available for model making such as papers, mount boards, wood, plastics, films, plaster of Paris, acrylic, Styrofoam, wax, metals, glass, etc. and exploring their potential in model-making. Introduction to the use of different types of tools and different types of joints used in carpentry, Joinery details which are commonly used in timber construction.

Assessment : Three carpentry joinery models (Maximum 25 Marks) and two three dimensional building blocks models for 25M, total marks of (25M+25M) =50M

REFERENCES:

- 1) Criss. B. Mills, Designing with Models
- 2) Wenninger, Spherical Models
- 3) John W. Mills, The Technique of Sculpture
- 4) Carpentry and Joinery by Peter Brett · 2005, Nelson Thornes publishers

ARC1205

BUILDING MATERIALS & CONSTRUCTION-II

Course Objective:

The objective of the subject is to enable students to understand aspects of materials and construction components/elements for building envelop and interiors

Course Outcome:

With the successful completion of the course student should have capability to:

Identify and differentiate types of timber, their joinery, finishes, etc.

Understand the properties and uses of manmade and natural materials.

Understand and differentiate between various types of openings

Analyse a design decision situation and come up with correct material choice and construction specification.

SYLLABUS

(Timber as Building Material) : Timber as a building material, its physical properties and uses, defects, seasoning, decay and preservation. Industrial timbers such as ply wood, hard board, block board, particle board, etc. with their properties and uses. Introduction to timber as described in Indian architectural treatises.

(Metals and man-made Building Materials) : Use of Iron in building industry such as pig iron, wrought iron and cast iron their properties and uses. Steel as building material, its definition, properties, Manufacture, casting, heat treatment, mechanical treatment process of steel, market forms of steel, corrosion ant treatment. Aluminium and aluminium alloys their manufacturing, properties, durability, and uses. Study of aluminium products and other non-ferrous metals such as copper, lead, zinc etc. Study of protection to non-ferrous metals and products such as anodizing, powder coating, painting, chromium plating, varnishing, melamine treatments, etc.

Paints and surface finishes their composition, properties and methods of application of different types of paints such as oil, synthetic enamels, acrylic and other plastic emulsions and formulations, interior and exterior grade paints. Cement based paints.

(Timber joinery) : Carpentry and joinery: Terms defined, mitring, ploughing, grooving, rebating, veneering, various forms of joints in wood work, such as lengthening joints, bearing joints, halving, dovetailing, housing, notching, tusk and tenon, etc. Jamb-casing. Timber joints as described in Indian architectural treatises.

(Doors) : Types of doors based on operation such as swing door, revolving door, sliding door, sliding-folding door. Details of Wooden Doors

their definition of terms, types of doors such as ledged, ledged and braced, panelled, flush doors, glazed doors etc. Hinged, single and double shutters. Z section doors, pressed steel and box section doors. Rolling shutters, collapsible gates. Complete aluminium swing, Sliding, sliding folding, and revolving doors. PVC / UPC Doors.

(Windows) : Types of windows based operation and location – fixed window, Casement window, Sliding window, pivoted window, louvered window, bay window, clerestory window, corner window –gable and dormer window, etc. Details of Timber windows and ventilators such as ordinary casement, top and bottom hung, pivoted and sliding sash with fixtures, locks, hinges, fastenings, etc. Z section window, pressed steel and box section windows. Aluminium casement and sliding windows. PVC / UPC windows.

Assessment : Two mid examinations (Maximum 20 Marks each) are to be conducted and average of the both are to be taken for 20M, and 30 Marks for continuous assessment (portfolio) i.e. total marks of (20M+30M)=50M

TEXT BOOKS:

- 6) W.B. Mc Kay, Building Construction Volume 1 to 4
- 7) R. Barry, Building Construction Volume 1 to 5
- 8) Francis Ching D.K., Building construction illustrated
- 9) S.K. Sharma, Civil Engineering construction Materials
- 10) Sushil Kumar, Building Construction

ARC1206 : STRUCTURAL MECHANICS-II

Course Objective:

To study the bending, shear stress distribution and combined stresses in beams for different symmetrical and unsymmetrical sections.

The relation between slope, deflection and curvature and deflection of statically determinant beams for different loadings. Analysis of statically in determinant beams and Three-Hinged arches.

Course Outcome:

The student will be in a position to calculate/access the variation of internal forces in a beam along the section of a beam for different cross-section; the deflection limits in a member.

The variation of shear force and bending moment along the length of the continuous beams. The behaviour of three hinged arches subjected to different loadings.

SYLLABUS

(THEORY OF SIMPLE BENDING) : Theory of simple bending; $\sigma = \frac{M}{I} y$, application of flexural formula.

(BENDING STRESSES IN BEAMS) : Bending and Shearing stresses distribution in beams for different sections. Combined stresses (direct and bending stresses) of symmetrical and unsymmetrical sections-beams only.

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(DEFLECTION OF BEAMS) : Deflection of beams (with supports at the same level): Relation between slope, deflection and curvature, Deflection of cantilever beam and simply supported beam with uniformly distributed load and point loads only using double integration method and moment area method.

(PROPPED CANTILEVER BEAMS) : Propped cantilever beams (with supports at the same level): Shear Force and Bending Moment diagrams of propped cantilever beams with uniformly distributed load and point loads only.

(ANALYSIS OF BEAMS AND FRAMES) : Analysis of beams and frames (with supports at the same level): Bending Moment (BM) & Shear Force (SF) diagrams for fixed beams and Continuous beams with uniformly distributed load and point loads only. Application of Clapeyron's theorem of three moments, Moment distribution method for continuous beams, Kani's method of analysis for structural frames (single storey single bay) including sway with uniformly distributed load and point loads only.

(THREE HINGED ARCHES) : Three Hinged Arches (with supports at the same level): determination of horizontal thrust, radial shear, normal force, and axial thrust. Shear force (SF) and bending moment (BM) diagrams for three-hinged arches.

Assessment: Two mid examinations (Maximum 20 Marks each) are to be conducted and average of the both are to be taken for consideration for 20 and 10 Marks for continuous assessment i.e. total marks will be (20M+10M) =30M

TEXT BOOKS:

- 1) Analysis of Structures - Analysis, Design and Details of Structures-Vol.-1 by V.N. Vazirani and M.M. Ratwani and S.K. Duggal
- 2) Analysis of Structures - Theory, Design and Details of Structures-Vol.-2 by V.N. Vazirani and M.M. Ratwani and S.K.Duggal

REFERENCES:

- 1) Basic structural analysis by C.S. Reddy
- 2) Intermediate Structural analysis by C.K.Wang
- 3) Theory of Structures by S. Ramamrutham and R.Narayanan
- 4) Elements of strength of materials by S.P.Timoshenko & D.H.Young

ARC1207

ENGLISH LANGUAGE LAB

Introduction

The Language Lab focuses on the production and practice of sounds of language and familiarizes the students with the use of the English language in everyday situations and contexts.

Course Objectives

To make students recognize the sounds of English through Audio-Visual aids.

To help students build their confidence and help them to overcome their inhibitions and self- consciousness while speaking in English. The focus shall be on fluency.

To familiarize the students with stress and intonation and enable them to speak English effectively.

Course Outcomes

Students will be sensitized towards recognition of unique English sound pattern and the fluency in speech will be enhanced.

A study of the communicative items in the laboratory will help the students become successful in the competitive world.

Students will be able to express themselves fluently and accurately in social as well professional context.

Students will be able to participate in group activities like roleplays, group discussions and debates.

(UNIT-I) : Introduction to Phonetics: The Sounds of English (Speech sound – vowels and consonants) - Stress and Intonation - Accent and Rhythm.

(UNIT-II) : Listening Skills: Listening for gist and specific information - listening for Note taking, summarizing and for opinions - Listening to the speeches of eminent personalities.

(UNIT-III) : Speaking Skills: Self-introduction - Conversation Skills (Introducing and taking leave) - Giving and asking for information - Role Play - Just A Minute (JAM) session - Telephone etiquette.

(UNIT-IV) : Reading and Writing skills: Reading Comprehension – Précis Writing - E-Mail writing - Punctuation.

(UNIT-V) : Presentation skills: Verbal and non-verbal communication - Body Language - Making a Presentation. 21

DISTRIBUTION AND WEIGHTAGE OF MARKS

The practical examinations for the English Language Lab shall be conducted as per the University norms prescribed for the core Engineering practical sessions.

For the Language lab sessions, there shall be a continuous evaluation during the semester for 50 sessional marks and 50 semester-end Examination marks.

For the 50 sessional (Internal) marks, 30 marks shall be awarded for day-to-day performance and for completing activities in the lab manual, 20 marks to be awarded by conducting Internal Lab Test(s).

For the 50 semester- end (External) marks, 30 marks shall be awarded for written examination (dialogues, the sounds of English and stress) and 20 marks for External Examiner viva-voce.

REFERENCE BOOKS:

- 1) Ashraf Rizvi. *Effective Technical Communication*. Tata McGraw Hill Education Private Limited, New Delhi.
- 2) *Speak Well*. Orient Blackswan Publishers, Hyderabad.
- 3) Allan Pease. *Body Language*. Manjul Publishing House, New Delhi.

UNIVERSAL HUMAN VALUES

(Non-credit mandatory courses)

The objective of the course is four fold:

Sensitization of student towards issues in society and nature.

Understanding (or developing clarity) of nature, society and larger systems, on the basis of human relationships and resolved individuals.

Strengthening of self-reflection.

Development of commitment and courage to act.

Course Outcomes:

At the end of the course, students are expected to become more aware of their surroundings, society, social problems and their sustainable solutions, while keeping human relationships and human nature in mind.

They would have better critical ability. They would also become sensitive to their commitment towards what they believe in (humane values, humane relationships and humane society).

It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

The focus is on understanding society and nature on the basis of self and human relationships

Ideas of self, pre-conditioning, and natural acceptance.

Harmony in the self. Understanding human being as co-existence of self and body. Identifying needs and satisfying needs of self and body. Self-observations. Handling peer pressure.

Nine universal values in relationships. Reflecting on relationships in family. Hostel and institute as extended family. Real life examples.

Teacher-student relationship. Shraddha. Guidance. Goal of education.

Harmony in nature. Four orders of nature – material order, plant order, animal order and human order. Salient features of each. Human being as cause of imbalance in nature. (Film “Home” can be used.)

Human being as cause of imbalance in nature. Depletion of resources – water, food, mineral resources. Pollution. Role of technology. Mutual enrichment not just recycling.

Prosperity arising out of material goods and understanding of self. Separation of needs of the self and needs of the body. Right utilization of resources.

Recapitulation on society. Five major dimensions of human society. Fulfillment of the individual as major goal. Justice in society. Equality in human relationships as naturally acceptable. Establishment of society with abhaya (absence of fear).

Ethical human conduct. Values, character and naitikataa.

Professional ethics. Conduct as an engineer / architect / scientist.

Holistic human being through holistic education in just order.

The mode of conduct would primarily be through group discussions in small groups. There would be no formal lectures in the course. In some group discussion sessions, the faculty mentor would introduce a topic and initiate the discussion. While analysing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students focus on the important or critical elements. In other group discussion sessions, there would be more “speaking out” and sharing by students.

While discussing different topics, the mentor encourages the student to connect with one's own self and do self-observation. Scenarios may be used to initiate discussion. The student is encouraged to take up “ordinary” situations rather than “extra-ordinary” situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting. It would be preferable to conduct the course in the mother tongue of the student. This helps connect with the student much better, and also because the Indian languages are much richer than English while describing and discussing the “self”.

Experiments or practical are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and

work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included.

The group discussions would also provide support to a student in performing actions commensurate to his/her beliefs. Hopefully, this would lead to development of commitment, namely behaving and working based on one's beliefs (or values).

REFERENCE BOOKS:

- 1) R R Gaur, R Sangal, G P Bagaria, *Human Values and Professional Ethics*
- 2) A Nagaraj, *Jeevan Vidya: Ek Parichaya*
- 3) A.N. Tripathi, *Human Values*
- 4) *Life and Philosophy of Swami Vivekananda*
- 5) *Swami Vivekananda on Himself*
- 6) Dharampal, *Rediscovering India*
- 7) Mohandas K. Gandhi, *Hind Swaraj or Indian Home Rule*
- 8) Maulana Abdul Kalam Azad, *India Wins Freedom*
- 9) Paramhansa Yogananda, *Autobiography of a Yogi*

ARC2101

ARCHITECTURAL DESIGN II

Course objectives:

This Course is designed to develop the skills of creative design synthesis for a single use, small span, single storey building.

To study theory of Architecture; principles of design & its process; analytical classification of spaces for different uses and their relation to one another;

Study of horizontal circulation in buildings

Understanding of the bye-laws and codes involved in the design of the building typology prescribed for the course

Course Outcome:

The student will be able to understand the iterative process of the architectural design of defining the problem, collecting information, analysing towards developing a solution after acquiring a feedback revisiting the design to improve.

Course content:

The design issues to be addressed include:

Functions and their spatial implications.

Maximum and optimum areas for various functions.

Anthropometrics, furniture layout and horizontal circulation.

Interior volumes and material qualities.

Lighting and ventilation.

Integration of form and function.

The list of suggested topics to be covered as design problems including:

Child care center, Kindergarten School, Primary Health Centre, Doctor's Clinic, Cafeteria, Village Post Office, Bank (branch office). Police Station, Beauty parlor/Salon Architect's Office, Department Store, School Gymkhana & Youth Club, or any other building of single storey.

The topics not covered as design problems could be covered by the Studio faculty members through lecture/slide to enhance their knowledge base and approach towards design issues and process.

At least one major exercise and two minor design/time problems should be given. The final submission shall necessarily include a model.

Assessment : Continuous assessment will be conducted for major (30M) minor (20M) design time problems i.e., total marks of (30M+20M) =50M. 25

References:

- 10) Time savers standards of Building Types-Joseph de chiara & others.
- 11) A History of Building Types-Nikolays Pevsner.
- 12) Architect's Data-Ernst Neufert.
- 13) Architect's Hand book-Charanjit. Shah
- 14) Doctor's offices & Clinics-Paul Hayden Klrk, Eugene D. Sternberg.
- 15) A History of Building Types-Nikolays Pevsner. Architect's Data-Ernst Neufert
- 16) National Building code

ARC2102

HISTORY OF ARCHITECTURE –II

Course Objective:

To enable students to understand:

How different architecture solutions were evolved within the restraints imposed by prevalent social and cultural setup, available building materials, climate and geography of particular region.

Insight of the evolution of architecture in Indian subcontinent and orient.

Course Outcome:

Student will gain knowledge on various Indian architecture styles as a response to the political and socio-cultural conditions in India at different time periods. The course sensitizes the analogy and appreciation of the then architectural, structural manifestations.

SYLLABUS

(Harappan and Vedic Architecture) : Architecture and town planning of Harappan civilization such as towns of Lothal, MohenjoDaro, Dholavira, Kalibanga etc. Understanding of Vedic architecture, and settlements.

(Buddhist and Jain Architecture) : Architectural examples of Mahayana and Hinayana Buddhism; Rock-cut and free standing. Study of caves, stupas, and viharas of places like Sanchi, Amravati, Karle, Ajanta etc. Medieval Jain temple architecture of western India.

(Hindu Architecture) : Elements of Hindu Temple. Development of temple form from example like Ladakh Temple, Temple at Deogarh, Bhitargaon Temple.

(North Indian Temple Architecture) : Architectural character of Gupta Temples - Architecture style of Orissan temple with examples. - Khajuraho group of Temples, and - Architectural character of Gujarat Temples.

(South Indian Temple Architecture) : Pallava, Chola, Pandya, Madura and Vijayanagar style with examples.

(Indo-Islamic Architecture) : Special features of Mosque and Tomb Influences of Indo-Islamic Architecture in India Use of arches, vaults, domes, squinches, pendentives, jaalis, minarets, etc. Special features: use of landscape, water bodies and gardens. Ornamentation in structures with interplay of materials such as stones, mosaics, gildings.

(Sultanate Architecture & Provincial Styles of Sultanate Period) : Sultanate Architecture: Slave Dynasty, Tughlaq Dynasty, Lodhi Dynasty. Provincial Styles of Sultanate Period: Punjab, Bengal, Jaunpur, Gujarat, Malwa, Bijapur and Golconda with examples.

(Mughal Architecture) : Mughal Style prevalent during the reign of a) Babur; b) Humayun; c) Akbar; d) Jahangir; e) Shah Jahan.

Assessment: Two mid examinations (Maximum 20 Marks each) are to be conducted and average of the both are to be taken for consideration for 20 and 10 Marks for continuous assessment i.e. total marks will be (20M+10M)=30M.

Textbooks:

1. Indian Architecture by Percy Brown. (Buddhist and Hindu period) 2. Indian Architecture by Percy Brown (Islamic Period). 3. The Architecture of India by Satish Grover. (Buddhist and Hindu period) 4. The Architecture of India by Satish Grover (Islamic Period).

References:

1. Art Architecture of India by Benjamin Rowland. 2. The history of Architecture in India by Christopher Tadgell. 3. Vistara: The Architecture of India, The festivals of India, Tata Press Limited 1986. 4. Nath – History of Mughal Architecture 5. Banister Fletcher, History of Architecture 27

ARC2103

BUILDING MATERIALS & CONSTRUCTION-III

Course Objective:

The objective of the subject is to enable students to understand the building materials and basic Sub structure and Super Structure structural systems

PCC and RCC material components and construction specifications and steps.

Indian standards for RCC work, reinforcement detailing etc.

Course Outcome:

With the successful completion of the course student should have capability to:

Understanding the method of executing of framework, shuttering and scaffolding.

Understand what type of details would be needed for a particular RCC/PCC work and

Understand planning and execution of staircase

Analyse a design decision situation and come up with correct material choice and construction specification

SYLLABUS

(BUILDING MATERIALS) : Concrete; types, grades, mixing and setting process, workability and other tests, admixtures and additives. Plain and reinforced. Steel section, steel bars, properties, manufacturing process, Indian standards, strength, joining, fabricating.

(FOUNDATION AND COLUMN) : Functions of Foundations, requirements and types of foundations, Site investigations, SBC test for Design of Foundations, Foundations in Special Situations (for very Low SBC Values, Foundations Close to Existing Building, Foundations required in water logged areas etc.). Reinforcement, spacing, RCC Grade mix details for all types of foundations. Reinforcement details of R.C.C. square, rectangular and circular columns.

(BEAM, SLABS, LINTELS) : Introduction to beams, Slabs and Lintels, Standard Sizes, Spacing, Grade mix details as per Latest IS Codes, Reinforcement and details for lintels and projections (Chajja). Reinforcement and details of R.C.C. beams: simply supported, rigid, continuous and cantilevered. Reinforcement and details for one-way and two-way slabs with fixed continuous and cantilever end conditions.

(STAIRCASE) : Introduction, terminology used in staircases, requirements for good staircase, Types of staircases, calculations for riser

and treads, reinforcement and details for various types of staircases. NBC Code 28

(FORMWORK, SHUTTERING, SCAFFOLDING) : Formwork for square, rectangular and circular columns. Scaffolding. Shuttering and centring beams, slabs and staircase. Shoring such as raking shores, flying shores and dead shores. Underpinning.

Assessment: Two mid examinations (Maximum 20 Marks each) are to be conducted and average of the both are to be taken for 20M, and 30 Marks for assignment (Including Drawing assignments) and continuous assessment (portfolio) i.e. total marks of (20M+30M)=50M

TEXT BOOKS:

- 9) W.B. Mc Kay, Building Construction Volume 1 to 4
- 10) R. Barry, Building Construction Volume 1 to 5
- 11) Francis Ching D.K., Building Construction Illustrated
- 12) S.K. Sharma, Civil Engineering construction Materials
- 13) Sushil Kumar, Building Construction
- 14) Building Construction , SS Bhavikatti
- 15) Building Construction , PC Varghese

ARC2104

BUILDING SERVICES-I

(Water Supply & Sanitary Engineering)

Course Objective:

The objective of the subject is to enable students to understand and apply

To understand the need for and importance of building services.

Fundamentals of water supply, drainage, sewerage system and solid waste disposal.

Water distribution systems and its requirements at different scales such as building, site, neighbourhood, etc.

Sanitation and its layout requirements at different scales such as building, colony and neighbourhood.

Calculations and disposal of rainwater and solid waste disposal.

Course Outcome:

With the successful completion of the course student should have capability to:

Interact technically with water supply and sanitation experts.

Design efficient water supply layouts with detail calculations.

Design sanitation layouts.

Design rain water disposal and rain water disposal drawings.

SYLLABUS

(IMPORTANCE OF BUILDING SERVICES) : The need and importance of building services. Historical overview of water supply, plumbing and sewerage systems in India and worldwide.

(WATER SUPPLY) : Sources of water, Quality of water, impurities in water and its treatment. qualities of potable water. Water demand calculations; norms and standards. Water storage, overhead tank, and sump. Water distribution system at city/ neighbourhood overview. Water treatment plant. Types of water distribution networks. Water pipe materials, apparatus, joints, fixtures, and valves. Guidelines for laying of water mains, distribution. Cold & hot water lines in buildings, Water supply to high rise buildings: problems encountered & systems adopted.

(BUILDING SANITATION) : Principles of sanitation, collection, and disposal of various kinds of refuse from buildings. Methods of carrying refuse, systems of refuse disposal, their principles. Plumbing definitions and related terms, building sanitation systems (separate, combined, single stack, one pipe and two pipe, etc.), House drainage system, Drainage of sub-soil water. Design calculations of septic tank, soak-pits, cesspools, aqua-privy, leeching pits etc. Study of details of types of traps and chambers (inspection chamber, disconnecting chamber, intercepting trap, S-trap, P-trap, gully trap, grease trap etc; and sanitary fixtures (washbasins, WCs, bathtubs, urinals, flushing cistern, etc. Types of pipes and joints. Design principles of sanitary layout (location and ventilation of chambers, traps, fixtures).

(STORM WATER DISPOSAL SYSTEM) : Surface area division for rain water disposal. Details of collection point/Khurra. Conveyance network for rain water (catch basin, gully traps, etc.). Calculation for rain water quantity, gradients, section of drains etc. Concepts of rainwater harvesting.

(DRAWING AND MARKET SURVEY) : Market survey for pipes, fittings and fixtures, traps etc. To prepare water supply and sanitary design project for a small building such as residence, primary school etc. Output for water supply design will be in the form of water quantity calculations, flow calculations and pipe diameter calculations. Water supply layouts from municipal supply to storage tank. Also design network for hot and cold water supply in the selected building in the form of plans and sectional elevations. Output for Sanitary design will be in the form of gradient and pipe diameter calculations. Layout design with details of all chambers and traps for building and site in the form of plans and sectional elevations.

Assessment: Two mid examinations (Maximum 20 Marks each) are to be conducted and average of the both are to be taken for consideration for 20 and 10 Marks for assignment and continuous assessment i.e. total marks will be (20M+10M) =30M.

TEXT BOOKS:

- 1) Rangwala, Water Supply and Sanitary Engineering
- 2) Kshirsagar, Water Supply and Sanitary Engineering
- 3) Shah, Water Supply and Sanitation
- 4) Patil, Plumbing Engineering
- 5) Indian Code Council, International Plumbing Code
- 6) P.N. Khanna, Indian Practical civil Engineers' Handbook

ARC2105 CLIMATOLOGY-I

Course Objective:

It is Science that explores aspects of human comfort and energy efficiency in built environment for sustainable habitat. Tools, data, standards, methods and principles for design of climate responsive built environments, are dealt particularly for tropical climates found in India.

Course Outcome:

It equips the student with the basic understanding of climatic types in India and initiatives of Sustainable Habitat mission; introduces basic science of human comfort and energy efficiency in buildings; familiarize with the data, methods, principles, standards and tools for planning and designing for climate responsive built environment and human comfort.

SYLLABUS

(Introduction to Building Climatology) : Global climatic factors, Elements of climate and graphic representation of climatic data, macro and micro climate, Climate control elements of building, Climate and built form interaction, Mahoney Tables.

(Tropical Climates) : General classification of tropical climates, Indian classification of climate, Characteristics of different climatic zones and design considerations, Traditional built forms with respect to climatic and cultural conditions.

(Human Comfort) : Elements of heat exchange between man and environment, Physiological and sensory responses, Biophysical effects of environmental factors, Thermal and visual comfort factors, indices/charts. 31

(Building Envelope) : Heat flow through buildings, Periodic heat flow, Elements of building related to control of solar radiation and ventilation, Thermo physical properties of different materials, Principles of light and Day-lighting, Elements of building related to daylight.

Note: Understanding climate data, its analysis and method of presentation, Study of traditional/vernacular architecture in relation with culture and climate of the study region, Study of conventional building envelope to assess comfort factors and undertake retrofitting/redesign for given parameters.

Assessment: Two mid examinations (Maximum 20 Marks each) are to be conducted and average of the both are to be taken for consideration for 20 and 10 Marks for assignment and continuous assessment i.e. total marks will be (20M+10M) =30M.

TEXT BOOKS:

- 1) Manual of Tropical Housing and Building by Koenigsberger, Ingersoll, Mayhew, Szokolay,.
- 2) Man, Climate and Architecture by B. Givoni,
- 3) GRIHA Manuals Volume 1-5, Ministry of New and Renewable Energy, Govt. of India
- 4) Energy Conservation Building Code, Bureau of Energy Efficiency, India

REFERENCE BOOKS:

- 1) Design for Hot Climates by Konya Allan,
- 2) Tropical Architecture by Kukreja, C.P.,
- 3) Buildings, Climate and Energy by Markus T.A., Morris E.N,
- 4) Solar Control and Shading Devices by Olgyay A., Olgyay V.,.
- 5) Sun, Wind and Light by Brown G.Z.,
- 6) Climate Responsive Architecture by Arvind Krishnan, Nick Baker, SimosYannas, S.V. Szokolay,
- 7) Website: <http://www.gsa.gov/portal/category/21049>

ARC2106

STRUCTURAL MECHANICS –II

Course objectives:

To study the theory and behaviour of columns for axially loaded and biaxially loaded columns for symmetrical and unsymmetrical sections.

The variation of shear force and bending moment at a point for moving loads.

types of forces acting on a retaining wall under different field conditions.

Plastic analysis of beams and frames for different loading conditions.

Course outcome:

The student will be in a position to estimate/access the minimum dimensions of columns required for a building and the stresses induced in a column section subjected to axial and biaxial loading.

Understanding the effect of point load, uniformly distributed load on shear force and bending moment at a particular point on a beam.

Behaviour of retaining walls due to different forces under different field conditions.

Application of Plastic analysis to limit state design of beams subjected to bending in steel structures.

SYLLABUS

(COLUMNS AND STRUTS) { Columns and struts: Buckling and crushing failures, types of end conditions, Euler's theory & equivalent length and slenderness ratio. Rankine's equation and IS code formula for critical load on columns.

(DIRECT AND BENDING STRESSES-COLUMNS) : Direct and bending stresses, eccentricity about both axes, symmetric and unsymmetrical sections-Columns.

(INFLUENCE LINE DIAGRAMS) : Influence Line Diagrams of statically determinate beams only.

- a) A single concentrated load
- b) uniformly distributed load (UDL) longer than the span
- c) uniformly distributed load (UDL) shorter than the span

(RETAINING WALLS) : Retaining walls, Types of retaining walls, Active Pressure, Passive Pressure, State of equilibrium in soil, Theories of Earth Pressure, Rankine's theory, Coloumb's theory, Earth pressure on retaining walls due to submerged soil (with horizontal backfill, horizontal surcharge only). Stability analysis of gravity type and Cantilever type retaining walls only.

(PLASTIC ANALYSIS OF STRUCTURES: INTRODUCTION) : Plastic Analysis: Introduction to Plastic analysis, Plastic bending of beams, Plastic Hinge, Moment curvature relationship, Shape factor and Load factor. Determination of shape factor for standard cross sections: Rectangle, Triangle, Diamond and Circle and Numerical problems for symmetric and unsymmetrical sections.

(PLASTIC ANALYSIS OF STRUCTURES: PLASTIC ANALYSIS) : Fundamental conditions for Plastic analysis, Mechanism, Upper and Lower bound theorems, Uniqueness theorem, Static method and Kinematic method, Plastic analysis of simply supported, fixed, continuous beams and

Frames (single bay single storey) for point load, UDL and unsymmetrical point load.

Assessment: Two mid examinations (Maximum 20 Marks each) are to be conducted and average of the both are to be taken for consideration for 20 and 10 Marks for continuous assessment i.e. total marks will be (20M+10M)=30M

TEXT BOOKS:

1) Analysis of Structures - Analysis, Design and Details of Structures-Vol.-1 by V.N. Vazirani and M.M. Ratwani and S.K.Duggal

2) Analysis of Structures - Theory, Design and Details of Structures-Vol.-2 by V.N. Vazirani and M.M. Ratwani and S.K.Duggal

REFERENCES:

1) Limit State Design of Steel structures by S.K.Duggal, Publishers: McGraw-Hill Education.

ARC2107

COMPUTER APPLICATIONS-I

Course Objective:

The objective of the subject is to enable students to understand and apply

Basic CAD skills to create simple and complex two dimensional geometric forms.

CAD skills to create technically correct and presentable drawings.

Skills to create technically correct and presentable three dimensional building models.

Skills to render and animate building models.

Course Outcome:

With the successful completion of the course student should have capability to:

Grasp 2 D CAD drafting

To transform sketches and manually drafted drawings into CAD drawings.

Prepare presentation drawings with the help of computer software's.

Visualize building / transform sketches and 2 dimensional CAD drawings to 3 dimensional building models and walkthrough.

Execute photo realistic rendering of the building project.

Prepare walkthroughs.

SYLLABUS

(INTRODUCTION TO 2D DRAFTING & 2D DRAFTING TOOLS) : Introduction to computer aided 2-D drafting. To develop and understand basic set up and menu bars for computer aided drafting. Screen Layout-status bar, tool bar, graphics area, labelled buttons, drawing editor, file handling commands (utility commands). Setting units and scale. Drafting simple and complex geometric shapes such as squares, circles, triangles, lines, curves, poly lines and their combinations etc. Application of various toolbars and their sub tools including draw, edit, modify, view, file, dimension, parametric, etc.

(2D DRAFTING OF BUILDING & 2D PRESENTATION DRAWINGS) : Preparation of two dimensional architectural drawings (including plans, elevations and sections) incorporating layers, line-weights, texts, scale, dimensioning and formatting of drawings for taking prints and plots. Preparation of two dimensional architectural presentation drawings (including plans, elevations and sections) incorporating human figures, plants, car etc. Preparation of two dimensional architectural presentation drawings (including plans, elevations and sections) incorporating grid, column, dimensioning, legend and architectural elements details with proper line weight etc.

Practical Work: Making 2-dimensional architectural plan, elevation and sections for any one of the architectural design assignments studied in previous semesters with submission in the form of printouts in scale.

(3D MODEL OF BUILDING & PHOTO REALISTIC RENDERING) : Understanding and converting plan, elevation and section of drawing to three-dimensional building model using three dimensional tools (Ex: Sketch up or 3D MAX). Creating building models using building elements and then converting model to orthographic projections. Making models photorealistic using materials, lighting, texture, background, etc. Creating new materials and environment attributes.

(WALK THROUGH OF INTERIOR/EXTERIOR) : Create interior walkthroughs for small spaces such as bedroom, office etc. by adding scenes, furniture, texture, finishes with lighting effect and camera angles. Create building exterior walkthroughs by adding scenes, trees, human figures, cars, sun light effect and camera angles.

Practical Work: Making Three- dimensional photorealistic rendered architectural models for any one of the architectural design assignments completed in previous semesters and to create walkthrough of the same. 35

Software for References

- 1) AutoCAD Student Version
- 2) Autodesk Revit
- 3) Sketch-Up

- 4) Paint 3D
- 5) 3D Max
- 6) 3D Home architect
- 7) Archi-Cad
- 8) Maya

ETHICS

Course Objectives:

To help students regulate their behaviour in a professional environment as employees.

To make students aware of the impact of taking non-ethical engineering decisions.

To understand that mind and desire control is needed for being ethical.

To understand organizational culture and to adapt to varying cultures without compromising ethical values

Course Outcomes:

On completion of this course, students should be able

Realize the importance of human values.

Understand that excessive desires of the mind make a person unethical and restless, while fewer desires lead to peace and professional progress.

Assess different types of risks involved in unethical practices. Know various means of protesting against unethical practices.

Assess the benefits of restraining from unethical practices like bribery, extortion, nepotism, nexus between politicians and industrialists.

Summarize case studies of ethical violations in Chernobyl meltdown, Challenger disaster, Ford Pinto design, Kingfisher Airlines financial misappropriation.

(Introduction To Terminology in Ethics) : Integrity, Honesty, Courage, Empathy, Personality, Character, Self-Confidence, Respect for Others – Work culture, social responsibility, Responsibilities as a citizen, Cooperation and commitment – Religion vs. Spirituality, Philosophy, Customs and practices – Self-interest, Fear, Deception, Ignorance, Ego, Uncritical acceptance of authority.

(Mind And Its Mysteries) : What is Mind? Mind and body, Mind and food – Mental faculties – Theory of perception, Memory, Imagination, Thought-Culture, Desires – Cultivation of Virtues, Control of Senses and Mind – Concentration, Meditation and Enlightenment.

(Risk And Safety in Engineering) : Estimating risk – What is acceptable risk? – Architects liability, Changing legal rights of the employees by non-

participation, by protest – Environmental laws and judicial intervention in related matters.

(Non-Ethical Practices in Vogue) : Conflict of Interest, Occupational crime – How multinational corporations influence government decisions, public policy – Architects as managers, advisors and experts, Architects as moral leaders – Problem of bribery, extortion, grease payments, nepotism – Nexus between politicians and industrialists. Case Study: Chinese Minister Sentenced to Death for Corruption.

(Case Studies –Variety of Moral Issues In Profession) : Chernobyl nuclear disaster, Fukushima reactor meltdown, Challenger blow-up, Ford Pinto design, Highway safety, Kingfisher Airlines financial misappropriation.

TEXT BOOKS:

1. Charles E Harris, Micheal J Rabins, Engineering Ethics, Cengage Learning Pub.
2. Mike Martin and Roland Schinzinger, Ethics in Engineering, McGraw Hill Pub.
3. Swami Sivananda, Mind, Its Mysteries and Control, Divine Life Society

ARC2201

ARCHITECTURAL DESIGN II

Course objectives:

This Course is designed to develop an Understanding design issues, formulating concepts and the skills of creative design synthesis for a small scale multi_ use buildings and more than a single floor building.

To understand the design issues like Functions and their spatial implications Analytical classification of spaces for different uses and their relation to one another; Anthropometrics, furniture layout and horizontal and vertical circulation; Interior volumes and material qualities; Lighting and ventilation and Integration of form and function.

Understanding of the bye-laws and codes involved in the design of the building typology prescribed for the course.

Course content

The design issues to be addressed include:

Functions and their spatial implications in a multi-use building.

Anthropometrics, furniture layout and horizontal and vertical circulation.

Understanding the interior volumes ,material qualities and integration of form and function.

Bye-laws and codes of the buildings that are taken up for design project sensitizing them towards inclusive design and the norms followed.

The list of suggested topics to be covered as design problems including:

Motels/ Hotel, Hostels, Police station, Office building, Apartments, and another building that is multi use and more than one floor buildings.

At least one major exercise and one minor design/time problems should be given. The final submission shall necessarily include a model for the main problem.

Assessment : Continuous assessment will be conducted for major (30M) minor (20M) design problems i.e., total marks of (30M+20M) =50M

Course outcome:

The student will be able to acquire the design skills such analysis, synthesis, conceptualisation.

REFERENCES:

- 1) Time savers standards of Building Types-Joseph de chiara & others.
- 2) A History of Building Types-Nikolays Pevsner.
- 3) Architect's Data-Ernst Neufert.
- 4) Architect's Hand book-Charanjit. Shah
- 5) National Building code

ARC2202

HISTORY OF ARCHITECTURE –III

Course Objective:

To enable students to understand:

Significant developments in Modern Architecture with the advent of steel, Glass and Ferro-concrete;

Different schools of thought along with understanding of various architectural philosophies and works of 20th century contemporary architects in India and abroad.

Course Outcome:

The student will gain an in-depth knowledge of

Modern Architectural philosophies in the evolution of innovative architectural forms and advent of new modern building materials.

Indian architecture styles as a response to the political and socio-cultural conditions in India at different time periods.

The course sensitizes the analogy and appreciation of the then architectural, structural manifestations.

SYLLABUS

(Introduction, Advent of Steel, Glass and Ferro-Concrete) : Late Renaissance and development of open spaces Advent of Steel and Henry

Labrouste Great Exhibitions of 1851 and 1889 and their contributions
Gustave Eiffel Development of Ferro concrete: Auguste Perret, Tony Garnier.

(Development of 'New Art & Architecture') : Le Art Nouveau movement and Victor Horta H.P. Berlage, H. H. Richardson and 'True Construction' Balloon Frame Structure and Plane Surfaces in America.

(Chicago School & Organic Developments) : Chicago School: Louis Sullivan Organic Architecture: Frank Lloyd Wright

(Programmatic Functionalism) : Walter Gropius and Bauhaus, Le Corbusier

(Development of International Style) : Mies van der Rohe, Philip Johnson, Louis I Kahn

(20th Century World Architecture) : Works of some master architects like, Eero Saarinen,,Alvar Aalto, Oscar Niemeyer, Richard Neutra, Norman Foster, Antonio Gaudi, Frank O. Gehry, I. M. Pei, KenzoTange 39

(INDIAN ARCHITECTURE) : Revival of Indian Architecture under British patronage - Architecture in Colonial India. Indian architecture since independence, B. V. Doshi, Charles Correa, Raj Rewal, A. P. Kanvinde , Laurie Baker.

Assessment: Two mid examinations (Maximum 20 Marks each) are to be conducted and average of the both are to be taken for consideration for 20 and 10 Marks for assignment and continuous assessment i.e. total marks will be (20M+10M) =30M.

TEXTBOOKS:

- 1) Introduction to Indian Architecture by Binda Thapar
- 2) Modern Architecture, Vol 2 of History of World Architecture by Manfredo Tafiri and Franscesco Dal Co
- 3) Makers of Modern Architecture, Vol II, from Le Corbusier to Rem Koolhaas by Martin Filler
- 4) Modern Architecture in India by Sarabjit Singh Bagha

REFERENCES:

- 1) History of Modern Architecture by Leonardo Benevolo.
- 2) Space, Time and Architecture: The growth of a New Tradition by Sigfried Guiedion.
- 3) Contemporary Architecture by Ann Lee Morgen and Colin Mayer.
- 4) After the Masters by Vikram Bhatt.
- 5) Architecture of Independence by John Lang, Mickey Desai, Madhavi Desai.
- 6) Post-Independence Architecture by S.S.Bahga.

- 7) The language of Post-Modern Architecture by Charles Jencks.
- 8) The Architecture of the City by Aldo Rossi.

ARC2203

BUILDING MATERIALS & CONSTRUCTION-IV

Course Objective:

The objective of the subject is to enable students to understand:

Large span truss components and construction details.

Use of materials like steel, aluminium, glass, gypsum in interiors and exteriors; their construction and to enable them to represent same through technical drawings.

Course Outcome:

With the successful completion of the course student should have capability to: Make a decision which type of construction detailing will be required for a given type of roofing depending on interior and exterior situation and make drawings for the same.

Understand design and execute false ceiling with different materials.

Understand and execute glass as material.

Understanding different wall treatments and prepare detail drawings.

SYLLABUS

(STEEL TRUSSES & ROOFING) : Types and fixing details of steel trusses – saw tooth, roof truss with north light glazing, simple trusses in steel, and ways of fixing and connections (to foundations, steel stanchions, and beams etc.). Space frames (single, double & triple layered tubular space frames with globe connections). Types of materials and details of industrial buildings, warehouse, and other building typologies.

(PARTITIONS, GRILLS AND PANELS) : Study of various types of aluminium and wooden partitions, its extrusions, and fixing details. Different types of wooden, aluminium panels, cladding components for various types' of buildings and structures. Aluminium, glass, and steel grill modules.

(FALSE CEILINGS) : Types and fixing details of various materials for suspended ceilings and false ceilings using aluminium and other material sections). Construction details for providing thermal insulation in cold storages. Types of insulation materials and fixing details of materials like glass wool, insulating boards, gypsum boards, plaster of paris, and various kinds of perforated boards.

(GLASS) : Various techniques to use glass and glass blocks with fixing details (structures like pavilions, greenhouses, staircases, multi storied buildings –curtain walls, roofing, panels).

(WALL TREATMENTS AND FINISHES) : Types and fixing details of sound absorbing materials such as acoustic plastic, acoustic tiles, wood, partition board, fibre board, cork, quilts and mats spun glass foamed glass, cork, gypsum, plaster of Paris, hydride gypsum properties, its properties (porous, baffle and perforated materials) and applications (vapor barriers, rigid insulations, blanket, poured and reflective insulation). Study of relevant IS codes, Study of damp-proofing materials such as Bitumen felts, etc. chemicals for W.P.C. & O.P.C etc.

Assessment Two mid examinations (Maximum 20 Marks each) are to be conducted and average of the both are to be taken for 20M, and 30 Marks for continuous assessment (portfolio) i.e. total marks of (20M+30M) =50M

TEXT BOOKS:

- 1) S.P. Arora & Bindra, A Textbook of Building Construction
- 2) J. Jha & S.K. Sinha, Building Construction
- 3) M.S. Shetty, Concrete Technology
- 4) Dr. B.C. Punmia, A Textbook of Building Construction
- 5) T.D. Ahuja and G.S. Birdie, Fundamentals of Building Construction
- 6) S.P. Arora and S.P. Bindra, A Textbook of Building Construction

ARC2204 : BUILDING SERVICES-II

(ACOUSTICS)

Course Objective:

To study Basic laws and terminologies related to Acoustics, Acoustical requirements of a given activity, its calculations and designing of the space.

Urban noise control and its application at site and building level.

Course Outcome:

Understand the basics of acoustics.

Develop capability to apply the fundamentals of acoustics in the design of building.

Communicate with technical accuracy in a professional and an academic environment.

SYLLABUS

(INTRODUCTION TO ACOUSTICS) : To understand the need for and importance of acoustics in various building typologies, the history of acoustics, works of pioneers. Understanding of terminologies, definitions of key concepts such as propagation, reflection, absorption, diffusion, velocity, intensity, and intensity levels etc. Introduction to properties of sound, decibel scale, directionality and sound sources, hearing noise effects, diffraction and

reflection resonance, echo, and reverberation. Classification of Sound Waves. Sensibility of human ear. Free field conditions and Inverse Square Law for noise reduction with distance.

(ACOUSTICS FOR AN ENCLOSURE / BUILDING DESIGN) : Reverberation Time and its importance for acoustical performance of an enclosure. Sabin's Equation and its application for designing new auditoriums and correcting RT of existing ones. (Classroom exercise) Acoustical defects in an auditorium and their remedies. Acoustical design of auditorium and other acoustically sensitive enclosures meant for speech, music, lecture, etc. Properties of materials and their application for acoustical treatment, shape analysis for different enclosures. Designing enclosures for variable RT's. Sound Amplification Systems.

(NOISE ISOLATION AND CONTROL) : To understand noise, its transmission (air borne and structure borne), insulation and transmission loss. Understanding of psychological and physiological effects of noise. Identification of various sources of indoor noise and methods of sound insulation for control of mechanical noise and vibrations and its control measures. Speech privacy and noise control in specific situations. Sources of outdoor noise such as traffic noise levels and planning and design for outdoor noise.

(ACOUSTICAL DESIGN PRINCIPLES AND FACTORS) : Case studies and at least one design exercise of an auditorium or other sensitive enclosures which require acoustical sensitivity meant for speech, music, lecture, etc. Selection criteria for cases and design exercise - Site selection and planning, shape, dimensions, occupancy and seating arrangements, treatment of interior surfaces, desired reverberation time and amplification systems. Exercise output would be in the form of plan, section, construction details and calculation sheets.

Assessment: Two mid examinations (Maximum 20 Marks each) are to be conducted and average of the both are to be taken for consideration for 20 and 10 Marks for classroom exercises and continuous assessment i.e. total marks will be (20M+10M) =30M

TEXT BOOKS:

- 3) David Egan, Architectural Acoustics
- 4) A.B. Wood, A Textbook of sound.
- 5) Yarwood, T.M., Acoustics.

REFERENCES:

- 5) Catalogues of leading Audio equipment's companies.
- 6) Kandaswamy, Architectural Acoustics and Noise Control
- 7) J.E. Moore, Design for Good Acoustics and Noise Control
- 8) National Building Code 2005
- 9) Templeton, D., Acoustics in the Built Environment.

ARC2205 CLIMATOLOGY-II

Course Objectives:

Methods and techniques to predict the effect of elements of climate on built spaces. Design of climate responsive and energy efficient built environment through Green building concepts for sustainable habitat.

Course Outcome:

To equip student with the principles of climatic control and to design sustainable habitat; Familiarize them with the green building concepts and rating system; Introduce them with building energy-simulation program.

SYLLABUS

(Solar Radiation and Day Lighting) : Solar geometry and charts, Sun control through various elements of building, Day lighting prediction techniques, Fenestrations with focus on skylight, north light etc.

(Natural Ventilation and Air Movement) : Principles and dynamics of air movement and ventilation, Effect of built environment on air movement and ventilation, Fenestrations and other elements to control air movement and ventilation.

(Passive and Mechanical Controls) : Passive methods of cooling, dehumidification, evaporative cooling etc., Substitutes of mechanical devices using renewable energy sources for cooling, dehumidification, evaporative cooling etc.

(Green Buildings and Energy Simulation Programs) : Background of different rating systems, Relevance of rating system and GRIHA rating system, Introduction to building energy simulation program, Different simulation program software.

Assignments: Calculation and design of elements of building for a project done in Architectural Studio the previous semester. Self-assessment of green rating system as per GRIHA specifications for their design project. To run CFD simulation for a small block the elements of building that the student designed.

Assessment: Two mid examinations (Maximum 20 Marks each) are to be conducted and average of the both are to be taken for consideration for 20 and 10 Marks for continuous assessment i.e. total marks will be (20M+10M)=30M.

TEXT BOOKS:

1) Manual of Tropical Housing and Building by Koenigsberger, Ingersoll, Mayhew, Szokolay,.

2) GRIHA Manuals Volume 1-5, Ministry of New and Renewable Energy, Govt. of India.

3) Energy Conservation Building Code, Bureau of Energy Efficiency, India

4) CFD online tutorials .

REFERENCE BOOKS:

1) Design for Hot Climates by Konya Allan,.

2) Tropical Architecture by Kukreja, C.P.,.

3) Buildings, Climate and Energy by Markus T.A., Morris E.N.,

4) Solar Control and Shading Devices by Olgyay A., Olgyay V.,.

5) Sun, Wind and Light by BrownG.Z.,

ARC2206

DESIGN OF STRUCTURES-I

Course objective:

To study the stress strain behaviour of steel and concrete; the concept of limit state method.

The basic idea of analysis and design different reinforced concrete members from substructure to superstructure of a reinforced concrete building.

Course Outcome:

The student acquires knowledge on the concept of limit state method of design for different reinforced concrete members from substructure to superstructure of a reinforced concrete building.

SYLLABUS

(Introduction to RCC Design) : Introduction to RCC, Working stress method, Ultimate load method, Limit state method, Characteristic strength, Characteristic load, Partial safety factor, Type of loads, Factored loads, Stress-strain relationship for steel and concrete. Introduction to IS 456:2000.

(Flexural Analysis and Design of Beams and Slabs) : Types of Beams, Moment of resistance, Neutral axis; balanced, under & over reinforced sections. Design of singly reinforced beams, doubly reinforced beams and T-beams, Design of lintels, cantilever beams, Types of Slabs, Behaviour of Slabs, General Considerations for Design of Slabs, Design of one way slab, two way slab and cantilever slabs (solid slabs only)

(Design for Shear and Bond) : Behaviour of Reinforced Concrete Beams under Shear, Factors Affecting Shear Strength of Concrete, Local or Flexural Bond Stress, Anchorage Bond, Bond Behaviour, Development Length, Design of beams for shear & bond.

(Design of Columns) : Types of Columns, Behaviour of Short Columns, Effective length of columns, Design of axially loaded columns, Design of columns subjected to axial load and uniaxial bending moment only.

(Design of Footings) : Types of RCC footings (isolated, square, rectangular, combined, pile and pile cap), Soil Pressure under Footings, Analysis and design of isolated Square and rectangular footings only.

(Design of Staircase) : Types of Staircases, Loads on Stair Slabs, Design of Dog-Legged staircase and Single Flight staircase only.

Note: Design of reinforced concrete structures conforming to IS 456:2000

Assessment: Two mid examinations (Maximum 20 Marks each) are to be conducted and average of the both are to be taken for consideration for 20 and 10 Marks for continuous assessment i.e. total marks will be (20M+10M)=30M

TEXT BOOKS:

1) Design of R.C.C. structures by S. Ramamrutham, Publishers: DhanpatRai

2) Reinforced Concrete Limit State Design by A.K.Jain, Publishers: Nem Chand & Brothers.

REFERENCES:

1) Limit State Design of Reinforced Concrete by P.C.Varghese, Publishers: Prentice-Hall of India Private Limited

2) Reinforced Concrete Limit State Design by P. Dayaratnam, Publishers: Oxford IBH

ARC2207 ENVIRONMENTAL SCIENCE FOR ARCHITECTURE

Course Objectives:

The objective of the subject is to enable students to have an understanding of:

Fundamental knowledge about natural and built environment

Fundamental concepts to understand environmental processes

Course Outcome:

With the successful completion of the course student should develop awareness and sensitivity to environment and ecology.

SYLLABUS

(Fundamentals of Environment & Ecology) : Definitions and concepts; environment, environmental segments, ecosystem, ecology etc. Introduction to types, characteristic features, structure and function of different

ecosystems (forest, grassland, desert and aquatic ecosystem). Effects of human activities such as agriculture, housing, industry, mining and transportation activities on environment. Threats to India's and the world's biological diversity.

(India's Bio-Geographic Regions) : India's biological diversity in relation to the physio-geographic regions. Identification of principal bio-geographic zones of India and their description. Eco-regions of India (floristic and physiographic). Distinction on the basis of flora and fauna differences in an eco-region. Evaluation of the importance of biological diversity to all life interconnections between biological diversity and human life – sustenance. Conservation of bio-diversity-In-situ and Exsitu conservation.

(Environmental Degradation and Human Impacts) : Environmental Pollution: Local and Global Issues. Causes, effects and control measures. Engineering aspects of environmental pollution control systems.

Air pollution: impacts of ambient and indoor air pollution on human health. Water pollution: impacts water pollution on human health and loss of fresh water resources. Soil pollution and its impact on environment. Marine pollution and its impact on blue economy. Noise pollution, thermal pollution, nuclear pollution.

Solid waste management: Important elements in solid waste management- Waste to energy concepts. Management of plastic waste and E-waste.

Complex relationships between the built and natural environments. Impact of pollution on natural and man-made environments; Role of an individual in prevention of pollution.

(Disaster management and climate change) : Disaster management; floods, earthquake, cyclone and landslides. Cause-and-effect relationships between various human, natural and climatic factors that impinge upon ecological systems and their linkages. Understanding of global climate change and impacts with respect to rural/urban communities; increased risk/vulnerabilities. Environmental Impact Assessment.

(Techniques and Details) : Fundamentals of Sustainable Development– Sustainability Strategies and Barriers – Industrialization and sustainable development. Circular economy concepts in Industrial waste (solid and fluid) management. Urban problems related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people. To understand implementation of ecological architecture at unit level. Rain water harvesting (contour bunds, wells, bunds, etc.). Techniques of waste water management (house level, bio swales etc.). Ecological planting (planting for wildlife, land improvement etc.)

Strategies to transform the built environment to meet the risks of climate change. Bio-mimicry - the study of natural structures and processes- in helping to solve man-made problems and enabling design; Concepts of

urban ecology and landscape urbanism; case studies; integration of Renewable Energy Systems in built environment.

Institutions and Governance) : Regulation by Government, Monitoring and Enforcement of environmental regulation, Environmental Acts, Water (Prevention and Control of pollution) act, Air Prevention and Control of pollution) act, Environment Protection act, Wild life protection act, Forest Conservation act, Coastal Zone Regulations, Institutions and policies relating to India, Environmental Governance.

(Conventions) : International conventions: Salient features of International conventions on Environment: Stockholm Conference 1972, Earth Summit 1992, World commission for environmental Development (WCED). Montreal Protocol, Kyoto protocol, Ramsar Convention on Wetlands, Stockholm Convention on Persistent Organic Pollutants, United Nations Framework Convention on Climate Change (UNFCCC).

(Case Studies) : Case studies: Chipko movement, Narmada Bachao Andolan, Silent Valley project, Madhura Refinery and TajMahal, Industrialization of Pattancheru, Nuclear reactor at NagarjunaSagar, Tehridam, Ralegaon Siddhi (Anna Hazare), Kolleru lake – aquaculture, Florosis in Andhra Pradesh, etc.

REFERENCES:

- 1) Miller T.G Jr., Environmental Sciences,
- 2) SC Sharma & MP Poonia, Environmental Studies
- 3) OP Gupta, Elements of Environmental Pollution Control
- 4) SC Sharma, Disaster Management
- 5) Cunningham, W.P. Cooper, T.H. Gorhani, E &Hepworth, Environmental Encyclopedia
- 6) E.P. Odum, Ecology
- 7) Keshav Kant & Rajni Kant, Air Pollution and Control

INDIAN TRADITIONAL KNOWLEDGE

(Non-credit mandatory courses)

Course Objectives:

To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.

To make the students understand the traditional knowledge and analyse it and apply it to their day to day life.

Course Outcome:

At the end of the Course, Student will be able to:

Identify the concept of Traditional knowledge and its importance.

Explain the need and importance of protecting traditional knowledge.

Illustrate the various enactments related to the protection of traditional knowledge. Interpret the concepts of Intellectual property to protect the traditional knowledge. Explain the importance of Traditional knowledge in Agriculture and Medicine

(Vastushastra) : In recent times, 'Vastushastra' has emerged as one of the major fields of discussion in the society. The word 'Vastushastra' brings a myriad of reaction from people in general and architects in particular. But technically, Vastu is meant as the Sanskrit equivalent of architecture or as the 'Indian System of Architecture' (Sthapatya). 'Sthapatya' has many aspects or fields of knowledge. It contains verses on planning of towns, villages, design of temples, halls, pavilions, and seats etc. It also has information on material specifications, brickwork, joinery and carpentry. Majority of the text is on architecture and construction. The remaining verses are on astrology, aayadi formulae, mandala diagrams, muhurta and other non-architectural aspects.

(Indian System of Architecture) : The chaos and confusion is mainly due to the prevailing ritualistic / mystic aspects of vastu as hyped by the media. This media hype has not only influenced public in general but also influenced architects to a major extent, as they are unaware about the technical aspects of the Indian System of Architecture. The objective here is to create awareness among architects regarding the Indian System of Architecture and equip them to design buildings as per Sthapatya (in sync with recent market trends & construction technologies).

(Legal framework and TK) : The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act); The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016.

(Traditional knowledge and intellectual property) : Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge

Assessment: This is a self-learning non-credit mandatory course. The mode of conduct would primarily be through self-learning, and group discussions in small groups, power point presentation, video lectures, subject movies. One faculty will be nominated as a mentor for this course by the Head of the Department to see that students are actively participating in the course for 2 hrs every week.

TEXT BOOKS:

- 1) Traditional Knowledge System in India, by Amit Jha, 2009.

REFERENCES:

1) Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002.

2) "Knowledge Traditions and Practices of India" Kapil Kapoor1, Michel Danino2.

ELECTRICAL ENGINEERING
SCHEME OF INSTRUCTION & EXAMINATION
I/IV B.Tech to IV/IV

Common With Six Year Dual Degree Course II/VI (B.Tech.+
M.Tech.)

(With effect from **2019-2020** admitted batch onwards)

B.TECH. (EEE) I YEAR I-Semester Scheme Of Instruction And Examination

Sub. Ref	Name of the Subject	Periods			Maximum Marks		Credits
		Theory	Tutorial	Lab	Sessionals	Exam	
ENG1101	English	2	—	—	30	70	2
ENG1102	Mathematics -1	3	—	—	30	70	3
ENG1103	Mathematics -2	3	—	—	30	70	3
ENG1105	Physics	3	1	—	30	70	4
ENG1107	Engineering Graphics	2	—	3	30	70	3.5
ENG1109	Physics Lab	—	—	3	50	50	1.5
ENG1111	Workshop	—	—	3	50	50	1.5
ENG1113	Professional Ethics & Moral Values	2	—	—	30	70	0
TOTAL		15	1	9	280	520	18.5

ENG1101: English

2L:0T:0P 2 Credits

Course Outcomes:

At the end of the course the student will be able to

- Infer explicit and implicit meaning of a text
- Construct clear, grammatically correct sentences using a variety of sentence structures
- Analyse and Produce various types & formats of emails, letters in formal & informal ways to meet particular purposes.
- Select and apply appropriate words and phrases in different contexts.
- Formulate and present ideas effectively in spoken form.
- Discuss social issues with concern and imagine possible solutions

The emphasis on English Language is enormously increasing as an effective medium of communication in all sectors the World over. As a consequence of this, the acquisition of effective communication skills in English has become most important to the students to flourish in their careers. In this connection there is a need to train the students to equip themselves with the necessary skills required for effective communication in English thereby enabling them to get a good placement immediately after the completion of their undergraduate courses. To meet the objectives of developing proficiency in English communication skills and developing Listening, Speaking, Reading and Writing (LSRW) skills. The following curriculum is designed for favorable consideration.

CURRICULUM: THEORY AND PRACTICE (LANGUAGE LAB)

1. A TEXT WITH FOCUS ON SKILLS APPROACH

Intended to develop the language skills of Listening, Speaking, Reading and Writing.

2. VOCABULARY :

- a) One – Word Substitutes.
- b) Words often Confused – Pairs of Words.
- c) Synonyms and Antonyms.
- d) Foreign Phrases.
- e) Phrasal verbs derived from the following dynamic verbs_Go, Get, Run, Take, Look, Hold, Put, Stand Etc.

f) Idioms and phrases.

3. GRAMMAR :

- a) Error Analysis
 - Correction of Errors in a given sentence – errors in the use of words – errors of indianisms – use of slang – errors in punctuation
- b) Concord
- c) Articles, Prepositions and words followed by prepositions.
- d) Tenses.
4. Writing skills :
 - a) Précis writing
 - b) Note Making
 - c) Letter writing.
 - d) Technical Report Writing.
 - e) Preparation of C.V and Resume writing.
 - f) Reading Comprehension.
 - g) Memo.
 - h) Notices/Circulars Agenda and Minutes of a Meeting.
 - i) E-Mail etiquette
 - j) Essay writing.

Text Books:

In order to improve the proficiency of the student in the acquisition of the above mention skills, the following texts and course content is prescribed.

- LEARNING ENGLISH: A Communicative Approach, Hyderabad: Orient Long man. (selected lessons)

The following lessons are prescribed from the above Text:

ENG1102 : Mathematics - I

3L:0T:0P 3 Credits

Course Outcome:

At the end of the course the student will learn

- Classify and solve analytically a wide range of first and higher order ordinary differential equations with constant coefficients
- Explain the concept of Convergence and divergence of series.
- Adapt methods for measuring lengths, volumes, surface area of an object and transformation of coordinates in practical situations
- Utilize basic knowledge of conservative field, potential function and work done in engineering problems
- Identify the relationships between line, surface and volume integrals
- Formulate and solve some of the physical problems of engineering using partial differential equations

UNIT: I : Partial Differentiation and its applications: Functions of Two or More Variables, Partial Derivatives, Homogeneous Functions- Euler's Theorem, Total Derivative. Differentiation of Implicit Functions, Geometrical Interpretation- Tangent Plane and Normal to a surface. Change of Variables, Jacobians, Taylor's Theorem for functions of two variables. Jacobians, Taylor's Theorem for functions of two variables. Errors and approximations. Total Differential, Maxima and Minima of functions two variables. Lagrange's method of undetermined multiples, Differentiation under the integral sign – Leibnitz Rule. Involutives and evolutes.

UNIT: II : Multiple integrals and their applications: Double integrals. Change of order of integration. Double integrals in Polar Co-ordinates, Areas enclosed by plane curves. Triple integrals. Volume of solids. Change of variables. Area of a curve of a curved surface. Calculation of Mass, Center of gravity, Center of pressure, Moment of inertia. Product of inertia. Principle Axes. Beta function, Gamma function. Relation between Beta and Gamma functions. Error function or Probability integral.

UNIT: III : Solid geometry (Vector Treatment): Equation of a plane. Equations of Straight line. Condition for a line to lie in a plane. Coplanar

lines. Shortest distance between two lines. Interaction of three planes. Equation of Sphere, Tangent plane to a sphere. Cone, cylinder, Quadric surfaces.

UNIT: IV : Infinite series: Definitions. Convergence, Divergence and oscillation of a series, General properties, series of Positive terms, comparison tests, Integral test. D'Alembert's ratio test. Raabe's test. Logarithmic test. Cauchy's Root test. Alternating series- Leibnitz's rule, Series of positive or negative terms. Power series. Convergence of exponential. Logarithmic and Binomial series. Uniform convergence. Weierstrass M-test. Properties of uniformly convergent series.

UNIT: V : Fourier series: Euler's formulae, Conditions for a Fourier expansion, Functions having points of discontinuity, Change of interval, Odd and even functions – Expansions of odd or even periodic function. Half range series. Parseval formula, Practical Harmonic analysis.

Text Books: :

1. Higher Engineering Mathematics by B.S.Grewal
2. Mathematics for Engineering by Chandrica Prasad.

Reference Books:

1. Higher Engineering Mathematics by M.K.Venkatraman.
2. Advanced Engineering Mathematics by Erwin Kreyszig.

ENG1103 : Mathematics – II

3L:0T:0P 3 Credits

Course Outcomes:

At the end of this course student will be able to

- Apply matrix knowledge to Engineering problems
- Solve problems related to engineering applications using Bernoulli's Equation.
- Make use of Laplace transforms in solving the differential equations with the initial and boundary conditions
- Explain the concept of solving Legendre's equations

UNIT: I : Linear Algebra: Rank of a Matrix. Eigen values Eigen vectors of a Matrix. Cayley Hamilton Theorem. Consistency of equations. Matrix Inversion, Gaussian Elimination Scheme. Cholesky factorization. Jacobi and Gauss-Seidel Iterative Methods for solving simultaneous equations. Eigen Value solution using forward iteration. Inverse iteration. Hermitian and skew Hermitian forms. Unitary Matrix, Functions of a Matrix. Quadratic forms and Conical forms.

UNIT: II : Differential Equations of First Order And Its Applications: Formation of differential equation. Solution of a differential equation. Geometrical meaning. Equations the first order and first degree. Variables

separable, Homogeneous equations. Linear equations. Bernoulli's equation. Exact equations. Equation reducible to exact equations. Equations of the first order and higher degree. Clairaut's equation. Geometric applications. Orthogonal trajectories, Physical applications. Simple Electric circuits. Heat flow, Chemical applications. Newton's law of cooling.

UNIT: III : Linear Differential Equations: Higher order linear differential equations with constant Coefficients. Deflection of beams. Simple harmonic motion. Oscillatory Electric circuits.

UNIT: IV : Series solutions of differential equations: Frobenius method, Special function as solution from series. Bessel equation, Bessel functions of first and second kind. Equation reducible to Bessel's equations. Legendre's equations, Legendre Polynomial, Rodrigues formula, Generating functions. Recurrence relation. Orthogonality relation for Bessel functions and Legendre Polynomial.

Text Books:

1. Theory of Matrices by Shantinayanan.
2. Higher Engineering Mathematics by B.S. Grewal
3. Adv. Math for Engg students, vol. 2 by Narayana, Maniavachgon Pillay, Ramanaiah

Reference Books:

1. Higher Engineering Mathematics by M.K.Venkataraman.
2. Advanced Engineering Mathematics by Erwin Kreyszig.
3. Engineering Mathematics by P.P. Gupta.
4. A text book on Engg Mathematics by N.P.Bali.

ENG1105 : Physics

3L:1T:0P 4 Credits

Course Outcome:

At the end of the course the student will be able to

- Illustrate the concepts of Interference, Diffraction, Polarization and their applications
- Summarize the concepts of electric fields, magnetic fields and superconductivity and make out the scope of applications in various engineering fields
- Outline the quantum mechanics to infer conductivity nature of metals
- Explain the properties and application of dielectric, magnetic and Nano - materials
- Demonstrate the emission of laser light, optical fibers and their applications in various Engineering fields

· Analyse the engineering Applications based on Fundamental concepts

UNIT: I : Thermodynamics: Heat and Work, First law of thermodynamics and applications, Reversible and Irreversible process, Carnot cycle and Efficiency, Entropy, Second law of thermodynamics, Entropy and disorder, Entropy and Probability, Third law of thermodynamics. Thermography and its Applications.

UNIT: II : Electromagnetism: Concept of electric field – Point charge in electric field, dipole in an electric field. Gauss law, some applications, electric potential and field strength, potential due to a point charge and dipole.

Magnetic field – magnetic force on current, torque on current loop, Hall effect, Ampere's law, B near a long wire, B for a solenoid and Toroid. The Biot-Savart's Law. B for a circular Current loop.

Faraday's law of induction. Lenz's law, Calculation of Inductance. L-R Circuit. Energy stored in Magnetic field. Induced magnetic fields, Displacement current. Energy density in Electric and Magnetic fields, Poynting Vector S.

Maxwells equations and Electromagnetic waves (Both differential and Integral forms). Magnetic properties of materials. Paramagnetism, Diamagnetism, Ferromagnetism, Ferrites and its applications.

UNIT: III : Optics: Interference – Principles of superposition – Young's Experiment – Coherence – Interference of thin films, Wedge shaped film, Newton's Rings, Michelson Interferometer and its applications. Diffraction – Single slit (Qualitative and quantitative treatment). Polarisation – Polarisation by reflection, refraction and double refraction in uniaxial crystals, Nicol prism, Quarter and Half wave plate, circular and elliptical polarization and detection.

UNIT: IV : Lasers and Fibre Optics: Spontaneous and stimulated emissions, population inversions, Ruby laser, Gas laser, Semiconductor laser, Applications of lasers.

Fibre Optics, Optical Fibre and Total Internal Reflection, Acceptance Angle and cone of a fibre, Fibre optics in communications, Optical parts in Fibre. Fibre Optic Sensors.

UNIT: V : Ultrasonics: Production of Ultrasonics by Magnetostriction and Piezoelectric effects – Ultrasonics and diffraction pattern, Applications of Ultrasonics.

UNIT: VI : Modern Physics: The quantization of energy, Photoelectric effect, De Broglie concept of matter waves, uncertainty principle, Schrodinger wave equation, application to a particle in a box.

Elementary concepts of Maxwell-Boltzmann, Bose-Einstein's and Fermi Dirac Statistics. Fermi Dirac Distribution function (no derivations). Free electron theory of metals, Band theory of solids, Kronig Penny Model,

Metals, Insulators and Semiconductors. Ferroelectrics and their applications Super conductivity, Meisner Effect, Types of Superconductors and Applications of Superconductors.

Nanophase materials – Synthesis, characterization of nanostructured materials, properties and applications. Renewable energies – Solar, wind and tidal – Applications

TEXT BOOKS:

1. Engineering Physics by R.K. Gaur and S.D. Gupta
2. Physics by David Halliday and Robert Resnick – Part I and Part II
3. Modern Engineering Physics by A.S. Vadudeva
4. University Physics by Young and Freedman
5. Materials Science by V. Rajendra and A. Marikani
6. Nonconventional Energy by Ashoke V. Desai

ENG1107 : Engineering Graphics

2L:0T:3P 3. 5 Credits

Course Outcomes:

At the end of this course student will be able to

- Understand Principles of engineering drawing
- Construct Conic sections using general methods and other methods
- Construct Orthographic projections of Points, Lines and Planes
- Construct Orthographic projections of Solids using basic drafting software
- Construct Isometric projections using basic drafting software
- Construct Orthographic projections from given isometric projections of an object and vice versa

UNIT: I : Introduction: Drawing Instruments and uses. Lettering scales in common use.

UNIT: II : Curves: Curves used in Engineering Practice, conic sections, construction of conics by different methods, rectangular-hyperbola, cycloidal curves, trochoids, epi and hypo- cycloids. involutes and Archemedian spiral.

UNIT: III : Orthographic Projections: Projection of points, projection of straight lines, traces of a line, projection of planes and projection on auxiliary planes.

UNIT: IV : Solids and Developments: Projection of solids in simple positions, projection of solids with axis inclined to one of the reference planes and parallel to the other, projection of solids with axis inclined to both the reference planes. Projection of spheres. Development of surfaces of

solids. Development of transition piece connecting a square and circular pipe. Helices and screw threads.

UNIT: V : Sections and Intersections: Sections of different solids and true shape of sections. Intersection of surfaces-simple problems with cylinders, prisms and cones.

UNIT: VI : Isometric and Perspective Projections: Isometric projection and conversion of orthographic projection into isometric projection. Perspective projection. Theory of visual ray method and vanishing point method. Simple problems involving regular geometrical solids.

Textbook:

1. Elements of Engineering Drawing by N.D. Bhatt

Reference:

1. Engineering Graphics by K.L. Narayana and P. Kanniah

ENG1109 : Physics Lab

0L:0T:3P 1.5 Credits

*** Common with all branches

ENG1111 : Workshop

0L:0T:3P : 1.5 Credits

Course Outcomes:

At the end of this course student will be able to

- Utilize basic carpentry tools for the preparation of wooden joints
- Make use of basic hand tools for the preparation of mild steel joints
- Build simple house hold items with GI sheet using tin smithy tools
- Make use of house wiring accessories to build simple electrical circuits
- Build simple components with hand tools for making experimental setups
- Build simple components with hand tools as per the drawing specifications

UNIT: I : **Carpentry:** Bench work, tools used in carpentry. Jobs for class work – half lap joint, mortise and tenon joint, half –lap dovetail joint, corner dovetail joint, bridle joint.

UNIT: II : **Sheet Metal:** Tools used in sheet metal work. Laying developments of sheet metal jobs, soldering. Jobs for class work – square tray, taper side tray, funnel, elbow pipe.

UNIT: III : **Fitting:** Tools used in fitting work. Different files, chisels, hammers and bench vice. Jobs for class work – hexagon, rectangular, circular and triangular fits. External and internal threads with dies and taps.

Reference:

1. Elements of Workshop technology, Vol.1 by S.K. and H.K. Hajra Choudary

ENG1113 : Professional Ethics & Moral Values

2L:0T:0P 0 Credits

Course Outcomes:

At the end of this course student will be able to

- Interpret the core values and awareness on professional ethics and human values
- Interpret engineering as social experimentation
- Identify the responsibilities of an engineer for safety, risk benefit analysis and professional rights
- Summarize the role of electrical engineers in assessing industrial safety
- Outline the operational issues of Electrical Apparatus
- Outline the operational issues of power grid

UNIT: I : Human Values and Engineering Ethics - Morals, Values and Ethics, Integrity, Work ethic, Service learning, Civic virtue, Respect for others, Living peacefully, Caring, Sharing, Honesty, Courage, Valuing time, Cooperation, Commitment, Empathy, Self- confidence, Character, Spirituality. Senses of Engineering Ethics, Variety of moral issues, Types of inquiry, Kohlberg's theory, Gilligan's theory, Consensus and Controversy, Models of professional roles, Theories about right action, Self - interest, Customs and Religion, Uses of Ethical Theories. Moral dilemmas, Moral Autonomy

UNIT: II : Safety, Responsibilities and Rights in Social Experimentation - Engineering as Experimentation, Engineers as responsible Experimenters, Codes of Ethics, Balanced Outlook on Law, Safety and Risk, Assessment of Safety and Risk, Risk Benefit Analysis and Reducing Risk, Respect for Authority, Collective Bargaining, Confidentiality, Conflicts of Interest, Occupational Crime, Professional Rights, Employee Rights. Intellectual Property Rights

UNIT: III : Operational Issues of Electrical Apparatus - Code of practice for construction, installation, protection, operation and maintenance of electric supply lines and apparatus, Installation and Testing of Generating Units, Meters, maximum demand indicators and other apparatus on consumer's premises, Point of commencement of supply, Test for resistance of insulation, Earth leakage protective device, Use of energy at high and extra - high voltages Maximum stresses; Factors of safety, clearances in overhead lines Role, qualification and licensing of electrical inspector

UNIT: IV : Operational Issues of Power Grid - Terminology, Objective, Scope and Structure of Indian Electricity Grid Code (IEGC), Role of various agencies under IEGC, Functioning of interstate transmission, Operating code, Scheduling and dispatch

Connection code

Text books:

1. R.S.Naagarazan, "Professional Ethics and Human Values", New Age International Ltd Publishers, 2006

ELECTRICAL ENGINEERING SCHEME OF INSTRUCTION & EXAMINATION

II/IV B.TECH Common with SIX YEAR DUAL DEGREE COURSE
II/VI (B.TECH.+ M.TECH.)

(With effect from 2019-2020 admitted batch onwards)

B.TECH. (EEE) I YEAR II-SEMESTER SCHEME OF INSTRUCTION AND EXAMINATION

Sub. Ref	Name of the Subject	Periods			Maximum Marks		Credits
		Theory	Tutorial	Lab	Sessionals	Exam	
ENG1201	Mathematics -3	3	1	—	30	70	100 4
ENG1202	Chemistry	3	1	—	30	70	100 4
ENG1204	Computer Programming using C & Numerical Methods	3	—	—	30	70	100 3
ENG1206	Fundamentals of Electrical Engineering	3	1	—	30	70	100 4
ENG1207	Chemistry Lab	—	—	3	50	50	100 1.5
ENG1209	CPNM Lab	—	—	3	50	50	100 1.5
ENG1211	English Lab	—	—	3	50	50	100 1.5
ENG1213	Essence of Indian Traditional Knowledge	2	—	—	30	70	100 0
TOTAL		14	3	9	300	500	800 19.5

ENG1201 : Mathematics – III

3L:1T:0P 4 Credits

Course Outcomes:

At the end of this course student will be able to

- Utilize numerical techniques to find approximate solutions of Complex Variables.
- Make use of method of least squares to fit a best curve for the given data

- Find approximate values of derivatives and finite integrals using numerical techniques
- Comprehend basic probability axioms and apply Baye's theorem related to engineering problems

UNIT: I : Functions of a Complex Variables Continuity concept of $f(z)$, Derivative of $f(z)$, Cauchy - Riemann Equations, Analytic Functions, Harmonic Functions, Orthogonal Systems, Applications to Flow Problems, Integration of Complex Functions, Cauchy's Theorem, Cauchy's Integral Formula, Statements of Taylor's and Laurent's Series without Proofs, Singular Points, Residues and Residue Theorem, Calculations of Residues, Evaluation of Real Definite Integrals, Geometric Representation of $f(z)$, Conformal Transformation, Some Standard Transformations:- (1) $w = z+c$, (2) $w = 1/z$, (3) $w = (az+b)$ (4) $w = z^2$, (6) $w = e^z$.

UNIT: II : Statistical Methods - Review of Probability theory (not be examined), Addition law of probability, Independent events, Multiplication law of probability, Bay's theorem, Random variable, Discrete probability distribution, Expectation, Moment generation function, repeated trials, Binomial distribution, Poission distribution, Normal distribution, Prable error, Normal approximation to binomial distribution.

UNIT: III : Sampling Theory: Sampling Distribution, Standard Error, Testing of Hypothesis, Level of Significance, Confidence Limits, Simple Sampling of Attributes, Sampling of Variables - Large Samples and Small Samples, Student's T-distribution, χ^2 - Distribution, F - Distribution, Fisher's Z - Distribution.

UNIT: IV : Difference Equations and Z-Transforms Z - transforms - Definition, Some Standard Z- transforms, Linear Property, Sampling Rule, Some Standard Results, Shifting Rules, Initial and Final Value Theorems, Convolution theorem, Evaluation of inverse transforms, definition, Order and Solution of Difference Equations, Formation of Difference Equations, Linear Difference Equations, Rules for finding C.F., Rule for finding P.L., Difference Equation Reducible to Linear Form, Simultaneous Difference Equations with Constant Coefficients, Application to Deflection of a Loaded String, Applications of Z-transform to Difference Equations.

Text Books:

1. Higher Engineering Mathematics, Dr. B.S. Grewal, Khanna Publisher - N. Delhi, 34th Edition, 1998.

Reference Books:

1. Higher Engineering Mathematics, Dr. M. K. Venkataraman, National Pub. and Co. - Madras.

ENG1202 : Chemistry

3L:1T:0P

4 Credits

Course Outcomes:

At the end of this course student will be able to

- Outline the fundamental chemistry with an applied perspective as future engineers with a focus on engineering and industry.
- Analyse the quality of water and its treatment methods for domestic and industrial applications
- Utilize the polymers, plastics, elastomers and advanced materials (Nano materials) as engineering materials and apply them in domestic and industrial life
- Infer the concepts of renewable & non - renewable energy sources, quality of fuels and apply a suitable fuel as an energy source
- Outline the corrosion factors and implement the prevention measures
- Interpret the Nernst equation for electrode potentials and construction and working of various types of energy storage devices

UNIT: I : Water Chemistry and pollution: Water Chemistry: Sources of water - impurities – Hardness and its determination – W.H.O. limits. Boiler troubles and their removal. Water softening methods – Lime Soda, Zeolite and Ion exchange. Municipal water treatment – Break point chlorination. Desalination of Sea Water - Electrodialysis and Reverse osmosis methods.

Water pollution: Source – BOD – COD – Sewage treatment - preliminary, primary, secondary and tertiary.

Air Pollution: Source – Air pollutants – CO, SO_x, NO_x, Hydrocarbons and particulates. Acid rain – Green House effect – control of Air pollution (General).

UNIT: II : Solid State Chemistry: Classification of Solids – Types of Crystals – Properties - imperfections in crystals. Band theory of solids. Chemistry of Semiconductors - Intrinsic, extrinsic, compound and defect. Organic semiconductors and superconductivity. Purification of solids by zone refining - Single crystal growth – epitaxial growth. Elementary ideas on liquid crystals.

UNIT: III : Energy Sources: (a) Thermal Energy: Coal- Ranking of coal - analysis (proximate and ultimate) Calorific value and determination (Bomb calorimeter method) – COKE – Manufacture – Otto Hoffmann's process – Applications.

(b) Chemical Energy: Electrode potential – Calomel electrode – Galvanic cells – primary secondary – Acid and alkaline cells – fuel cells.

(c) Nuclear Energy : Fission and fusion – power reactors – Atomic pile applications .

(d) Solar Energy : Methods of utilization – thermal conversion – Liquid Flat – Plate collector – Photovoltaic conversion - solar cell - Applications.

UNIT: IV : Corrosion Chemistry : Origin and theories of corrosion – Types of corrosion - Factors affecting corrosion – corrosion control methods . Protective coatings –Metallic coatings – Chemical conversion coatings - phosphate , chromate , Anodized . Organic Coating – paints – special paints – Varnishes and lacquers.

UNIT: V : Fuels and Lubricants: Petroleum – refining - Motor fuels – Petrol and Diesel Oil - Knocking – Octane number - Cetane number. Synthetic petrol – Fisher - Tropsch and Bergius methods. LPG and CNG - Applications. Rocket fuels -Propellants - Classification. Lubricants: Classification - mechanism - properties of lubricating oils - Selection of lubricants for Engineering applications.

UNIT: VI : Polymers and Plastics: Definition – Types of polymerization – Mechanism of addition polymerization. Effect of polymer structure on properties. Plastics – Thermoplastic resins and Thermosetting resins - Compounding of plastics – Fabrication of plastics. Preparation and properties of cellulose derivatives - Vinyl resins-Nylon(6,6)- bakelites – polycarbonates - epoxy resins. Reinforced plastics. Conducting polymers. Engineering applications of polymers.

Building Materials: (a) Portland Cement: Manufacture - Dry and Wet process. Setting and hardening of cement - Cement concrete - RCC - Decay of concrete - special cements.

(b) Refractories: Classifications - properties - Engineering applications.

(c) Ceramics: Classification - Properties - uses.

Prescribed Text Books:

1. Engineering Chemistry, P.C. Jain and M. Jain - Dhanapathi Rai & Sons, Delhi
2. A text book of Engineering Chemistry, S.S. Dara - S. Chand & Co. New Delhi
3. Engineering Chemistry, B.K. Sharma - Krishna Prakashan, Meerut
4. A text book of Engineering Chemistry, - Allied Publishers Balasubramanian et.al.,
5. Material Science and Engineering V. Raghavan - Prentice-Hall India Ltd.,

ENG1204 : Computer Programming using C & Numerical Methods

3L:0T:0P : 3 Credits

Course Outcomes:

At the end of this course student will be able to

- Develop the flow charts and algorithms, and then implement, compile and debug programs in C language for solving a problem

- Design programs involving decision structures, loops for problem solving
- Design programs to develop applications using array data structure
- Solve scientific problems using function
- Make use of pointers to design applications for efficient and dynamic memory allocation
- Design programs to create/update basic data files

Section A : Computer Programming in C

UNIT: I **Basics:** Variables – Constants – Expressions – Operators and their precedence and associativity. Basic input and output statements. Control structures. Simple programs in C using all the operators and control structure.

UNIT: II : Functions: Concept of a function – Parameters and how they are passed – Automatic Variables – Recursion – Scope and extent of variables. Writing programs using recursive and non-recursive functions.

UNIT: III : Arrays and Strings: Single and multidimensional arrays- Character array as a string- Functions on strings. Writing C Programmes using arrays and for string manipulation.

UNIT: IV : Structures: Declaring and using structures-Operations on structures – Arrays of structures- User defined data types-Pointers to using files.

UNIT: V : Files: Introduction –file structure- File handling functions- file types- Files- Error handling- C Programming examples for using files.

Section B

Computer Oriented Numerical Methods

1. Basic Concepts: Preliminary Concepts of Algorithms-Flow Charts and their execution traces- A Simplified Model of a Computer.
2. Representation for Characters and Numbers: Representation for integer and real numbers. Effect of finite representation on arithmetic operations for example overflow, underflow, associativity and normalization. Some elementary methods for overcoming these limitations.
3. Numerical Methods: Notation of round-off and truncation errors, numerical methods of finding roots of an algebraic equation of one variable. Successive bisection method, False position method, Newton Raphson method and Secant method.
4. Solutions of simultaneous Algebraic Equations; Gauss elimination method and Gauss Seidel methods.
5. Interpolation: Lagrange's Interpolation and difference table methods.
6. Numerical integration: Simpson's rule, Gaussian Quadrature Formula.

7. Numerical Solution of Differential Equation: Euler's method, Taylor's series method and Runge-Kutta method.

Books:

1. Section A: Programming with C by K.R.Venugopal & Sudeep R Prasad
2. Section B: Introduction to Numerical Methods by S.S Sastry
3. Elementary Numerical Methods by S.D.Conte

Reference:

1. C Programming Language by Kerningham & Ritchie

ENG1206 : Fundamentals of Electrical Engineering

3L:1T:0P : 4 Credits

Course Out Comes:

At the end of this course student will be able to

- Demonstrate the basic principles of electrical components.
- Outline electric circuits using network laws and reduction techniques.
- Illustrate the behavior of basic circuit elements for an AC excitation.
- Outline the working principle and construction of the measuring instruments.
- Choose appropriate wiring schemes.

UNIT: 1 : Electrical Engineering Fundamentals: Electrical circuit elements and sources, Ohm's law, effect of temperature on resistance, resistance temperature coefficient, insulation resistance, Series-parallel connection of inductors, rise and decay of current in inductive circuit, Concepts of mutual inductance, Concept of Potential difference. Charging and discharging of capacitor, Concepts of induced emfs, comparison between electric and magnetic circuit, Kirchhoff's laws, star-delta conversion.

UNIT: 2 : Fundamental Laws of Electrical Engineering: Coulombs law of Electrostatics (1st law and 2nd), Faradays laws of Electromagnetic induction, Fleming Left hand and Right hand rules, Lenz's law, Biot-Savart's law, Ampere circuital law, Maxwell's corkscrew rule.

UNIT: 3 : Alternating Current Fundamentals: Sinusoidal voltage and currents, their mathematical and graphical representation, concept of cycle, period, frequency, instantaneous value, peak value, average value, RMS value, Peak factor and Form factor; Phase difference, lagging, leading and in phase quantities; and phasor representation, Rectangular and polar representation of phasors, study of A.C circuits (RL, RC and RLC series

circuits), Phasor diagrams, voltage, current, powers and power factor, Introduction to poly-phase systems.

UNIT: 4 : Fundamentals of Electrical Measurements: (no need to explain errors and compensations) Classification of instruments, various forces in indicating instruments (deflection, control and damping), construction and operation of MI and MC type instruments for voltage and current measurement, Construction and operation of dynamometer type wattmeter, Construction and operation of single phase induction type energy meter.

UNIT: 5 : Electrical Wiring: Symbols for various electrical equipment, Service mains, meter board and distribution board, Types of wirings and their Installations, Various types of conductors, conductor sizes and current ratings, Examples of house wiring (one lamp-one switch, Stair case, Corridor wiring, Power wiring), Elementary discussion on Circuit protective devices: fuse and Miniature Circuit Breaker (MCB's), significance of various parameters on name plates of equipment.

Note: The syllabus is prepared to give basic concepts of Electrical Engineering to First year students. Hence, in the evaluation, problems need to be avoided.

Text Books:

1. Basic Electrical Engineering D. C. Kulshreshtha TMH 1st Edition.
2. S L Uppal and G C Garg, "Electrical Wiring, Estimating & Costing", Khanna Publishers, 2015.

Reference Books:

1. Fundamentals of Electrical Engineering Rajendra Prasad PHI Third Edition 2014.
2. V. N. Mittal and Arvind Mittal, " Basic Electrical Engineering" McGraw Hill.
3. A.K.Sawhney, A Course in Electrical and Electronics Measurements and Instruments- Dhanpat Rai and Sons, Delhi, 2005.

ENG1207 : Chemistry Lab

0L:0T:3P 1.5 Credits

*** Common with all branches

ENG1209 : CPNM Lab

0L:0T:3P 1.5 Credits

*** Common with all branches

ENG1211 : English Lab

0L:0T:3P 1.5 Credits

*** Common with all branches

ENG1213 : Essence of Indian Traditional Knowledge

2L:0T:0P 0 Credits

*** Common with all branches

ELECTRICAL ENGINEERING
SCHEME OF INSTRUCTION & EXAMINATION
III/IV B.TECH

Common with SIX YEAR DUAL DEGREE COURSE III/VI
(B.TECH.+ M.TECH.)

(With effect from 2019-2020 admitted batch onwards)

B.TECH. (EEE) II YEAR I-Semester Scheme of Instruction and Examination

Sub. Ref	Name of the Subject	Periods			Maximum Marks		Credits
		Theory	Tutorial	Lab	Sessionals	Exam	
EEB2101	BSC-5: Mathematics-IV	3	1	—	70	30	100 3
EEO21xx	OEC-1:	3	1	—	70	30	100 3
EEO21xx	OEC-2:	3	1	—	70	30	100 3
EEC2102	PCC-2: Network Theory	3	1	—	70	30	100 3
EEC2103	PCC-3: Electronic Circuits	3	1	—	70	30	100 3
EES2105	ESC-5 : Engineering Mechanics & Strength of Materials	3	1	—	70	30	100 3
EEL2101	Laboratory – I: Electrical Networks Lab	—	—	3	50	50	100 1.5
EEL2102	Laboratory – II: FM & HMLab	—	—	3	50	50	100 1.5
TOTAL		18	6	6	520	280	800 21

Open Electives Courses (OEC) (Semester-III)

S.No.	Subject Code	Subject Name
1	EEO2101	Fluid Mechanics & Hydraulic Machines
2	EEO2102	Thermal Prime Movers
3	EEO2103	Data Structures & Algorithms
4	EEO2104	Electrical Engineering Materials
5	EEO2105	Probability and Stochastic Process
6	EEO2106	Solid State Electronic Devices

BSC-5:EEB2101 : Mathematics - IV 3L:1T:0P 3 Credits

Course Outcomes:

After going through this course, the students would be able to:

- Operate the differential operator 'del' to the scalar and vector point functions, Calculate the Gradient, Divergence and Curl, Vector normal to a surface, maximum rate of change of a scalar field, test whether two surfaces are to cut orthogonally or not .

- Find the rate per unit volume at which the physical quantity is issuing from a point, the rate of inflow minus out flow using the Divergence and the angular velocity of rotation at any point of the vector field using the Curl.

- Test whether the given motion is irrotational or rotational, whether a vector force acting on a particle is conservative or not

- Apply the vector integral theorems (Green's theorem in the plane, Stoke's and Divergence theorems) for evaluating the double and triple integrals as these are used to find areas and volumes.

- Solve the Linear Partial Differential Equations with constant coefficients (homogeneous and non homogeneous) and know the procedure for finding the complementary function and particular integrals

- Apply and extend the knowledge of Fourier transform techniques in solving several Initial and Boundary value problems of Engineering, such as in Conduction of heat / Thermodynamics, Hydraulics transverse vibrations of a string, oscillations of an elastic beam, bending of beams, electrical circuits, free and forced vibrations of a membrane and transmission lines , etc.

UNIT: I : VECTOR CALCULUS-1: Differentiation of vectors, curves in space, velocity and acceleration, relative velocity and relative acceleration, scalar and vector point functions, vector operator applied to scalar point functions- gradient, ? applied to vector point functions-divergence and curl. Physical interpretation of Invalid parameter. | In-line.WMF *) [* Invalid parameter. | In-line.WMF applied twice to point functions, applied to products of two functions; Irrotational and Solenoidal fields.

UNIT: II : VECTOR CALCULUS-2: Integration of vectors, line integral, circulation, work done, surface integral-flux, Green's theorem in the plane, Stoke's theorem, volume integral, Gauss Divergence theorem. Introduction of orthogonal curvilinear coordinates, cylindrical and spherical polar coordinates.

UNIT: III : INTRODUCTION OF PARTIAL DIFFERENTIAL EQUATIONS: Formation of partial differential equations, solutions of partial differential equations- equations solvable by direct integration, linear equations of first order: Lagrange's Linear equation, non-linear equations of

first order, Charpit's method. Homogeneous linear equations with constant coefficients- rules for finding the complementary function, rules for finding the particular integral (working procedure), non- homogeneous linear equations.

UNIT: IV : APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS: Method of separation of variables, One dimensional wave equation-vibrations of a stretched string, one dimensional Heat equation, Two dimensional heat flow in steady state - solution of Laplace's equation in Cartesian and polar coordinates (two dimensional).

UNIT: V : INTEGRAL TRANSFORMS: Introduction, definition, Fourier integral, Sine and Cosine integrals, Complex form of Fourier integral, Fourier transform, Fourier Sine and Cosine transforms, Finite Fourier Sine and Cosine transforms, properties of Fourier transforms, Convolution theorem for Fourier transforms, Parseval's identity for Fourier transforms, Fourier transforms of the derivatives of a function, simple applications to Boundary value problems.

TEXT BOOKS:

1. Scope and treatment as in "Higher Engineering Mathematics", by Dr. B.S.Grewal, 43rd Edition, Khanna Publishers.

REFERENCE BOOKS:

1. A text book of Engineering Mathematics by N.P. Bali and Dr. Manish Goyal, Lakshmi Publications.
2. Mathematical Methods of Science & Engineering aided with MATLAB by Kanti B.Dutta, Cengage Learning India Pvt. Ltd.
3. Advanced Engineering Mathematics by Erwin Kreyszig.
4. Higher Engineering Mathematics by B. V. Ramana, Tata McGraw Hill Company.
5. Advanced Engineering Mathematics by H.K.Dass. S.Chand Company.
6. Higher Engineering Mathematics by Dr. M.K.Venkataraman.

OEC-1:EEO2101 : Fluid Mechanics & Hydraulic Machines

3L:1T:0P : 3 Credits

Course Outcomes:

At the end of this course student will be able to,

- * Develop to gain knowledge on fluid statics, fluid dynamics, and closed conduit flow and hydro-electric power stations.
- * Design various components of pumps and turbines and study their characteristics.

* Apply conservation laws to derive governing equations of fluid flows.

* Analyze and design simple pipe systems.

* Describe the functioning of various turbines and analyze the performance characteristics of various turbines.

UNIT: I : Introduction To Fluid Mechanics: Principle Of Continuum–Fluid Properties–Mass Density, Specific Weight, Specific Gravity, Viscosity, Surface Tension, Capillarity, Compressibility & Bulk Modulus Of Electricity, Vapour Pressure.

UNIT: II : Fluid Statics: Fluid Pressure and Its Measurement, Pascal's Law, Hydrostatic Pressure Distribution, Manometers-Micro manometers-Mechanical Gauges, Hydrostatic Forces On Plane Surfaces.

UNIT: III : Fluid Kinematics: Definition Of Steady and Unsteady, Uniform and Non Uniform, Compressible and Incompressible, Rotational and Irrotational, 1-D, 2-D and 3-D, Laminar and Turbulent Flows, Stream Line, Path Line, Streak Line, Stream Function, Velocity Potential Function, Local And Convective Accelerations-Flow Nets, Principle Of Conservation Of Mass, 3-D Continuity Equation In Cartesian Coordinates, Continuity Equation For Stream Tube.

UNIT: IV : Fluid Dynamics: Derivation Of Bernoulli's Equation From The Concepts Of Work Done, Total Head, Limitations Of Bernoulli's Principle, Application Of Bernoulli's Equation, Venturi Meter, Orifice Meter, Flow Nozzle, Pitot Tube, Momentum Principle-Impulse Momentum Equation And Its Application To Pipe Bends And Reducers, Impact Of Jets On Single Stationary Plates.

UNIT: V : Flow Through Pipes: Laws Of Friction, Reynolds Experiment, Darcy-Weibach Equation, Major And Minor Losses, Pipes In Series, Pipes In Parallel, Pipes Connecting Two Reservoirs, Siphon, Power Transmission Through Pipes And Nozzles, Water Hammer (Concept only) .

Hydraulic Machines: Impact Of Jets On Series Of Stationary And Moving Vanes, Velocity Triangles, Work done-Turbines-Hydraulic, Mechanical And Overall Efficiency, Classification, Component Parts And Working Principles Of Pelton, Francis And Kaplan Turbines, Unit Quantities, Specific Speed, Characteristic Curves.

UNIT: VI : Pumps: Classification of Pumps, Positive Displacement and Rotodynamic Pumps, Centrifugal Pumps-Components Parts, Working Principles, Manometric, Static And Overall Efficiency, Work Done- Pumps In Parallel And Series, Specific Speed And Pump Characteristic Curves.

TEXT BOOKS:

1. Fluid Mechanics and Hydraulic Machinery by P.N. MODI & SM SETHI
2. Fluid Mechanics and Hydraulic Machinery by A.K.Jain.

OEC-1:EEO2102 : Thermal Prime Movers

3L:1T:0P 3 Credits

Course Outcomes:

Upon completion of this course the student will be able to:

- Describe the basic components of steam power plants and working principles of different types of steam turbines.
- Explain the working principle of different types of gas turbines.
- Identify the main components of diesel power plant and explain the working principle of diesel engines.
- Discuss the working principle of different types of hydraulic turbines.
- Illustrate the working principle of centrifugal and reciprocating pumps.

UNIT: I : Laws Of Thermodynamics: Laws of thermodynamics (Statements Only), Gas Laws, Relation between Gas Constant and Specific Heat at Constant Pressure and Constant Volume, Thermodynamics Processes of Perfect Gases and Entropy, Properties of Steam and Use of Steam Tables, Extent Work and Internal Energy, Thermodynamic Processes of Vapor and Entropy of Steam.

UNIT: II : Boilers: Classification, Simple Vertical, Cochran, Lancashire, and Babcock & Wilcox Boilers.

UNIT: III : I C Engines: Classification, Otto Cycle, Diesel Cycle and Dual Combustion Cycle. Working Of 2-Stroke and 4-Stroke Engines, Petrol Engines and Diesel Engines, Power and Efficiency of IC Engines.

UNIT: IV : Steam Nozzles: Flow through Steam Nozzles Critical Pressure Ratio, Effect of Friction and Super Saturation.

UNIT: V : Steam Turbines: Impulse And Reaction Turbines, Velocity diagrams, Methods of Reduction of Rotor Speed.

UNIT: VI : Gas Turbines: Introduction, Classification of Gas Turbines. Analysis of Constant Pressure Closed Cycle Gas Turbines, Open Cycle Gas Turbines. Methods to Improve the Thermal Efficiency of Gas Turbines.

Text Books:

1. Thermal Engineering by R.S. Khurmi And J.K. Gupta, S.Chand & Co Ltd.
2. Elements of Heat Engines, Vols. I & II by R.C. Patel And C.J. Karam Chandani, Acharya Book Depot, Baroda.

OEC-1:EEO2103 : Data Structures & Algorithms

3L:1T:0P 3 Credits

Course Outcomes:

At the end of this course student will be able to

- Explain basic operations of stacks, queues, and linked – lists
- Understand various sorting and searching techniques
- Choose an appropriate hashing techniques for a given problem
- Understand the basic operations of trees and its types
- Explain the concept of height balancing in AVL and B trees
- Demonstrate graph traversal algorithms

UNIT: I : Introduction to Data Structures: Information and Meaning – Representation of Multi- Dimensional Arrays _ Review of C Programming.

The Stack: Primitive operations – As an Abstract Data Type – Implementing the Stack operations in C. Infix, Postfix and Prefix: Definitions, Evaluation and Conversions using C.

UNIT: II : Recursion: Recursive Definition and Processes, Recursion in C and Recursive Implementation of Applications. Simulation of Recursion – Efficiency of Recursion.

Queues and Lists: The Queue as Abstract Data Type – Sequential Representation _Types of Queues – Operations – Implementation in C.

UNIT: III : Linked List: Operations – Implementation of Stacks, Queues and priority Queues in C. Circular Lists: Insertion, Deletion and Concatenation Operations _ Stacks and Queues as Circular Lists _ Doubly Linked Lists _Applications.

UNIT: IV : Trees: Binary Trees Operations and Applications. Binary Tree Representation: Node Representation – Implicit array Representation – Choice of Representation – Binary Tree Traversal – Threaded Binary Trees and their Traversal – Trees and their Applications

UNIT: V : Sorting: General Background: Efficiency – The big O Notation – Efficiency of Sorting. Bubble Sort and Quick Sort and their Efficiency – Selection Sorting – Binary Tree Sort – Heap Sort – Insertion Sorts – Shell Sort – Address calculation Sort – Merge and Radix Sorts. Searching: Basic Searching Techniques: Dictionary as an Abstract Data Type – Algorithmic Notation – Sequential Searching and its Efficiency – Binary Search – Interpolation Search.

Tree Searching: Insertion into a Binary Search Tree – Deleting from a Binary Search Tree – Efficiency of Binary Search Tree operation

UNIT: VI : Graphs and Their Application: Graphs: Application of Graphs – Representation of Graphs in C –Transitive closure – Warshall's Algorithm – Shortest Path Algorithm.

Linked Representation of Graphs: Dijkstra's Algorithm – Organizing the set of Graph Nodes – Application to Scheduling and its implication. Graph Traversal and Spanning Forests – Undirected Graph and their

Traversals, Applications and Efficiency – Minimal Spanning Trees –Prim's and Kruskal's Algorithms.

Textbooks:

1. Data Structures Using C and C++ Yddish Langsam, Moshe J. Augenstein and Aaron M. Tanenbaum, Prentice Hall Of India (2nd Edition) (Chapters 1 to 8)
2. Data Structures, Algorithms and Applications with C++, Sahani Mc-Graw Hill.

OEC-2:EEO2104 : Electrical Engineering Materials

3L:1T:0P 3 Credits

Course Outcomes: After completion of this course, the student will be able to

- * Understand various types of dielectric materials, their properties in various conditions.
- * Evaluate magnetic materials and their behavior.
- * Evaluate semiconductor materials and technologies.
- * Acquire Knowledge on Materials used in electrical engineering and applications.

UNIT: I : Dielectric Materials: Dielectric as Electric Field Medium, leakage currents, dielectric loss, dielectric strength, breakdown voltage, breakdown in solid dielectrics, flashover, liquid dielectrics, electric conductivity in solid, liquid and gaseous dielectrics, Ferromagnetic materials, properties of ferromagnetic materials in static fields, spontaneous, polarization, curie point, anti-ferromagnetic materials, piezoelectric materials, pyroelectric materials.

UNIT: II : Magnetic Materials: Classification of magnetic materials, spontaneous magnetization in ferromagnetic materials, magnetic Anisotropy, Magnetostriction, diamagnetism, magnetically soft and hard materials, special purpose materials, feebly magnetic materials, Ferrites, cast and cermet permanent magnets, ageing of magnets. Factors effecting permeability and hysteresis.

UNIT: III : Semiconductor Materials: Properties of semiconductors, Silicon wafers, integration techniques, Large and very large scale integration techniques (VLSI)

UNIT: IV : Materials for Electrical Applications: Materials used for Resistors, rheostats, heaters, transmission line structures, stranded conductors, bimetal fuses, soft and hard solders, electric contact materials, electric carbon materials, thermocouple materials. Solid, Liquid and Gaseous insulating materials, Effect of moisture on insulation.

UNIT: V : Special Purpose Materials: Refractory Materials, Structural Materials, Radioactive Materials, Galvanization and

Impregnation of materials, Processing of electronic materials, Insulating varnishes and coolants, Properties and applications of mineral oils, Testing of Transformer oil as per ISI.

Text Books:

1. "R K Rajput", " A course in Electrical Engineering Materials", Laxmi Publications, 2009
2. "T K Basak", " A course in Electrical Engineering Materials", New Age Science Publications 2009

Reference Books:

1. TTTI Madras, "Electrical Engineering Materials", McGraw Hill Education, 2004.
2. "Adrianus J. Dekker", Electrical Engineering Materials, PHI Publication, 2006.
3. S. P. Seth, P. V. Gupta "A course in Electrical Engineering Materials", Dhanpat Rai & Sons, 2011.

OEC-2:EEO2105 : Probability and Stochastic Process

3L:1T:0P 3 Credits

Course Outcomes:

Upon completion of the subject, students will be able to compute:

- * Simple probabilities using an appropriate sample space.
- * Simple probabilities and expectations from probability density functions (pdfs)
- * Likelihood ratio tests from pdfs for statistical engineering problems.
- * Least -square & maximum likelihood estimators for engineering problems.

UNIT: I : Probability: Probability introduced through Sets and Relative Frequency, Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms, Mathematical Model of Experiments, Probability as a Relative Frequency, Joint Probability, Conditional Probability, Total Probability, Bayes' Theorem, Independent Events.

UNIT: II : Random Variable: Definition of a Random Variable, Conditions for a Function to be a Random Variable, Discrete, Continuous and Mixed Random Variables

Distribution & Density Functions: Distribution and Density functions and their Properties - Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh and Conditional Distribution, Methods of defining Conditional Event, Conditional Density, Properties.

UNIT: III : Operation on One Random Variable – Expectations: Introduction, Expected Value of a Random Variable, Function of a Random

Variable, Moments about the Origin, Central Moments, Variance and Skew, Chebychev's Inequality, Characteristic Function, Moment Generating Function.

UNIT: IV : Stochastic Processes-I: The Stochastic Process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, Concept of Stationarity and Statistical Independence, First-Order Stationary Processes, Second-Order and Wide-Sense Stationarity, Nth Order and Strict-Sense Stationarity, Time Averages and Ergodicity, Mean-Ergodic Processes, Correlation-Ergodic Processes.

UNIT: V : Stochastic Processes-II: Autocorrelation Function and its Properties, Cross-Correlation Function and its Properties, Covariance and its Properties, Linear System Response of Mean and Mean-squared Value, Autocorrelation Function, Cross-Correlation Functions, Gaussian Random Processes, Poisson Random Process.

UNIT: VI : Spectral Characteristics: Power Spectrum, Properties, Relationship between Power Spectrum and Autocorrelation Function, Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Spectrum and Cross-Correlation Function, Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Spectral Density of Input and Output of a Linear System.

TEXT BOOKS:

1. Probability, Random Variables & Random Signal Principles - Peyton Z. Peebles, 4Ed., 2001, TMH.
2. Probability and Random Processes – Scott Miller, Donald Childers, 2 Ed, Elsevier, 2012.

REFERENCE BOOKS:

1. Probability, Random Variables and Stochastic Processes – Athanasios Papoulis and S. Unnikrishna Pillai, 4 Ed., TMH.
2. Theory of Probability and Stochastic Processes- Pradip Kumar Gosh, University Press
3. Probability and Random Processes with Application to Signal Processing – Henry Stark and John W. Woods, 3 Ed., PE
4. Probability Methods of Signal and System Analysis - George R. Cooper, Clave D. MC Gillem, 3 Ed., 1999, Oxford.

OEC-2:EE02106 : Solid State Electronic Devices

3L:1T:0P 3 Credits

Course Outcomes:

On successful completion the student should be able to:

- Demonstrate an understanding of the key concepts involved in semiconductor device operation and their characteristics.

- Perform simple analysis of semiconductor devices to derive basic V-I characteristics.
- Predict the effect of device design variations on device performance.
- Assess the relative advantages/disadvantages of different classes of electronic and optoelectronic devices for particular applications.

UNIT: I : Elemental and compound semiconductors, Fermi-Dirac distribution, Equilibrium and steady state conditions, Equilibrium concentration of electrons and holes, Temperature dependence of carrier concentration, Carrier transport in semiconductors, drift, conductivity and mobility, variation of mobility with temperature and doping, High Field effects, Hall effect.

UNIT: II : Excess carriers in semiconductors: Generation and recombination mechanisms of excess carriers, quasi Fermi levels, diffusion, Einstein relations, Continuity equations, Diffusion length, Gradient of quasi Fermi level.

UNIT: III : PN junctions : Contact potential, Electrical Field, Potential and Charge density at the junction, Energy band diagram, Minority carrier distribution, Ideal diode equation, Electron and hole component of current in forward biased p-n junction, piecewise linear model of a diode effect of temperature on V-I characteristics

UNIT: IV : Diode capacitances, switching transients, Electrical Breakdown in PN junctions, Zener and avalanche break down (abrupt PN junctions only), Tunnel Diode basics only, Metal Semiconductor contacts, Ohmic and Rectifying Contacts, current voltage characteristics

UNIT: V : Bipolar junction transistor, current components, Minority carrier distributions, basic parameters, Evaluation of terminal currents (based on physical dimensions), Transistor action, Base width modulation

Text Books:

1. Ben G. Streetman and Sanjay Kumar Banerjee, Solid State Electronic Devices, Pearson, 6/e, 2010
2. Achuthan, K N Bhat, Fundamentals of Semiconductor Devices, 1e, McGraw Hill ,2015.
3. Electronic Devices & Circuits, K Venkata Rao and K Rama Sudha, McGraw Hill Education, 1986.

PCC-2:EEC2102 : Network Theory

3L:1T:0P 3 Credits

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- * Apply network theorems for the analysis of electrical circuits.

- * Obtain the transient and steady-state response of electrical circuits.
- * Analyze circuits in the sinusoidal steady-state.
- * Analyze two port circuit behavior.

UNIT: I : Network Elements: Charge, Voltage, Current, Power, Energy, Circuit concept, Active and Passive circuit elements, Ideal, Practical and dependent sources and their V-I characteristics, Energy stored in Inductors and Capacitors, Kirchoffs Laws, Voltage and Current division, Nodal Analysis, Mesh Analysis, Star-Delta transformation and Source Transformation.

UNIT: II : Network Theorems Linearity and superposition, Thevenin's and Norton's, Reciprocity, Compensation, Maximum power transfer theorems, Tellegen's and Millman's theorems, Application of theorems to DC circuits.

UNIT: III : DC Transients: Inductor, Capacitor, Source free RL, RC and RLC Response, Evaluation of Initial conditions, application of Unit-step Function to RL, RC and RLC Circuits, Concepts of Natural, Forced and Complete Response.

UNIT: IV : Alternating Circuits: The Sinusoidal Forcing Function Instantaneous, Peak, Average and RMS values of Voltage and Current, Crest factor, Form factor, Concept of phase and phase difference in sinusoidal waveform, Phase relation in pure resistor, Inductor and capacitor, Impedance diagram, phasor diagram, series and parallel circuits, compound Circuits, Instantaneous and Average Power, Complex Power Computation of active, reactive and complex powers, power triangle, power factor.

UNIT: V : Sinusoidal Steady State Analysis: Steady State Analysis Using Mesh and Nodal Analysis, Application of Network Theorems to AC Circuits, Series resonance, Impedance and phase angle, voltages and currents, bandwidth and Q factor and its effect on bandwidth, parallel resonance, resonant frequency, variation of impedance with frequency, Q factor and its effect on bandwidth, Balanced 3-phase circuits, Resonance, Concept of Duality. Magnetically Coupled Circuits, Dot Convention, Y, Z, H, T – Parameters of Two – Port Networks.

UNIT: VI : Laplace Transform Techniques: Transforms of Typical Signals, Response of Simple Circuits to Unit – Step, Ramp and Impulse Functions, Initial and Final Value Theorem, Convolution Integral, Time Shift and Periodic Functions, Transfer Function.

Text Books:

1. Engineering Circuit Analysis, William H. Hayt Jr., and Jack E. Kemmerly, 5th Edition, McGraw Hill.
2. Electric circuits by J.A Edminister (Schaum outline series)

Reference Books:

1. Franklin F.Kuo, Network Analysis and Synthesis, 2nd Edition, John Wiley & Sons
2. Network Analysis, M. E. Vanvalkenburg, 3rd Edition, PHI.

PCC-3:EEEC2103 : Electronic Circuits

3L:1T:0P

3 Credits

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- * Understand the characteristics of transistors.
- * Design and analyze various rectifier and amplifier circuits.
- * Design sinusoidal and non-sinusoidal oscillators.
- * Understand the functioning of OP-AMP and design OP-AMP based circuits.

UNIT: I : Multistage Amplifiers: BJT and FET RC Coupled Amplifiers – Frequency Response. Cascaded Amplifiers. Calculation of Band Width of Single and Multistage Amplifiers. Concept of Gain Bandwidth Product.

UNIT: II : Feedback Amplifiers: Concept of Feedback Amplifiers – Effect of Negative feedback on the amplifier Characteristics. Four Feedback Amplifier Topologies. Method of Analysis of Voltage Series, Current Series, Voltage Shunt and Current Shunt feedback Amplifiers.

UNIT: III : Sinusoidal Oscillators: Condition for oscillations –LC Oscillators – Hartley, Colpitts, Clapp and Tuned Collector Oscillators – Frequency and amplitude Stability of Oscillators – Crystal Oscillators – RC Oscillators – RC Phase Shift and Weinbridge Oscillators.

UNIT: IV : Power Amplifiers: Classification of Power Amplifiers – Class A, Class B and Class AB power Amplifiers. Series Fed, Single Ended Transformer Coupled and Push Pull Class A and Class B Power Amplifiers. Cross-over Distortion in Pure Class B Power Amplifier, Class AB Power Amplifier – Complementary Push Pull Amplifier, Derating Factor – Heat Sinks.

UNIT: V : Tuned Voltage Amplifiers: Single Tuned and Stagger Tuned Amplifiers – Analysis – Double Tuned Amplifier – Bandwidth Calculation.

UNIT: VI : Operational Amplifiers: Concept of Direct coupled amplifiers, Ideal Characteristics, Differential amplifier, normalized transfer characteristics, Measurement of Op-Amp Parameters.

Applications of Op-Amps: Inverting and Non-inverting Amplifiers, Integrator, Differentiator, Comparator, Logarithmic Amplifiers, Instrumentation Amplifiers.

Text Books:

1. Integrated Electronics, Analog Digital Circuits and systems, Jacob Millman and D. Halkias, McGraw Hill, 1972

2. OP-Amps and Linear Integrated Circuits, Gayakwad, 4th ed. PHI publications, 1993.

3. Electronic Devices & Circuits, K Venkata Rao and K Rama Sudha, McGraw Hill Education, 1986.

References:

1. Linear Integrated Circuits, D Choudhury Roy, New Age International Pvt Ltd, publishers, New Delhi, 2004

2. Electronic Devices and Circuits – G.K.Mithal, Khanna Publishers, 23rd Edition, 2004.

ESC-5:EES2105 : Engineering Mechanics & Strength of Materials

3L:1T:0P 3 Credits

Course Outcomes: At the end of this course, students will demonstrate the ability to

- * Understand the concepts of co-ordinate systems.
- * Analyze the three-dimensional motion.
- * Understand the concepts of rigid bodies.
- * Analyze the free-body diagrams of different arrangements.
- * Analyze torsional motion and bending moment.

UNIT: I : Introduction to vectors and tensors and co-ordinate systems: Introduction to vectors and tensors and coordinate systems; Vector and tensor algebra; Indical notation; Symmetric and anti-symmetric tensors; Eigenvalues and Principal axes.

UNIT: II : Three-dimensional Rotation: Three-dimensional rotation: Euler's theorem, Axis-angle formulation and Euler angles; Coordinate transformation of vectors and tensors.

UNIT: III : Kinematics of Rigid Body: Kinematics of rigid bodies: Dentition and motion of a rigid body; Rigid bodies as coordinate systems; Angular velocity of a rigid body, and its rate of change; Distinction between two and three-dimensional rotational motion; Integration of angular velocity to find orientation; Motion relative to a rotating rigid body: Five term acceleration formula.

UNIT: IV : Kinetics of Rigid Bodies: Kinetics of rigid bodies: Angular momentum about a point; Inertia tensor: Dentition and computation, Principal moments and axes of inertia, Parallel and perpendicular axes theorems; Mass moment of inertia of symmetrical bodies, cylinder, sphere, cone etc., Area moment of inertia and Polar moment of inertia, Forces and moments; Newton-Euler's laws of rigid body motion.

UNIT: V : Free Body Diagram: Free body diagrams; Examples on modeling of typical supports and joints and discussion on the kinematic and kinetic constraints that they impose.

General Motion: Examples and problems. General planar motions. General 3-D motions. Free precession, Gyroscopes, Rolling coin.

UNIT: VI : Bending Moment: Transverse loading on beams, shear force and bending moment in beams, analysis of cantilevers, simply supported beams and overhanging beams, relationships between loading, shear force and bending moment, shear force and bending moment diagrams.

Torsional Motion: Torsion of circular shafts, derivation of torsion equation, stress and deformation in circular and hollow shafts.

Friction: Concept of Friction; Laws of Coulomb friction; Angle of Repose; Coefficient of friction.

Text / References:

1. J. L. Meriam and L. G. Kraige, "Engineering Mechanics: Dynamics", Wiley, 2011.

2. M. F. Beatty, "Principles of Engineering Mechanics", Springer Science & Business Media, 1986.

EEL2101 : Laboratory-I: Electrical Networks Lab

0L:0T:3P 1.5 Credits

EEL2102 : Laboratory-II: FM & HM Lab

0L:0T:3P 1.5 Credits

Electrical Engineering

Scheme of Instruction & Examination

II/IV B.Tech

Common With Six Year Dual Degree Course II/VI (B.Tech.+ M.Tech.)

(With effect from 2019-2020 admitted batch onwards)

B.Tech. (EEE) II Year II-semester Scheme of Instruction and Examination

Sub. Ref	Name of the Subject	Periods			Maximum Marks		Credits
		Theory	Tutorial	Lab	Sessionals	Exam	
EE022xx	OEC-3:	3	1	—	70	30	100 3
EE022xx	OEC-4:	3	1	—	70	30	100 3
EEC2201	PCC-4:Electrical Machines-I	3	1	—	70	30	100 3
EEC2202	PCC-5:ElectromagneticFields	3	1	—	70	30	100 3
EEC2203	PCC-6: Pulse and Digital Circuits	3	1	—	70	30	100 3
EEH2201	HSMC-2/MC-5:Environmental Science	3	1	—	70	30	100 3

EEL2201	Laboratory – III: Electrical Machines Lab – I	—	—	3	50	50	100	1.5
EEL2202	Laboratory – IV: Electronic Circuits Lab	—	—	3	50	50	100	1.5
TOTAL		18	6	6	520	280	800	21

Open Electives Courses (OEC) (Semester-IV)

S.No.	Subject Code	Subject Name
1	EEO2201	Signals, Systems & Synthesis
2	EEO2202	Digital Logic Design
3	EEO2203	Computer Networks
4	EEO2204	Wavelet Transforms
5	EEO2205	Optical Fiber Communications
6	EEO2206	Engineering Geology

OEC-3:EEO2201 : Signals, Systems & Synthesis

3L:1T:0P 3 Credits

Course Outcomes:

Upon the completion of the course, students will be able to:

- Evaluate the Fourier Series of periodic signals.
- Make use of Fourier Transform Properties.
- Use z-transform for analyzing discrete time signals and systems.
- Convert a continuous time signal to the discrete time domain and reconstruct using the sampling theorem

UNIT: I : Signals, Transformations of Independent Variables, Basic Continuous Time Signals, Basic Discrete Time Signals, Signal Energy and Power Systems, Properties of Systems, Linear Time

- invariant Systems. Continuous Time and Discrete time.

UNIT: II : Fourier series, Convergence of Fourier series, Fourier Transform. Periodic Signals and Continuous and discrete Fourier Transform. Z-transform of a Discrete Sequence, Region of Convergence for the Z-transform. Inverse Z-transform, Properties of Z-transform, Relation Between Z and Fourier Transform.

UNIT: III : Linear Time – Invariant (LTI) Systems, Representation of Signals in terms of Impulses, Discrete Time LTI Systems, the Convolution Sum, Continuous Time LTI Systems, the Convolution Integral. Properties of LTI Systems, Systems described by Differential and Difference Equations. Block Diagram Representation of LTI Systems described by Differential Equations and, Singularity Functions. Frequency Response Characterized by Linear Constant Coefficient Differential Equations. First-order and

Second-order Systems. Representation of DTFT, First-order and Second-order Systems

UNIT: IV : Sampling Theorem, Reconstruction of a Signal from Samples, the Effect of under sampling, Discrete Time Processing of Continuous Time Signals. Sampling in Frequency Domain, Sampling of Discrete Time Signals.

UNIT: V : Positive Real Function and Other Properties, Herwitz Polynomials, Computation of Residues, Even and Odd Functions, Test for Positive Real Functions. Network Synthesis Elementary Synthesis Operation, LC Network Synthesis, Properties of RC Network Functions, Foster and Cauer Forms of RC and RL Networks.

Text Books:

1. A.V. Oppenheim et al.,(1997) Signals & Systems (2nd Edition), Prentice Hall., ISBN 0- 13-814757-4
2. P.Rama Krishna Rao, “Signals & Systems”, 1st Edition, TMH, 2008. Modern Network Synthesis, M. E. Van Valkenburg, Wiley Eastern

OEC-3:EEO2202 : Digital Logic Design

3L:1T:0P 3 Credits

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- * Understand working of logic families and logic gates.
- * Design and implement Combinational and Sequential logic circuits.
- * Understand the process of Analog to Digital conversion and Digital to Analog conversion.
- * Use PLDs to implement the given logical problem.

UNIT: I : **Numbering Systems:** Basic structure and brief description of Digital computers and Digital systems - Binary, Octal, Decimal and Hex numbering systems – Number base Conversions – (n-1)'s and n's complements of the various numbering systems – Binary arithmetic – Various methods to represent signed binary numbers.

UNIT: II : Binary Codes: BCD, Excess-3 codes – Binary arithmetic using BCD and Excess-3 codes – Gray code – Error detecting codes: parity checking and Hamming code – Error correcting codes: Hamming code – Basic idea of 2421, 84-2-1, ASCII codes.

UNIT: III : Boolean Algebra and Boolean Functions: Boolean theorems and postulates – Logic gates – Truth table - Boolean functions – Dual of a function – Complement of a function – Canonical and standard forms – Simplification of Boolean functions using Boolean theorems and postulated, Karnaugh map (K-map) with maximum of 5 variables – Quine-McCluskey Tabular method.

UNIT: IV : Combinational Logic Circuits- I: Boolean function implementation using AND-OR logic, multilevel NAND and multilevel NOR implementation – Transformation of multilevel NAND and NOR circuits to AND-OR diagram – Combinational logic design - Half adder – Full adder – Half subtractor – Full subtractor – Parallel adder – Parallel adder/subtractor – Carry look ahead adder – BCD adder – Magnitude comparator – Even and odd functions – Parity generator and checker – code converters.

UNIT: V : Combinational Logic Circuits- II: Decoders – Encoders – Demultiplexer – Multiplexer – Read Only Memory (ROM) – PLA – PAL – implementation of the Boolean functions using decoders, multiplexers, ROMs, PLA, and PAL. Sequential Logic Circuits: Differences between combinational logic and sequential logic – Flip-flops (R-S, J-K, D, T, Master-slave J-K flip) – Truth tables and excitation tables of the flip-flops, Conversions of flip-flops – state diagram – Mealy and Moore models – Design of sequential circuits with various flip-flops – Design of synchronous counters – Serial adder.

UNIT: VI : Micro Computer Components Design with Flip-flops: Register – Register with parallel load – Shift register – Bidirectional shift register with parallel load – Ripple counters (Binary and BCD) – Binary counters with parallel load.

Text Book:

1. M. Morris Mano, Digital Design, Prentice-Hall of India Pvt. Limited, New Delhi, 2nd Edition. 2000.

Reference Books:

1. Zvi Kohavi, Switching and Finite Automata Theory, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2nd Edition, 2008.

2. Frederick J. Hill and Gerald R. Peterson, Introduction to Switching Theory and Logic Design, John Wiley & sons, Inc. New York, 3rd edition, 1981.

OEC-3:EEO2203 : Computer Networks

3L:1T:0P 3 Credits

Course Outcomes:

At the end of the course students are able to:

- Suggest appropriate network model for data communication.
- Know how reliable data communication is achieved through data link layer.
- Propose appropriate routing algorithm for data routing.
- Connect internet to the system and knowledge of trouble shooting.

UNIT: I : INTRODUCTION: Network Hardware, Network Software, and Reference Models: OSI, TCP/IP, The ARPANET, Network Topologies,

Physical Layer: Transmission media: Magnetic Media, Twisted pair, Base band Coaxial Cable, Fiber optics, Wireless Transmission: Electromagnetic Spectrum, Radio Transmission, Microwave Transmission.

UNIT: II : Data link layer: Design issues: framing, error detection and correction, CRC, Elementary Data link Protocols: Stop and wait, Sliding Window protocols: Go-back-n, Selective Repeat,

UNIT: III : Medium Access sub layer: Channel allocation methods, Multiple Access protocols: ALOHA, CSMA, IEEE Standard 802.3 and Ethernet, IEEE Standard 802.4: Token bus.

UNIT: IV : Network Layer: Network Layer design issues, Virtual circuit and Datagram subnets, Routing algorithms: Shortest path routing, Flooding, Hierarchical routing, Distance vector routing. Broad cast and Multi cast routing, Congestion Control: Congestion prevention policies.

UNIT: V : The Network layer in the internet: The IP Protocol, IP Addresses, and Internet Control Protocols.

UNIT: VI : Transport Layer: Transport Services, Connection management, Elements of Transport Protocols, Internet Transport Protocols: UDP and TCP.

Application Layer -Domain name system, Electronic Mail, WWW

TEXT BOOK:

1. Computer Networks—Andrew S Tanenbaum, 4th Edition. Pearson Education /PHI

REFERENCES:

1. Data Communications and Networking - Behrouz A. Forouzan. Third Edition TMH

2. Understanding communications and Networks, 3rd Edition, W.A. Shay, Thomson

OEC-4:EEO2204 : Wavelet Transforms

3L:1T:0P 3 Credits

Course Outcomes:

At the end of this course student will be able to

- Interpret fundamental concepts of Time-Frequency Resolution
- Explain Multi resolution analysis
- Implement continuous wavelet transform with various wavelets
- exemplify discrete wavelet transform with its properties
- Demonstrate various applications of wavelet transform

UNIT: I : Continuous Wavelet Transform: Introduction, Continuous-time wavelets, Definition of the CWT, the VWT as a Correlation, Constant-Factor

Filtering Interpretation and Time- Frequency Resolution, the VWT as an Operator, Inverse CWT, Problems.

UNIT: II : Discrete Wavelet Transform and Orthogonal Wavelet Decomposition: Introduction, Approximation of Vectors in Nested Linear Vector Subspaces, Examples of an MRA, Problems.

UNIT: III : MRA, Orthonormal Wavelets, and their relationship to filter banks: Introduction, Formal Definition of an MRA, Construction of General Orthonormal MRA, a wavelet Basis for the MRA, Digital Filtering Interpretation, Examples of Orthogonal Basis Generating Wavelets, Interpreting Orthonormal MRAs for Discrete-Time signals, Miscellaneous Issues Related to PRQME Filter Banks, generating Scaling Functions and wavelets from Filter Coefficient, Problems.

Unit-IV : Wavelet Transform And Data Compression: Introduction, Transform Coding, DTWT for Image Compression, Audio Compression, And Video Coding Using Multiresolution Techniques: a Brief Introduction.

UNIT: V : Other Application of Wavelet Transforms: Introduction, Wavelet denoising speckles Removal, Edge Detection and Object Isolation, Image Fusion, Object Detection by Wavelet Transform of Projections, Communication application.

Textbooks:

1. James S. Walker, "A Primer on Wavelets and their Scientific Applications", CRC Press, (1999).
2. Rao, "Wavelet Transforms", Pearson Education, Asia.
3. C. Sidney Burrus, Ramesh A. Gopinath, "Introduction to Wavelets and Wavelets Transforms", Prentice Hall, (1997).

References:

1. J. C. Goswami and A. K. Chan, "Fundamentals of wavelets: Theory, Algorithms and Applications "Wiley Inter science Publication, John Wiley & Sons Inc., 1999.
2. M. Vetterli, J. Kovacevic, "Wavelets and subband coding" Prentice Hall Inc, 1995.

OEC-4:EEO2205 : Optical Fiber Communications

3L:1T:0P 3 Credits

Course Outcomes:

At the end of this course student will be able to

- Explain about optical fiber communication system and fiber optic devices.
- Illustrate the significance of various components involved in optical fiber communication system design.
- Attribute the various optical communication networks.

- Assess various Optical switching and Access Networks.
- Illustrate the multicasting and optical network simulators.
- Explain various Optical Metro Networks and Network Routing.

UNIT: I : Basic Optical Communication Network: Overview of basic fiber optic communication system: optical fibers, optical sources & optical detectors, Wave propagation through optical fibers, optical link design & calculation of various losses, Optical receiver design, Modulation formats for optical communication system.

UNIT: II : Wavelength Division Multiplexing Network: Advantages of optical network, telecom network overview and architecture, WDM optical networks, WDM network evolution, WDM network construction, broadcast and select optical WDM network, wavelength routed optical WDM network, Challenges of optical WDM network. Optical connectors

UNIT: III : Optical Networking Components and Networks Optical Networking Components: Optical transmitters, semiconductor laser diode, tunable and fixed laser, laser characteristics, photodetectors, tunable and fixed optical filters, channel equalizers, optical amplifiers and its characteristics, semiconductor laser amplifier, Raman amplifier, doped fiber amplifier, Direction Couplers, beam splitters, switches, connectors, Star couplers, OADM, OXC, CLOS architecture, MEMS, wavelength converters, polarizer, polarization controllers.

UNIT: IV : Single and Multi-hop Networks: Introduction to single and multi-hop networks, Characteristics of single and multi-hop networks, experimental single hop networks: LAMBDANET, STARNET, SONATA, Rainbow, experimental multi-hop networks: Shufflenet, De Bruijn Graph, Hypercube. Adhoc Networks

UNIT: V : Optical switching and Access Networks: Optical packet switching basics, slotted and unslotted networks, header and packet format, contention resolution in OPS networks, self-routing, examples on OPS node architecture, optical burst switching, signaling and routing protocols for OBS networks, contention resolution in OPS networks, multicasting, implementation and application.

MEMS based switching, switching with SOAs. Introduction to access network, PON, EPON and WDM EPON: overview, principal of operation, architecture; dynamic wavelength allocation, STARGATE: overview, need, architecture, operation and application, gigabit Ethernet, radio over fiber network. Network applications

UNIT: VI : Optical Metro Networks and Routing: Introduction to metro network, overview of traffic grooming in SONET ring, traffic grooming in WDM ring, Interconnected WDM networks, packet communication using tunable WADM, RINGOSTAR: architecture, proxy stripping, protect oration and network lifetime Routing and wavelength assignment: Problem

formulation, routing sub-problem: routing types, wavelength assignment sub-problem, algorithms: simulated annealing, flow deviation algorithm. Introduction to multicasting, Multicast-capable switch architecture, unicast, broadcast and multicast traffic, multicast tree protection, static and dynamic traffic grooming, Introduction to Optical Network simulators (NS-2, NS-3, OMNeT++, and OPNET) Optical Networks Budget

Textbooks:

1. Gerd Keiser, Fibre Optic communication, TMH 4th Edition, 2000.
2. Behrouz A Forouzan, Data Communications and Networking, McGraw Hill, 4th Edition, 2007.
3. Tarek S. El. Bawab, Optical Switching, Springer, 2006.

References:

1. John M Senior, Optical Fiber Communications -Principles and Practice, Pearson, 3rd Edition, 2009
2. Biswanath Mukherjee, Optical Network Series, Springer, 2006.
3. R.Ramaswami and K.Sivarajan, Optical Networks, Morgan Kaufmann Publishers, 2nd Edition, 2002.
4. Mayer & Martin, Optical Switching Networks, Cambridge University Press, 2008

OEC-4:EEO2206 : Engineering Geology

3L:1T:0P 3 Credits

Course Outcomes:

At the end of this course student will be able to

- Identify the different minerals and rocks using physical properties
- Construct cross sections of geological maps showing tilted beds, faults, folds, joints and unconformities
- Analyse the seismic hazard potential and practical implementation of earthquake response spectra
- Assess the suitability of materials in the project site by interpreting data from different site investigation techniques
- Apply the investigation techniques to decide the suitability of project site for different structures

UNIT: I : Physical Geology: Geology in civil engineering – branches of geology – structure of earth and its composition - weathering of rocks – scale of weathering – Earth processes – Work of wind, rivers and sea and their engineering importance. Plate tectonics – Earthquakes – Seismic zones in India.

UNIT: II : Mineralogy: Definition of mineral, Importance of study of minerals, Physical properties of minerals - Role of study of physical

properties in their identification, Study of physical properties of different rock forming mineral groups.

UNIT: III : Petrology: Geological classification of rocks - igneous, sedimentary and metamorphic rocks, Different methods of formation of igneous, sedimentary and metamorphic rocks. Description, occurrence, engineering properties, distribution and use of following rocks Granite, Syenite, Diorite, Basalt, Sandstone, Limestone, Conglomerate, shale, Quartzite, Marble, Slate, Gneiss.

UNIT: IV : Structural Geology and Geophysical Methods: Attitude of beds – out crop - geological maps – study of structures – folds, faults and joints their bearing on engineering construction. Geophysical methods – Seismic and electrical methods for subsurface investigations

UNIT: V: Application of Geological Investigations: Remote sensing for civil engineering applications; Geological conditions necessary for design and construction of Dams, Reservoirs, Tunnels, and Road cuttings – Hydrogeological investigations and mining – Coastal protection structures. Investigation of Landslides, causes and mitigation.

Textbooks:

1. Subinoy Gangopadhyay, Engineering Geology, 1st Edition, Oxford University Press, New Delhi, 2013
2. A.Parthasaradhy, V.Panchapakesan, R.Nagarajan, Engineering Geology, 1st Edition, Wiley Private India Limited, New Delhi, 2013

References:

1. N Chenna Kesavalu, Text Book of Engineering Geology, 2nd Edition, Trinity Press, Hyderabad, 2014.
2. Haluk Sucuoglu, Sinan Akkar, Basic Earthquake Engineering, 1st Edition, Springer International Publishing, 2014.
3. David George Price, Engineering Geology: Principles and Practice, 2nd Edition, Springer International Publishing, 2009

PCC-4 : EEC2201 : Electrical Machines-I

3L:1T:0P 3 credits

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- * Understand the operation of dc machines.
- * Understand the testing of dc motors
- * Analyze the differences in operation of different dc machine configurations.
- * Analyze single phase and three phase transformers circuits.

UNIT: I : Electro mechanical Energy Conversion: Principles, Forces and Torques in Magnetic Field Systems, Energy Balance, Energy and Force in Singly Excited Magnetic Field System, Co- energy, Multiply Excited Magnetic Field Systems.

UNIT: II : D.C. Generators: Principle of Operation, Constructional Features, EMF Equation of a D.C. Generator, Collection and Flow of Current from Armature, Armature Reaction, Methods to Reduce Effects of Armature Reaction and Commutation Process, Armature Winding Diagram (Lap and Wave), Methods of Excitation, Generator Characteristics, Parallel Operation, Losses occur in DC Generator, Power Stages in D.C. Generator, Efficiency, Condition for Maximum Efficiency of a dc generator and Applications.

UNIT: III : D.C. Motors: Principle of operation, Types of DC Motors, Significance of Back Emf, condition for maximum power, Torque and Speed Equations, Starting and necessity of Starters, Types of Starters, DC Motor characteristics, Speed Control Methods of a D.C. Motors, Losses occur in DC Motors, Power Stages in D.C. Motor, Condition for Maximum Efficiency and Applications.

UNIT: IV : Testing of D.C. Motors: Brake Test, Swinburne's Test, Hopkinson's Test, Retardation Test, Field's Test and Separation of Losses.

UNIT: V : Transformers: Principle of operation, Constructional features, Types of Transformers, emf equation of a Transformer, Idea Transformer, Practical Transformer on No-Load and Load and its vector diagrams, Equivalent Circuit of a Transformers, Losses in a Transformer, Voltage Regulation and Efficiency, Testing of a Transformers, All Day Efficiency, Condition for Maximum Efficiency of a Transformer, auto transformers, tap changers on transformers, Parallel Operation of single phase transformers.

UNIT: VI : Three Phase Transformers: Three-phase Transformers, Three-phase Transformer Connections, Star/Star or Y/Y Connection, Delta-Delta or Connection, Wye/Delta or Y/Connection, Delta/Wye or /Y Connection, Open-Delta or Y-Y Connection, Power supplied by Y-Y Bank, Three-phase to Two-Phase conversion and vice-versa, Parallel operation of 3- phase Transformers.

TEXT BOOKS:

1. Electrical Machinery by DR.P.S.BIMBHRA, KHANNA PUBLISHER.
2. Electrical Machines by D P KOTHARI and I J NAGRATH, Mc Graw Hill Education (India) Private Limited.

Reference Books:

1. Electrical Machines, by J B Gupta, S K Kataria & Sons.
2. Electrical Machines by U A Bakshi and M V Bakshi, Technical Publications.

PCC-5 : EEC2202 : Electromagnetic Fields

3L:1T:0P

3 credits

Course Outcomes:

At the end of the course, the student could able to

- * Understand the concepts of electric and magnetic fields.
- * Understand the electromagnetic wave behaviour.
- * Estimate the effect of electric and magnetic fields on the materials used in electrical equipments.
- * Understand the various principles used to estimate the effects of electric and magnetic fields.

UNIT: I : Introduction: Rectangular, Cylindrical and Spherical Coordinate Systems.

UNIT: II : Electrostatics: Superposition, Coulomb's Law, Electric Field of Different Charge Configurations using Coulomb's Law and Superposition, Flux of a Vector, Field Lines, Gauss's Law in terms of E (Integral Form and Point Form), Applications of Gauss's Law, Curl of the Electric Field, Electric Potential, Calculation of Electric Field Through Electric Potential for given Charge Configuration, Electrostatic Energy, Method of Images.

UNIT: III : Electric Dipoles: Electric dipoles, Polarization of Dielectrics, Bound Charges and Their Physical Interpretation, the Displacement Vector D, Comments about the Curl of D in Electrostatics, Linear Dielectrics, Determination of Electric fields in the Presence of Linear Dielectrics by finding D, Electrostatic Boundary Conditions at a Charged Surface(Assuming no Dielectric Polarization), Continuity Equation, Basic Properties of Conductors in Electrostatic Fields, Capacitance, Poisson's and Laplace's Equations, Properties of the Solutions of Laplace's Equations, Uniqueness Theorem, Examples on Laplace's and Poisson's equations.

UNIT: IV : Magnetic Fields and Lorentz force Law: Magnetic field intensity H, Magnetic flux Φ , flux density B, Biot-Savart's law, Determination of Magnetic Field using Biot-Savart's Law, Divergence and Curl of B, Ampere's Law in Integral and Differential Form, Applications, The Scalar and Vector Magnetic Potential, Calculation of Magnetic Field through the Vector Magnetic Potential for given Steady Current Configurations, Comparison of Electrostatics and Magnetostatics, Magnetostatic Boundary Conditions(assuming no magnetic polarizations)

UNIT: V : The Magnetic Dipole: Diamagnetism, Paramagnetism & Ferro Magnetism, Torques and Forces on Magnetic dipoles, Magnetization, Bound current, Physical Interpretation of Bound Currents, the H Vector, the Divergence and Curl of H, Linear Magnetic Materials, Determination of Magnetic Fields in the Presence of Magnetic Materials by Finding H, EMF, Ohm's Law, Motional EMF, Faraday's Laws, Lenz's law, Quasistatic Fields, Inductance and Energy in Magnetic Fields.

UNIT: VI : Time Varying fields and Maxwell's Equations: Maxwell's modification of Ampere's Law, Maxwell's Equations in any medium in terms of E & B and in terms of D,E,B & H, General Boundary Conditions, The Uniform Plane Wave, Maxwell's Equations in Free Space, Plane Wave Propagation, Phase Velocity and Wave length, Intrinsic Impedance, Perfect Dielectrics, Attenuation, Phase and Propagation Constants, the Poynting Vector and Power Considerations.

Text Books:

1. Introduction to Electrodynamics by David J. Griffiths, 3rd Edition, Prentice Hall, New Jersey, 1999.
2. Engineering Electromagnetics by William H. Hayt Jr. and John A. Buck, Sixth Edition, Mc Graw Hill, New Delhi, 2001.

Reference Books:

1. Principles of Electromagnetics by Mathew N.O. Sadiku, Oxford International Student edition, 2009.
2. Electromagnetics by John D Kraus, Mc Graw-Hill International Edition, 1999.
3. Engineering Electromagnetics by J. P. Tewari, Khanna Publishers, 2nd edition.

PCC-6 : EEC2203 : Pulse and Digital Circuits

3L:1T:0P 3 Credits

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Understand working of logic families and logic gates.
- Design and implement Combinational and Sequential logic circuits.
- Understand the process of Analog to Digital conversion and Digital to Analog conversion.
- Be able to use PLDs to implement the given logical problem.

UNIT: I : LINEAR WAVE SHAPING: High pass and Low pass RC circuits, Response of High pass and Low pass RC circuits to sinusoidal, step, pulse, square, exponential and Ramp inputs, High pass RC circuit as a differentiator, Low pass RC circuit as an integrator. Attenuators and its application as CRO probe, RL and RLC Circuits and their response for step input, Ringing Circuit.

UNIT: II : NONLINEAR WAVE SHAPING: Diode clippers, Transistor Clippers, Clipping at two independent levels, Comparator, Applications of voltage Comparators, Diode Comparator, Clamping Operation, Clamping Circuits using Diode with Different Inputs, Clamping Circuit Theorem, Practical Clamping circuits, Effect of diode Characteristics on Clamping Voltage.

UNIT: III : BISTABLE MULTIVIBRATORS: Transistor as a switch, Switching times of a transistor, Design and Analysis of Fixed-bias and self-bias transistor binary, Commutating capacitors, Triggering schemes of Binary, Transistor Schmitt trigger and its applications.

UNIT: IV : MONOSTABLE AND ASTABLE MULTIVIBRATORS: Design and analysis of Collector coupled Monostable Multivibrator, Expression for the gate width and its waveforms. Design and analysis of Collector coupled Astable Multivibrator, expression for the Time period and its waveforms, The Astable Multivibrator as a voltage to frequency convertor.

UNIT: V : TIME BASE GENERATORS: General features of a time-base signal, Methods of Generating time base waveform, Exponential voltage sweep circuit, Basic principles of Miller and Bootstrap time base generators, transistor Miller sweep generator, transistor Bootstrap sweep generator, Current Sweep circuit, Linearity correction through adjustment of driving Waveform.

UNIT: VI : LOGIC GATES: Realization of gates using diodes and Transistors, RTL, DTL.

Text Books:

1. Pulse Digital and Switching Waveforms, J. Millman and H. Taub, McGraw-Hill, 2nd Edition 1991.
2. Pulse and Digital Circuits, K.VenkatRao, Pearson Education India, 2nd Edition, 2010.

Reference Books:

1. Pulse and Digital Circuits, A. Anand Kumar, PHI, second edition, 2005.
2. Pulse switching and digital circuits – David A.Bell, PHI ,5th Edn., oxford university press.

HSMC-2/MC-5 : EEH2201 : Environmental Science

3L:1T:0P 3 Credits

Course Outcomes:

At the end of this course, student will be able to

- Motivate environmental organizations to create a concern about our present state of Environment.
- Find solutions for conservation of natural resources
- Illustrate social issues of environmental protection and adopt sustainable developmental practices
- Perceives the basic structure of environmental policy and law pertaining to specific environmental issues (water quality, air quality, biodiversity protection, Forest, etc.)

UNIT: 1 : Introduction To Environmental Sciences – Importance - Types of Ecosystems – Lake – River – Marine – Forest – Desert – Bio-Diversity.

UNIT: 3 : Environmental Pollution Causes, Effects, Standards And Control Of (A) Air Pollution; (B) Water Pollution; (C) Soil Pollution; (D) Marine Pollution; (E) Noise Pollution.

UNIT: 4 : Legal Aspects Of Pollution (A) Air (Prevention and Control of Pollution) Act. (B) Water (Prevention and Control of Pollution) Act. (C) Environmental Protection Act. (D) Forest Conservation Act.

(i) A. Global Issues. B. Green House effect C. Global Warming D. Nuclear Accidents

(ii) A. Local Issues: Causes and Action B. Air Pollution due to Industries C. Automobiles

(iii) Public Interest Litigation Case Studies – Success Stories Leather Industries Taaj & Mathura Refinery Silent Valley

1. Introduction To Environmental Sciences – Turk & Turk And Witties &Witties.

Reference Books:

1. Cunningham, W.P., Cunningham, M.A., Principles of Environmental Science, TMH.

2. Kaushik, A., Kaushik, C.P., Perspectives in Environmental Studies, 3rd ed., New Age International Publishers.

0L:0T:3P 1.5 Credits

0L:0T:3P 1.5 Credits

SCHEME OF INSTRUCTION & EXAMINATION IV/IV B.Tech

Common With Six Year Dual Degree Course II/VI (B.Tech.+ M.Tech.)

(With effect from **2019-2020** admitted batch onwards)

B.Tech. (EEE) IV Year II-semester Scheme Of Instruction And Examination

Sub. Ref	Name of the Subject	Periods			Maximum Marks		Credits	
		Theory	Tutorial	Lab	Sessionals	Exam Total		
EEL4201	Project Work (Part-II)	—	—	14	50	50	100	11

EEL4201 Project Work 11

Electrical Engineering Scheme of Instruction & Examination

II/IV B.Tech

**Common with SIX YEAR DUAL DEGREE COURSE
II/IV(B.Tech+M.Tech)**

(With effect from 2020-21admitted batch onwards)

B.Tech II Year - I Semester(Academic Year - 2020-21 onwards)

Course Category		Course Title	Hours per week			Internal	External	Total	
Credits	code		L	T	P	Marks	Marks	Marks	
EE2101	BS	Operations Research	3	0	0	30	70	100	3
EE2102	PC	Network Theory	3	0	0	30	70	100	3
EE2103	PC	Electronic Circuits	3	0	0	30	70	100	3
EE2104	PC	Electrical machines-I	3	0	0	30	70	100	3
EE2105	HSS	Managerial Economics	3	0	0	30	70	100	3
EE2106	PC	Electrical Networks LAB	0	0	3	50	50	100	1.5
EE2107	PC	Electrical Machines-I LAB	0	0	3	50	50	100	1.5
EE2108	PC	Electronic Circuits LAB	0	0	3	50	50	100	1.5
EE2109	SC	MATLAB & Interfacing	1	0	2	50	50	100	2
EE2110	MC	Professional Ethics and Universal Human Values	0	0	0	—	100	100	0
EE2111	MC	NCC/NSS	0	0	2				0
Total credits								21.5	

B.Tech II Year - II Semester (Academic Year - 2020-21 onwards)

Course Category		Course Title	Hours per week Internal				External	Total	
Credits	code		L	T	P	Marks	Marks	Marks	
EE2201	ES	Signals& Systems	3	0	0	30	70	100	3
EE2202	BS/PC	Electrical Measurements	3	0	0	30	70	100	3
EE2203	PC	Electrical Machines-II	3	0	0	30	70	100	3
EE2204	PC	E M F Theory	3	0	0	30	70	100	3
EE2205	PC	Electrical Engineering Materials	3	0	0	30	70	100	3
EE2206	PC	Electrical Machines–II LAB	0	0	3	50	50	100	1.5
EE2207	PC	Electrical Measurements lab	0	0	3	50	50	100	1.5
EE2208	SC	Electrical CAD	1	0	2	50	50	100	2
EE2209	MC	Environmental science	0	0	0		100	100	0
Total credits									20

Summer Internship(Community Service)

EE2101 : Operations Research

3L:0T:0P

3.0 Credits

Prerequisite: None

Course Objectives:

I To introduce optimization techniques to students.

I To explain linear programming, transportation problem, assignment problem, pert network with few computations.

I To discuss few inventory models.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

I Analyse any real life system with limited constraints and depict it in a model form.

I Convert the problem into a mathematical model.

I Solve the mathematical model manually as well as using soft resources/software such as solver, TORA etc.

I Understand variety of problems such as assignment, transportation, travelling salesman etc.

I Solve the problems mentioned in point 4 using linear programming approach using software.

I Understand different queuing situations and find the optimal solutions using models for different situations.

Introduction to Optimization: Engineering Applications of Optimization, Statement of Problem, Classification of Optimization Problem Techniques.

Linear Programming: Introduction, Requirements For a LP Problem, Examples on The Application of LP, Graphical Solution of 2-Variable LP Problems, Some Exceptional Cases, General Mathematical Formulation For LPP, Canonical And Standard Forms of LP Problem, Simplex Method, Examples on The Application of Simplex Techniques.

Artificial Variable Techniques: Big-M Method and Two Phase Techniques.

Transportation Problem: Matrix Terminology, Definition and Mathematical Representation of Transportation Model, Formulation and Solution of Transportation Models (Basic Feasible Solution by North-West Corner Method, Inspection Method. Vogell's Approximation Method).

Assignment Problem: Matrix Terminology, Definition of Assignment Model, Comparison with Transportation Model, Mathematical Representation of Assignment Model, Formulation and Solution of Assignment Models.

Pert Network: Introduction, Phases of Project Scheduling, Network Logic, Numbering the Events (Fulkerson's Rule), Measure of Activity.

Pert Network Computations: Forward Pass And Backward Pass Computations, Slack Critical Path, Probability of Meeting the Scheduled Dates.

Inventory Models: Introduction, Necessity For Maintaining Inventory, Classification of Inventory Models, Inventory Models With Deterministic Demand, Demand Rate Uniform Production Rate Infinite, Demand Rate Non-Uniform Production Rate Finite, Demand Rate Uniform-Production Rate Finite. Game Theory: Useful Terminology, Rules For Game Theory, Saddle Point, Pure Strategy, Reduce Game By Dominance, Mixed Strategies, 2x2 Games Without Saddle Point.

Textbooks:

1. "Operations Research-An Introduction' By H.Taha, Prentice Hall Of India Pvt. Ltd.

2. "Engineering Optimization-Theory & Practice" By S.S. Rao, New Age International (P) Ltd.

3. "Operations Research – An Introduction" By P.K.Gupta&D.S.Hira, S. Chand & Co. Ltd

EE2102 : Networktheory

3L:0T:0P

3.0 Credits

Prerequisite: None

Course Objectives:

I To enrich the students to acquire knowledge about the basics of circuit analysis, network theorems, concepts of AC circuits, coupled & three phase circuits, transient analysis.

I Explain the basic laws and theorems of DC circuits.

I Discuss the DC transients for RL, RC & RLC circuits and explain about Magnetic Circuits.

I Explain different types of Laplace Transforms of different signals and their response when applied to simple circuits.

Course Outcomes:

At the end of this course, a student

I Will be able to articulate in working of various components of a circuit.

Introduction of Network Elements: Basic definition of the unit of Charge, Voltage, Current, Power and Energy, Circuit concept, Active and Passive circuit elements; Ideal, Practical and dependent sources and their V-I characteristics, , Reference Directions for current and voltage, Energy stored in Inductors and Capacitors ,Kirchhoff's Laws, Voltage and Current Division

Nodal Analysis, Mesh Analysis, Star-Delta transformation, Source Transformation.

Network Theorems: Linearity and superposition, Thevenin's and Norton's Theorem, Reciprocity, Compensation, Maximum power transfer theorems, Tellegen's and Millman's theorems, Application of theorems to DC circuits.

DC Transients: Inductor, Capacitor, Source free RL, RC and RLC Response, Evaluation of Initial conditions, application of Unit-step Function to RL, RC and RLC Circuits, Concepts of Natural, Forced and Complete Response.

Introduction of Alternating Circuits: The Sinusoidal Forcing Function Instantaneous, Peak, Average and RMS values of Voltage and Current; Crest factor, Form factor; Concept of phase and phase difference in sinusoidal waveforms; Phase relation in pure resistor, Inductor and capacitor; Impedance diagram, phasor diagram, series and parallel circuits, compound Circuits, Instantaneous and Average Power, Complex Power Computation of active, reactive and complex powers; power triangle, power factor.

Sinusoidal Steady State Analysis: Steady State Analysis Using Mesh and Nodal Analysis, Application of Network Theorems to AC Circuits, Series resonance, Impedance and phase angle, voltages and currents, bandwidth and Q factor and its effect on bandwidth, parallel resonance, resonant frequency, variation of impedance with frequency, Q factor and its effect on bandwidth, Balanced 3-phase circuits, Resonance, Concept of Duality, Magnetically Coupled Circuits, Dot Convention, Y, Z, H, T – Parameters of Two – Port Networks.

Laplace Transform Techniques: Transforms of Typical Signals, Response of Simple Circuits to Unit – Step, Ramp and Impulse Functions, Initial and Final Value Theorem, Convolution Integral, Time Shift and Periodic Functions, Transfer Function.

Textbooks:

1. Engineering Circuit Analysis, William H. Hayt Jr., and Jack E. Kemmerly, 5th Edition, McGraw Hill.
2. Electric circuits by J.A Edminister (Schaum outline series)

Referencebooks:

1. Franklin F. Kuo, Network Analysis and Synthesis, 2nd Edition, John Wiley & Sons
2. Network Analysis, M. E. Van Valkenburg, 3rd Edition, PHI.

EE2103 : Electronic circuits

3L:0T:0P

3.0 Credits

Prerequisite: Network Theory, Electronic Devices

Course Objectives:

I To familiarize the students with theory of various kinds of amplifiers and oscillators.

I To explain concepts of gain, band-width and gain band-width product.

I To analyse all kinds of feedback amplifiers.

I To deal with various aspects of power amplifiers and tuned voltage amplifiers.

I To introduce operational amplifiers and their applications.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

I Understand the characteristics of transistors.

I Design and analyze various rectifier and amplifier circuits.

I Design sinusoidal and non-sinusoidal oscillators.

I Understand the functioning of OP-AMP and design OP-AMP based circuits.

Multistage Amplifiers: BJT and FET RC Coupled Amplifiers – Frequency Response. Cascaded Amplifiers. Calculation of Band Width of Single and Multistage Amplifiers. Concept of Gain Bandwidth Product.

Feedback Amplifiers: Concept of Feedback Amplifiers – Effect of Negative feedback on the amplifier Characteristics. Four Feedback Amplifier Topologies. Method of Analysis of Voltage Series, Current Series, Voltage Shunt and Current Shunt feedback Amplifiers.

Sinusoidal Oscillators: Condition for oscillations – LC Oscillators – Hartley, Colpitts, Clapp and Tuned Collector Oscillators – Frequency and amplitude Stability of Oscillators – Crystal Oscillators – RC Oscillators – RC Phase Shift and Weinbridge Oscillators.

Power Amplifiers: Classification of Power Amplifiers – Class A, Class B and Class AB power Amplifiers. Series Fed, Single Ended Transformer Coupled and Push Pull Class A and Class B Power Amplifiers. Cross-over Distortion in Pure Class B Power Amplifier, Class AB Power Amplifier – Complementary Push Pull Amplifier, Derating Factor – Heat Sinks.

Tuned Voltage Amplifiers: Single Tuned and Stagger Tuned Amplifiers – Analysis – Double Tuned Amplifier – Bandwidth Calculation.

Operational Amplifiers: Concept of Direct coupled amplifiers, Ideal Characteristics, Differential amplifier, normalized transfer characteristics, Measurement of Op-Amp Parameters.

Applications of Op-Amps: Inverting and Non-inverting Amplifiers, Integrator, Differentiator, Comparator, Logarithmic Amplifiers, Instrumentation Amplifiers.

Text Books:

1. Integrated Electronics, Analog Digital Circuits and systems, Jacob Millman and D. Halkias, McGraw Hill, 1972
2. OP-Amps and Linear Integrated Circuits, Gayakwad, 4th ed. PHI publications, 1993.
3. Electronic Devices & Circuits, K VenkataRao and K Rama Sudha, McGraw Hill Education, 1986.

Reference books:

1. Linear Integrated Circuits, D Choudhury Roy, New Age International Pvt Ltd, publishers, New Delhi, 2004
2. Electronic Devices and Circuits – G.K.Mithal, Khanna Publishers, 23rd Edition, 2004.

EE2104 : Electrical machines – I

3L:0T:0P 3.0 Credits

Prerequisite: Basic Physics

Course Objectives:

- I To understand the concepts of Thermal Prime Movers.
 - I To understand the concepts of Hydraulic turbines
 - I To familiarize the concepts of electro-mechanical energy conversion principles.
 - I To explain the theory of dc machines, and their testing.
- Course Outcomes:
- At the end of this course, students will demonstrate the ability to
- I Discuss the working principle of different types of thermal & hydraulic turbines.
 - I Understand the operation of dc machines.
 - I Understand the testing of dc motors
 - I Analyze the differences in operation of different dc machine configurations.

Gas Turbines: Introduction, Classification of Gas Turbines. Analysis of Constant Pressure Closed Cycle Gas Turbines, Open Cycle Gas Turbines. Methods to Improve the Thermal Efficiency of Gas Turbines.

Hydraulic turbines: Layout of a typical hydro power installation, heads and efficiencies – classification of turbines – pelton wheel, francis turbine, Kaplan turbine working – velocity diagram, work done and efficiency.

Electro-mechanical Energy Conversion: Principles, Forces and Torques in Magnetic Field Systems, Energy Balance, Energy and Force in Singly

Excited Magnetic Field System, Co-energy, Multiply Excited Magnetic Field Systems.

D.C. Generators: Principle of Operation, Constructional Features, EMF Equation of a D.C. Generator, Collection and Flow of Current from Armature, Armature Reaction, Methods to reduce Effects of Armature Reaction and Commutation Process, Armature Winding Diagram (Lap and Wave), Methods of Excitation, Generator Characteristics, Parallel Operation, Losses occur in DC Generator, Power Stages in D.C. Generator, Efficiency, Condition for Maximum, Efficiency of a dc generator and Applications.

D.C. Motors: Principle of operation, Types of DC Motors, Significance of Back Emf, condition for maximum power, Torque and Speed Equations, Starting and necessity of Starters, Types of Starters, DC Motor characteristics, Speed Control Methods of a D.C. Motors, Losses occur in DC Motors, Power Stages in D.C. Motor, Condition for Maximum Efficiency and Applications.

Testing of D.C. Motors: Brake Test, Swinburne's Test, Hopkinson's Test, Retardation Test, Field's Test and Separation of Losses.

Text books:

1. Thermal Engineering by R.S. Khurmi And J.K. Gupta, S.Chand & Co Ltd.
2. Elements of Heat Engines, Vols. I & II by R.C. Patel And C.J. Karamchandani, Acharya Book Depot, Baroda.
3. Electrical Machinery by DR.P.S. Bimbhra, KHANNA PUBLISHER.
4. Electrical Machines by D P KOTHARI and I J NAGRATH, Mc Graw Hill Education (India) Private Limited.

Reference books:

1. Electrical Machines, by J B Gupta, S K Kataria & Sons.
2. Electrical Machines by U A Bakshi and M V Bakshi, Technical Publications.

EE2105 : Managerial Economics

3L:0T:0P 3.0 Credits

Prerequisite: None

Course Objectives:

- I To introduce the managerial economics to students.
- I To explain the concepts of demand forecasting and cost analysis.
- I To discuss concepts of investment decisions & market structures.
- I To understand financial statements.
- I To describe marketing.

Course Outcomes:

At the end of this course student will be able to

I Explain basic principles of engineering economics

I Apply cost – volume -profit (CVP) analysis in their business decision making

I Evaluate investment proposals through various capital budgeting methods

I Apply the knowledge to prepare the simple financial statements for measuring performance of business firm

I Analyse key issues of organization, management and administration

I Evaluate project for accurate cost estimates and plan future activities

Introduction to Engineering Economics: Concept of Engineering Economics – Types of efficiency – Managerial Economics - Nature and Scope – Law of Demand – Types of Elasticity of demand.

Demand Forecasting & Cost Analysis: Demand Forecasting: Meaning, Factors Governing Demand Forecasting, Methods of Demand Forecasting (Survey and Statistical Methods) – Cost Analysis: Basic Cost Concepts, Break Even Analysis. Factors affecting the elasticity of demand – Supply and law of Supply.

Investment Decisions & Market Structures: Financial Statements & Ratio Analysis Time Value of Money – Capital Budgeting: Meaning, Need and Techniques of Capital Budgeting – Types of Markets Structures – Features – Price Out - put determination under Perfect Competition and Monopoly.

Financial Statements & Ratio Analysis: Introduction to Financial Accounting –Double entry system – Journal - Ledger – Trail Balance – Final Accounts (with simple adjustments) – Financial Analysis through Ratios: Interpretation of Liquidity Ratios (Current Ratio and quick ratio), Activity Ratios (Inventory turnover ratio and Debtor Turnover ratio, Creditors Turnover Ratio, Capital Turnover Ratio), Solvency Ratios (Debt - Equity ratio, Interest Coverage ratio), and Profitability ratios (Gross Profit Ratio, Net Profit ratio, Operating Ratio, P/E Ratio and EPS). Price output determination under Monopolistic markets, Accounting concepts and conventions.

Introduction to Management & Strategic Management: Introduction to management: Nature –Importance – Classical Theories of Management: F.W.Taylor's and Henri Fayol's Theory – Functions and Levels of Management – Decision Making Process. Methods of Production (Job, Batch and Mass production) - Inventory Control, Objectives, Functions – Analysis of Inventory –EOQ.Maslow& Douglas Mc.Gregor theories of Management, ABC Analysis.

Project Management: Introduction – Project Life Cycle and its Phases – Project Selection Methods and Criteria – Technical Feasibility – Project

Control and Scheduling through Networks – Probabilistic Models of Networks – Time - Cost Relationship (Crashing) –Human Aspects in Project Management: Form of Project Organization – Role & Traits of Project Manager.

Textbooks:

1. Chan S. Park, "Fundamentals of Engineering Economics", Pearson, 2013, 3 Edition, New Delhi, 2015

2. Rajeev M Gupta, "Project Management", 2nd Ed., PHI Learning Pvt. Ltd. New Delhi, 2014

Reference books:

1. PanneerSelvam. R, "Engineering economics", 3rd Edition., Prentice Hall of India, New Delhi, 2013

2. R.B.Khanna, "Project Management", PHI Learning Pvt. Ltd. New Delhi, 2011

EE2106 : Networks laboratory

0L:0T:3P

1.5 CREDITS

Prerequisite: Network Theory

Course Objectives

I To enhance student learning by applying knowledge and skills to provide solutions to Electrical and Electronics Engineering problems in industry and governmental organizations

I To identify, formulate, design and investigate complex engineering problems of electric circuits.

I Work as a team with a sense of ethics and professionalism, and communicate effectively with a practical orientation.

Course Outcomes:

After completion of this course, a student will be

I Able to analyze and design DC and AC circuits.

I Able to apply concepts of electrical circuits throughout engineering.

I Able to evaluate response in any given network using theorems

I Able to analyze a given network by applying various Network Theorems

1. Verification of ohm's law and to measure filament lamp resistance.

2. Verification of Kirchhoff's law

3. Verification of Thevenin's theorem

4. Verification of Norton's theorem

5. Verification of superposition theorem.

6. Verification of Maximum Power Transfer theorem.

7. Verification of Reciprocity theorem.
8. Two Port Network Parameters
9. Time response of first order RC / RL network for periodic non – sinusoidal inputs – Time constant and Steady state error determination
10. Series and Parallel Resonance
11. Measurement of Active Power for Star and Delta connected balanced loads
12. Measurement of reactive Power for Star and Delta connected balanced loads

EE2107 : Electrical Machines – I lab

0L:0T:3P 1.5 CREDITS

Prerequisite: Electrical Machines-I

Course Objective:

- I To understand design and each part of dc electrical machines.
- I To gain expertise in controlling dc electrical machines.
- I Also to perform tests on dc electrical machines and transformers and determine their characteristics.

- I To inculcate team spirit and cooperative behaviour.

Course Outcome:

After completion of course, a student will be able to

- I Analyse dc electrical machines and transformers.
- I To define characteristics of dc machines and transformers.
- I To test them in various methods.

Experiments can be drafted basing on the theory course#

EE2108 : Electronic Circuits lab

0L:0T:3P 1.5 CREDITS

Prerequisite: Electronic Devices and Electronic Circuits

Course Objectives:

- I To gain practical knowledge on electronic circuits.
- I To understand the functioning of electronic devices.
- I To draw the characteristics of the devices.
- I To develop team spirit.

Course Outcomes:

After completion of this course, a student will be able to

- I Analyse electronic components.
- I Design rectifier, filter circuits.

- I Design electronic circuits for small applications.

#experiments can be drafted basing on the theory course#

EE2109 : MATLAB & Interfacing

0L:1T:2P 2 CREDITS

Prerequisite: Basics of Electrical Engineering

Course Objectives:

- I To understand the MATLAB software
- I To write program for electrical applications
- I To simulate an electric and electronic circuit.

Course Outcome:

After completion of this course, a student

- I Can use the software effectively.
- I Can simulate and program an electrical and electronic application.

#the programs/experiments can be drafted to make the student acquainted with the latest concepts

Related to Electrical Engineering#

EE2110 : Professional ethics and Universal human values

0L:0T:0P 0 CREDITS

Course Objectives:

The objective of the course is Six fold:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- This course will illuminate the students in the concepts of laws and its applicability to engineers
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection, Development of commitment and courage to act and also enable the students to imbibe and internalize the Values and Ethical Behaviour in the personal and professional lives
- To enable the students to imbibe the Values and Ethical Behavior in the personal and Professional lives
- The students will learn the rights and responsibilities Individual, employee, team member and a global citizen

Course Outcomes:

By the end of the course Student will be able to:

- Grasp the meaning of the concept – Law and also Get an overview of the laws relating to Engineers and also Apprehend the importance of being a law abiding person and They would have better critical ability

- Self-explore by using different techniques to live in harmony at various levels

- Analyze themselves and understand their position with respect to the moral and ethical character needed for a successful and satisfactory work life

- Students are expected to become more aware of themselves and their surroundings (family, society, nature)

- They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.

- They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society)

SYLLABUS

Need, Basic Guidelines, Content and Process for Value Education Self-Exploration—what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation - as the process for self-exploration, Continuous Happiness and Prosperity - A look at basic Human Aspirations, Right understanding, Relationship and Physical Facility - the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels. Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking, Include practice sessions and case studies.

Understanding Harmony in the Human Being - Harmony in Myself!

- Understanding human being as: a co-existence of the sentient 'I' and the material 'Body', the needs of Self ('I') and 'Body' - happiness and physical facility, the Body as an instrument of 'I' (I being the doer, seer and enjoyer), the characteristics and activities of 'I' and harmony in 'I', the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail, P to ensure Sanyam and Health, Include practice sessions and case studies.

Understanding Harmony in the Family and Society - Harmony in Human – Human Relationship

- Understanding values in human-human relationship: meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship, the meaning of Trust; Difference between intention and competence, the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship, the harmony in the society (society being an extension of family), Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society, Universal Order from family to world family, Include practice sessions and case studies. Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

- Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature recyclability and self-regulation in nature, Understanding Existence as Co-existence of mutually interacting units in all – pervasive space, Holistic perception of harmony at all levels of existence, Include practice sessions and case studies.

Concept of Law and Law of Torts

- Understanding Essentials of a Valid Contract and the basics of contract law protecting rights and obligations, Introduction to the Law of Torts and the basics to protect oneself and the company Law affecting the Workplace Employers Responsibilities/Duties Hiring Practices, Introduction to Intellectual Property Law, Professional Code of Conduct for Engineers, Relationship between Law and Ethics, Include practice sessions and case studies.

Implications of the above Holistic Understanding of Harmony on Professional Ethics

- Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations, Include practice sessions and case studies.

Text Books

1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1

2. R R Gaur, R Asthana, G P Bagaria, "Teachers' Manual for A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

3. R. Subramanian, "Professional Ethics", Oxford University Press.

4. S.B. Srivastha, "Professional Ethics & Human Values", SciTech Publications (India) Pvt. Ltd. New Delhi.

5. D.R. Kiran, "Professional Ethics & Human Values", TATA Mc Graw Hill Education.

6. Saroj Kumar, "Business Law" and Avtar Singh, "Law of Contract"

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.

2. A. N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, 2004.

3. The Story of Stuff (Book), Mohandas Karamchand Gandhi "The Story of My Experiments with Truth", E. F. Schumacher. "Small is Beautiful", Slow is Beautiful – Cecile Andrews, J C Kumarappa "Economy of Permanence", Pandit Sunderlal "Bharat Mein Angreji Raj" and Dharampal, "Rediscovering India"

4. G K Kapoor, "Business Law" and Sen & Mitra, "Business & Commercial Laws" and Calvin Frank Allen, "Business law for Engineers"

5. Hilgard, E. R.; Atkinson, R. C. & Atkinson, R.L. (1975). *Introduction to Psychology*. 6th Edition. New Delhi: Oxford and IBH Publishing Co. Pvt. Ltd.

6. Govindarajan, M; Natarajan, G. M. & Senthilkumar, V.S. (2013). *Professional Ethics & Human Values*. Prentice Hall: New Delhi

7. Gogate, S. B. (2011). *Human Values & Professional Ethics*. Vikas Publishing: New Delhi.

8. Charles E Harris Jr., Michael S Pritchard, Michael J Rabins, "Engineering Ethics, Concepts Cases: 4e, Cengage learning, 2015.

9. Caroline Whitbec, "Ethics in Engineering Practice & Research: 2e, Cambridge University Press 2015.

EE2111 : NCC/NSS

0L:0T:2P 0 CREDITS

2ND YEAR 2ND SEM

EE2201 : Signals & Systems

3L:0T:0P 3 CREDITS

Prerequisite: None

Course objectives:

I To understand the fundamental properties of linear systems

I Use linear systems tools, especially transform analysis and convolution, to analyse and predict the behaviour of linear systems

I Apply properties of the Fourier Transforms and Z-transforms .

Course Outcome: A student be

I Able to describe signals mathematically and to perform mathematical operations on signals

I Able to classify the signals.

I Able to compute the output of an LTI system for a given input.

I Able to find Fourier series coefficients of a periodic signal.

I Able to find Z transform of a discrete-time signal.

Size of a Signal, Signal Energy, Signal Power, Some Useful Signal Operations, Time Shifting, Time Scaling, Time Reversal, Combined Operations.

Classification of Signals, Continuous-Time and Discrete-Time Signals, Analog and Digital Signals, Periodic and Aperiodic Signals, Energy and Power Signals, Deterministic and Random Signals.

Some Useful Signal Models, Unit Step Function $u(t)$, The Unit Impulse Function, The Exponential Function, Even and Odd Functions, Some Properties of Even and Odd Functions, Even and Odd Components of a Signal.

Systems, Classification of Systems, Linear and Nonlinear Systems, Time-Invariant and Time-Varying Systems, Instantaneous and Dynamic Systems, Causal and Noncausal Systems, Continuous-Time and Discrete-Time Systems, Analog and Digital Systems, Invertible and Noninvertible Systems, Stable and Unstable Systems.

Properties of Systems, Linear Time – invariant Systems. Continuous Time and Discrete time. Fourier series, Convergence of Fourier series, Fourier Transform. Periodic Signals and Continuous and discrete Fourier Transform. Z-transform of a Discrete Sequence, Region of Convergence for the Z-transform. Inverse Z-transform, Properties of Z-transform, Relation Between Z and Fourier Transform.

Linear Time – Invariant (LTI) Systems, Representation of Signals in terms of Impulses, Discrete Time LTI Systems, the Convolution Sum, Continuous Time LTI Systems, the Convolution Integral. Properties of LTI Systems, Systems described by Differential and Difference Equations. Block Diagram Representation of LTI Systems described by Differential Equations and, Singularity Functions.

Frequency Response Characterized by Linear Constant Coefficient Differential Equations. First-order and Second-order Systems. Representation of DTFT, First-order and Second-order Systems.

Sampling Theorem, Reconstruction of a Signal from Samples, the Effect of under sampling, Discrete Time Processing of Continuous Time Signals. Sampling in Frequency Domain, Sampling of Discrete Time Signals.

Textbooks:

1. V. Oppenheim et al.,(1997) Signals & Systems (2nd Edition), Prentice Hall.,
2. Principles Of Linear Systems And Signals, B.P. Lathi, Oxford University Press
3. Open Course Ware material Signals and Systems, Massachusetts Institute of Technology
4. Theory and Problems of Signals and Systems, Hwei P. Hsu, Schaums Outline Series.
5. Signals and Systems ,P.Ramakrishna Rao, Shankar Prakriya, Mc Graw Hill Education India.

EE2202 : Electrical Measurements

3L:0T:0P

3CREDITS

Prerequisite: none

Course objectives:

I Gain knowledge between different types analog and digital measurements.

I Study the characteristics of moving element measurements

I Study the concepts of measuring various electrical parameters/quantities

I Knowledge regarding the magnetic measurement & devices.

I To study various bridges and their applications.

I To study various potentiometers configurations.

Course Outcome:

Upon successful completion of the course, the students will be able to

- Describe operation of electrical measuring instruments.
- Select suitable instrument for measuring power and energy of electrical systems.
- Determine the parameters of electrical circuits using suitable measuring instruments.

Instruments: Objectives of Measurements, Analog versus Digital Measurements, Accuracy, Precision and Uncertainty, Sources of Measurement Error, Standard Cell And Standard Resistance.

Characteristics of measuring instruments with a moving element instruments: Ammeter, Voltmeter, Expression for Torque of Moving Coil, Moving Iron, Dynamometer, Induction and Electrostatic Instruments.

Extension of Range Of Instruments: Wattmeters, Torque Expression for Dynamometer Instruments. Reactive Power Measurement, Energy Meters Single Phase And Poly Phase, Driving Torque And Braking Torque Equations, Errors And Testing, Compensation, Maximum Demand Indicator, Power Factor Meters, Frequency Meters, Electrical Resonance And Weston Type of Synchro-Scope.

Bridge Methods: Measurement of Inductance, Capacitance & Resistance Using Bridges. Maxwell's, Anderson's, Wein's Heave-Side & Campbell's, Desauty's, Schering's Bridges, Kelvin's Double Bridge, Price Guard Wire Bridge, Loss Of Charge Method, Megger, Wagner's Earthing Device.

Magnetic Measurements: Ballistic Galvanometer, Calibration of Hibbert's Magnetic Standard Flux Meter, Ioydfischer Square for Measuring Iron Loss. Testing Of Ring and Bar Specimens, Determination Of B-H Curve And Hysteresis Loop Using CRO, Determination Of Leakage Factor.

Potentiometers & Instrument Transformers: Crompton's D.C. Potentiometer, A.C. Polar and Co-Ordinate Type Potentio Meters. Applications measurement Of Impedance, Calibration of Ammeters, Voltmeters and Wattmeters. Use of Oscilloscope in Frequency, Phase and Amplitude Measurements, Indian Standard Specifications for Voltmeters, Ammeters, Energy Meters, Instrument Transformers –Ratio and Phase Angle Errors and Their Reduction.

Text Book:

1. Electric and Electronic Instrumentation By A.K. Sawhney, Dhanpat Rai & Sons, Delhi, 11th Edition, 1995.

References:

1. Electrical & Electronic Instrumentation by Umesh Sinha, Satya Prakashan, New Delhi, 1998
2. Electrical Measurements by E.W. Golding. & Widdis, 5th Edition, Wheeler Publishing.

EE2203 : Electric machines – II

3L:0T:0P

3.0 CREDITS

Prerequisite: Network Theory

Course Objectives:

- I To introduce the concept of transformers.

- I To introduce the concepts of Induction motors
- I To introduce the concepts of Synchronous machines

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- I Analyze single phase and three phase transformers circuits.
- I Analyze the operation of different configurations of Induction motors
- I Analyse the operation of synchronous machines

Transformers: Principle of operation, Constructional features, Types of Transformers, emf equation of a Transformer, Ideal Transformer, Practical Transformer on No-Load and Load and its vector diagrams, Equivalent Circuit of a Transformer, Losses in a Transformer, Voltage Regulation and Efficiency, Testing of a Transformer, All Day Efficiency, Condition for Maximum Efficiency of a Transformer, auto transformers, tap changers on transformers, Parallel Operation of single phase transformers.

Three Phase Transformers: Three-phase Transformers, Three-phase Transformer Connections, Star/Star or Y/Y Connection, Delta-Delta or Connection, Wye/Delta or Y/ Connection, Delta/Wye or /Y Connection, Open-Delta or Y-Y Connection, Power supplied by Y-Y Bank, Three-phase to Two-Phase conversion and vice-versa, Parallel operation of 3- phase Transformers.

Synchronous Generators: Basic requirements, Constructional details, EMF equation, Effect of chording and distribution of winding, Armature reaction, Phasor diagram, Regulation of Synchronous Generators using EMF, MMF and ZPF method.

Synchronization of alternators, Parallel operation of two-alternators, Parallel operation of Synchronous Generator to infinite bus, Sharing of real and reactive powers, Capability curve, Salient-pole synchronous machine, Two-reaction theory, Determination of direct axis and quadrature axis reactances of salient-pole machines, Power-Angle characteristics of cylindrical and salient-pole machines.

Synchronous Motors: Principle of operation, starting methods, phasor diagram, effect of changing load and changing excitation on machine performance, V and Inverter 'V' curves, Hunting, Damper winding, power developed by synchronous motor.

Textbooks:

1. Electrical Machinery by DR.P.S.BIMBHRA, KHANNA PUBLISHER.
2. Electrical Machines by D P KOTHARI and I J NAGRATH, Mc Graw Hill Education (India) Private Limited.

Reference books:

1. M G Say, The performance and Design of Alternating Current Machines, 3rd edition, CBS Publishers & Distributors, New Delhi, 2002.
2. Electrical Machines, by J B Gupta, S K Kataria & Sons.
3. Electrical Machines by U A Bakshi and M V Bakshi, Technical Publications.

EE2204 : EMF Theory

3L:0T:0P

3.0 CREDITS

Prerequisite: Basic Physics, Differential Calculus

Course Objectives:

- I To familiarize the students with different coordinate systems.
- I To impart knowledge on the concepts of electrostatics, electric potential, energy density and their applications.
- I To impart knowledge on the concepts of magnetostatics, magnetic flux density, scalar and vector potential and its applications.
- I To impart knowledge on the concepts of Faraday's law, induced emf and Maxwell's equations.

Course Outcomes:

At the end of the course, the student could able to

- I Understand the basic mathematical concepts related to electric and magnetic vector fields.
- I Apply the principles of electrostatics to the problems relating to electric field and electric potential, boundary conditions and electric energy density.
- I Apply the principles of magnetostatics to the problems relating to magnetic field and magnetic potential, boundary conditions and magnetic energy density.

Introduction: Rectangular, Cylindrical and Spherical Coordinate Systems.

Electrostatics: Coulomb's Law, Electric Field of Different Charge Configurations using Coulomb's Law, Electric Flux, Field Lines, Gauss's Law in terms of E (Integral Form and Point Form), Applications of Gauss's Law, Curl of the Electric Field, Electric Potential, Calculation of Electric Field Through Electric Potential for given Charge Configuration, Potential Gradient, The Dipole, Energy density in the Electric field.

Conductors, Dielectrics, and Capacitance: Current and Current Density, Continuity of current, Metallic conductors, Conductor properties and Boundary Conditions, The Method of Images, Semiconductors, The Nature of Dielectric materials, Boundary conditions for Perfect Dielectric Materials, Capacitance, Several Capacitance Examples, Continuity Equation, Basic Properties of Conductors in Electrostatic Fields, Capacitance, Poisson's and

Laplace's Equations, Examples of the Solution of Laplace's Equations, Uniqueness Theorem, Examples Of The Solution Of Poisson's equations.

The Steady Magnetic Field: Biot-Savart's Law, Amperes Circuital Law, Curl, Stokes Theorem, Magnetic Flux and Magnetic Flux Density, The Scalar and Vector Magnetic Potentials, Derivation of Steady Magnetic Field Laws.

Magnetic Forces, Materials and Inductance: Force on Moving Charge, Force on a Differential Current Element, Force Between Differential Current Elements, Force and Torque on a Closed Circuit, The Nature of Magnetic Materials, Magnetization and Permeability, Magnetic Boundary Conditions, The Magnetic Circuit, Potential Energy and Forces On Magnetic Materials.

Self-Inductance, Internal Inductance and Mutual Inductance, Magnetic circuits, BH Curve, Cores with Air Gaps, Parallel Magnetic Circuits (Chapter 11 Joseph. A. Edminister)

Time Varying Fields and Maxwell's Equations: Faraday's Law, Transformer and Motional EMFs, Displacement Current, Maxwell's Equations in Point Form, Maxwell's Equations in Integral Form, Time - Varying Potentials Time-Harmonic Fields.

Textbooks:

1. Elements of Electromagnetics by Matthew N.O. Sadiku, Oxford University Press.
2. Engineering Electromagnetics by William H. Hayt Jr. and John A. Buck, Sixth Edition, Mc Graw Hill, New Delhi, 2001.
3. Electromagnetics, Joseph A. Edminister, Schaum's Outline Series, McGrawHill International Editions.

Referencebooks:

1. Introduction to Electrodynamics by David J. Griffiths, 3rd Edition, Prentice Hall, New Jersey, 1999.
2. Electromagnetics by John D Kraus, Mc Graw-Hill International Edition, 1999. Engineering Electromagnetics by J. P. Tewari, Khanna Publishers, 2nd edition.

EE2205 : Electrical Engineering Materials

3L:0T:0P 3.0 Credits

Prerequisite: Basic Physics

Course Objectives:

- I To explain students about dielectric materials and their properties.
- I To detail about magnetic materials and their properties.
- I To familiarize with semiconductor materials and their applications.
- I To introduce various kinds of special purpose materials.

Course Outcomes:

After completion of this course, the student will be able to

- I Understand various types of dielectric materials, their properties in various conditions.
- I Evaluate magnetic materials and their behavior.
- I Evaluate semiconductor materials and technologies.
- I Acquire Knowledge on Materials used in electrical engineering and applications.

Dielectric Materials: Dielectric as Electric Field Medium, leakage currents, dielectric loss, dielectric strength, breakdown voltage, breakdown in solid dielectrics, flashover, liquid dielectrics, electric conductivity in solid, liquid and gaseous dielectrics, Ferromagnetic materials, properties of ferromagnetic materials in static fields, spontaneous, polarization, curie point, anti-ferromagnetic materials, piezoelectric materials, pyroelectric materials.

Magnetic Materials: Classification of magnetic materials, spontaneous magnetization in ferromagnetic materials, magnetic Anisotropy, Magnetostriction, diamagnetism, magnetically soft and hard materials, special purpose materials, feebly magnetic materials, Ferrites, cast and cermet permanent magnets, ageing of magnets. Factors effecting permeability and hysteresis.

Semiconductor Materials: Properties of semiconductors, Silicon wafers, integration techniques, Large and very large scale integration techniques (VLSI)

Materials for Electrical Applications: Materials used for Resistors, rheostats, heaters, transmission line structures, stranded conductors, bimetal fuses, soft and hard solders, electric contact materials, electric carbon materials, thermocouple materials. Solid, Liquid and Gaseous insulating materials, Effect of moisture on insulation.

Special Purpose Materials: Refractory Materials, Structural Materials, Radioactive Materials, Galvanization and Impregnation of materials, Processing of electronic materials, Insulating varnishes and coolants, Properties and applications of mineral oils, Testing of Transformer oil as per ISI.

Textbooks:

1. "R K Rajput", "A course in Electrical Engineering Materials", Laxmi Publications, 2009

2. "T K Basak", "A course in Electrical Engineering Materials", New Age Science Publications 2009

Reference books:

1. TTTI Madras, "Electrical Engineering Materials", McGraw Hill Education, 2004.

2. "Adrianus J. Dekker", Electrical Engineering Materials, PHI Publication, 2006.

3. P. Seth, P. V. Gupta "A course in Electrical Engineering Materials", Dhanpat Rai & Sons, 2011.

EE2206 : Electrical Machines – II lab

0L:0T:3P 1.5 CREDITS

Prerequisite: Electrical Machines-II

Course Objective:

- I To understand design and each part of ac electrical machines.
- I To gain expertise in controlling dc electrical machines.
- I Also to perform tests on ac electrical machines and transformers and determine their characteristics.
- I To inculcate team spirit and cooperative behaviour.

Course Outcome:

After completion of course, a student will be able to

- I Analyse dc electrical machines.
- I To define characteristics of ac machines.
- I To test them in various methods.

#experiments can be drafted basing on the theory course#

EE2207 : Electrical Measurements lab

0L:0T:3P 1.5 CREDITS

Prerequisite: Electrical measurements & measuring devices

Course Objectives:

- I To gain practical knowledge on measuring electrical quantities.
- I To understand the functioning of measuring devices
- I To understand the circuits of electrical measuring devices.
- I To develop team spirit.

Course Outcomes:

After completion of this course, a student will be able to

- I Analyse various measured electrical quantities.

I Developing circuits for small applications.

#experiments can be drafted basing on the theory course#

EE2208 : Electrical CAD

0L:1T:2P 2.0 credits

Prerequisite: Network theory, Electric Machines

Course objectives:

- I To understand the software.
- I To design electrical networks.

Course Outcome:

- I After completion of this course, a student
- I Can design a CAD model of an electrical network

#experiments/programs can be drafted to suit the technical needs of the students#

EE2209 : Environmental studies

0L:0T:0P 0 credits

Course Objectives

The objectives of the Environmental Science course are to

- Familiarize the fundamental aspects of environment and the environmental management'
- Provide information of some of the important international conventions which will be useful during the future endeavors after graduation.
- Make realize the importance of natural resources management for the sustenance of the life and the society.
- Apprise the impact of pollution getting generated through the anthropogenic activities on the environment
- Provide the concept of Sustainable Development, energy and environmental management
- Impart knowledge on the new generation waste like e-waste and plastic waste.

Course Outcomes

After completion of the course the students will have

- Knowledge on the fundamental aspects of environment and the environmental management
- The knowledge on the salient features of the important international conventions

- Understanding of the importance of natural resources management for the sustenance of the life and the society.
- Familiarity on various forms of pollution and its impact on the environment.
- Understand the elements of Sustainable Development, energy and environmental management
- Knowledge on the new generation waste like e-waste and plastic waste.

SYLLABUS

Introduction: Structure and functions of Ecosystems-Ecosystems and its Dynamics-Value of Biodiversity-impact of loss of biodiversity, Conservation of bio-diversity. Environmental indicators - Global environmental issues and their impact on the ecosystems. Salient features of International conventions on Environment: Montreal Protocol, Kyoto protocol, Ramsar Convention on Wetlands, Stockholm Convention on Persistent Organic Pollutants, United Nations Framework Convention on Climate Change (UNFCCC),

Natural Resources Management: Importance of natural resources management-Land as resource, Land degradation, Soil erosion and desertification, Effects of usage of fertilizer, herbicides and pesticide-watershed management.

Forest resources: Use and over-exploitation, Mining and dams – their effects on forest ecosystems and the living beings.

Water resources: Exploitation of surface and groundwater, Floods, droughts, Dams:benefits and costs.

Mineral Resources: Impact of mining on the environment and possible environmental management options in mining and processing of the minerals. Sustainable resource management (land, water, and energy), and resilient design under the changing environment.

Environmental Pollution: Local and Global Issues. Causes, effects and control measures. Engineering aspects of environmental pollution control systems.

Air pollution: impacts of ambient and indoor air pollution on human health. Water pollution: impacts water pollution on human health and loss of fresh water resources. Soil pollution and its impact on environment. Marine pollution and its impact on blue economy. Noise pollution.

Solid waste management: Important elements in solid waste management- Waste to energy concepts. Air (prevention and control of

pollution) Act, Water (prevention and control of pollution) Act and their amendments. Salient features of Environmental protection Act, 1986.

Sustainable Development: Fundamentals of Sustainable Development– Sustainability Strategies and Barriers – Industrialization and sustainable development. Circular economy concepts in waste (solid and fluid) management.

Energy and Environment: Environmental Benefits and challenges, Availability and need of conventional energy resources, major environmental problems related to the conventional energy resources, future possibilities of energy need and availability. Solar Energy: process of photovoltaic energy conversion, solar energy conversion technologies and devices, their principles, working and applications, disposal of solar panel after their usage. Biomass energy: Concept of biomass energy utilization, types of biomass energy, conversion processes, Wind Energy, energy conversion technologies, their principles, equipment and suitability in context of India.

Management of plastic waste and E-waste: Sources, generation and characteristics of various e- and plastic wastes generated from various industrial and commercial activities; Waste management practices including onsite handling, storage, collection and transfer. E-waste and plastic waste processing alternatives. E-Waste management rules and Plastic waste management rules, 2016 and their subsequent amendments.

Text Books:

1. Bharucha, Erach (2004). Textbook for Environmental Studies for Undergraduate Courses of all Branches of Higher Education, University Grants Commission, New Delhi.
2. Basu, M., Xavier, S. (2016). Fundamentals of Environmental Studies, Cambridge University Press, India
3. Masters, G. M., & Ela, W. P. (1991). Introduction to environmental engineering and science. Englewood Cliffs, NJ: Prentice Hall.
4. Enger, E. and Smith, B., Environmental Science: A Study of Interrelationships, Publisher: McGraw-Hill Higher Education; 12th edition, 2010.

Reference Books:

1. Sharma, P. D., & Sharma, P. D. (2005). Ecology and environment. Rastogi Publications
2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
3. Clark R.S. (2001). Marine Pollution, Clanderson Press Oxford (TB)

4. Jadhav, H & Bhosale, V.M. (1995). Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
5. MoEF&CC, Govt. of India, CPCB: E-waste management rules, 2016 and its amendments 2018.
6. MoEF&CC, Govt. of India, CPCB: Plastic waste management rules, 2016.

**SCHEME OF INSTRUCTION & SYLLABUS FOR
B.Tech. (CIVIL ENGINEERING), B.Tech.+M.Tech.
(CIVIL ENGINEERING)**

(effective from 2020-21 Admitted Batch)

Semester III (Second year)

Course Category	Course Title	Hours per week	Internal	External	Total	
CreditsC						
code		L T P	Marks	Marks	Marks	
CV2101	BS Mathematics-III	3 0 0	30	70	100	3
CV2102	PC Mechanics of Solids	3 0 0	30	70	100	3
CV2103	PC Fluid Mechanics-I	3 0 0	30	70	100	3
CV2104	PC Structural Analysis-I	3 0 0	30	70	100	3
CV2105	PC Concrete Technology	3 0 0	30	70	100	3
CV2106	PC Mechanics of Solids Lab	0 0 3	50	50	100	1.5
CV2107	PC Fluid Mechanics -I Lab	0 0 3	50	50	100	1.5
CV2108	PC Survey Field Work	0 0 3	50	50	100	1.5
CV2109	SC Computer Aided Drafting Tools1	0 2	50	50	100	2
CV2110	MC Environmental Science	0 0 0	-	100	100	0
Total credits					21.5	

**B.Tech. (CIVIL ENGINEERING), B.Tech.+M.Tech.
(CIVIL ENGINEERING)**

(Effective from 2020-21 Admitted Batch)

Semester IV (Second year)

Course Category	Course Title	Hours per week	Internal	External	Total	
CreditsC						
code		L T P	Marks	Marks	Marks	
CV2201	ES Environmental Engineering-I	3 0 0	30	70	100	3
CV2202	BS/PC Fluid Mechanics-II	3 0 0	30	70	100	3
CV2203	PC Hydrology and Water Resources Engineering	3 0 0	30	70	100	3
CV2204	PC Geotechnical Engineering-I	3 0 0	30	70	100	3

CV2205	HSS	Managerial Economics	3	0	0	30	70	100	3
CV2206	PC	Building Planning and Drawing	0	0	3	50	50	100	1.5
CV2207	PC	Building Materials Lab	0	0	3	50	50	100	1.5
CV2208	SC	Computer Aided Building Drawing	1	0	2	50	50	100	2
CV2209	MC	Professional Ethics & Universal Human Values	0	0	0	-	100	100	0
CV2210	MC	NCC/NSS	0	0	2	-	-	-	0
Total credits									20

Summer Internship (Community Service)

III Semester- Second Year

CV2101 MATHEMATICS – III

Course Objectives:

- The basic knowledge and applications of Vector Calculus used in Engineering problems.
- About the gradient, divergence and curl under the differentiation of scalar and vector point functions, also on Line-, Surface- and Volume integrals under the integration of point functions along with their applications in Engineering issues.
- Transformation theorems such as Green's theorem in the plane, Stoke's theorem, Gauss Divergence theorem and their applications.
- How to formulate the Partial Differential Equations from the relation between the dependent and independent variables, the methods of solving first order first degree linear, non-linear Partial Differential Equations, Homogeneous and Non homogeneous linear partial differential equations with constant coefficients .
- The procedure to find out the solutions of Partial Differential Equations by using the method of separation of variables (product method) about the formulation of one dimensional wave (string equation), one-and two-dimensional Heat flow equations, Laplace's equation in Cartesian and polar coordinates, and how to solve these equations using the method of separation of variables.
- The concept of integral transforms, namely, Fourier transforms, Fourier Sine, Cosine and related inversetransforms, and their applications in solving several Physical and Engineering problems.

Course Outcomes:

- operate the differential operator 'del' to the scalar and vector point functions, Calculate the Gradient, Divergence and Curl, Vector normal to a

surface, maximum rate of change of a scalar field, test whether two surfaces are to cut orthogonally or not .

- find the rate per unit volume at which the physical quantity is issuing from a point, the rate of inflow minus out flow using the Divergence and the angular velocity of rotation at any point of the vector field using the Curl.

- test whether the given motion is irrotational or rotational, whether a vector force acting on a particle is conservative or not

- find out the potential function from a given vector field.

- obtain the well known Laplace and Poisson equations from an irrotational field

- understand to determine the work done by a force field and circulation using a Line integral

- find out the Line, Surface and Volume integrals, find flux using surface integral and volumes using the volume integral.

- apply the vector integral theorems (Green's theorem in the plane, Stoke's and Divergence theorems) for evaluating the double and triple integrals as these are used to find areas and volumes.

- know the methods of solving Linear and Non linear first order and first degree partial differential equations.

- solve the Linear Partial Differential Equations with constant coefficients (homogeneous and non homogeneous) and know the procedure for finding the complementary function and particular integrals

- apply the method of separation of variables to obtain solutions to the boundary value problems involving Linear partial differential equations occurred in engineering studies

- solve wave equation, heat flow equation and the Laplace's equations in Cartesian and polar coordinates using the method of separation of variables.

- apply and extend the knowledge of Fourier transform techniques in solving several Initial and Boundary value problems of Engineering, such as in Conduction of heat / Thermodynamics, Hydraulics transverse vibrations of a string, oscillations of an elastic beam, bending of beams, electrical circuits, free and forced vibrations of a membrane and transmission lines , etc.

SYLLABUS

Unit-I : (VECTOR CALCULUS-DIFFERENTIATION) : Differentiation of vectors, curves in space, velocity and acceleration, relative velocity and relative acceleration, scalar and vector point functions, vector operator ∇ applied to scalar point functions- gradient, ∇ applied to vector point functions- divergence and curl. Physical interpretation of gradient, divergence and curl (i.e.,), Irrotational and Solenoidal fields, the relations

obtained after ∇ applied twice to point functions, ∇ applied to products of two functions.

Unit-II : (VECTOR INTEGRATION) : Integration of vectors, line integral, circulation, work done, surface integral-flux, Green's theorem in the plane, Stoke's theorem, volume integral, Gauss Divergence theorem. (All theorems without proofs) Introduction of orthogonal curvilinear coordinates, cylindrical and spherical polar coordinates

Unit-III : (PARTIAL DIFFERENTIAL EQUATIONS) : Formation of partial differential equations, solutions of partial differential equations- equations solvable by direct integration, linear equations of first order: Lagrange's Linear equation, non-linear equations of first order, Charpit's method. Homogeneous linear equations with constant coefficients- rules for finding the complementary function, rules for finding the particular integral (working procedure), non- homogeneous linear equations.

Unit-IV : (APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS) : Method of separation of variables, One dimensional wave equation- vibrations of a stretched string, one dimensional Heat flow equation, Two dimensional heat flow in steady state - solution of Laplace's equation in Cartesian and polar coordinates (two dimensional).

Unit-V : (INTEGRAL TRANSFORMS (Fourier Transform) : Introduction, definition, Fourier integral, Sine and Cosine integrals, Complex form of Fourier integral, Fourier transform, Fourier Sine and Cosine transforms, Finite Fourier Sine and Cosine transforms, properties of Fourier transforms.

Convolution theorem for Fourier transforms, Parseval's identity for Fourier transforms, Fourier transforms of the derivatives of a function, simple applications to Boundary value problems.

TEXT BOOKS:

Scope and treatment as in "Higher Engineering Mathematics", by Dr. B.S.Grewal, **43rd Edition**, Khanna Publishers.

REFERENCE BOOKS:

1. Graduate Engineering Mathematics by V B Kumar Vatti, I.K.International publications

2. Advanced Engineering Mathematics by Erwin Kreyszig.

3. A text book of Engineering Mathematics by N.P. Bali and Dr. Manish Goyal, Lakshmi Publications.

4. Mathematical Methods of Science & Engineering aided with MATLAB by Kanti B.Dutta, Cengage Learning India Pvt. Ltd.

5. Higher Engineering Mathematics by B. V. Ramana, Tata McGraw Hill Company.

6. Advanced Engineering Mathematics by H.K.Dass. S.Chand Company.

CV2102 MECHANICS OF SOLIDS

Course Objectives:

- The student can understand the concepts of stress and strain by analysis of solids.
- The student can understand the engineering properties of materials, force-deformation, and stress-strain relationships.
- The student can understand the determinate and indeterminate members, and beams, torque, shear forces, and bending moments.
- The student can understand the combined bending and direct stresses on column and strut members, axial load on open and closed coiled helical spring subjected to axial load.

Course Outcomes:

- The students will have a clear and thorough understanding of the fundamental concepts of stress and strain analysis of solids.
- The students will have the ability to understanding the properties of materials, force-deformation, and stress-strain relationships.
- The students will have a clear and through understanding of determinate and indeterminate members, torque, shear forces and bending moments.
- The students will have a clear and through understanding of the combined bending and direct stresses on column and strut members.

SYLLABUS

Duties/Obligations Accountability of Structural Engineer for the Design of a Structure: a) Economy b) Safety: (i) Strength Consideration (ii) Stiffness Consideration. Need for Assessment of Strength of a Material – Analysis for Strength Requirement for Design Purposes – Review of IS Code Provisions.

Effects of Force: Tension, Compression and Shear. Stress as Internally Elastic Resistance of a Material – Strain – Property of Elasticity – Hooke's Law – Stress-Strain Diagrams. Characteristic Strengths, Factors of Safety and Working Stresses for Materials and Various Types of Application of Load. Elastic Strain – Energy, Stress due to Gradually Applied Load, Sudden Load, Impact Load and Shock Load. Lateral Strain, Poisson's Ratio. Complementary Shear Stress, Shear Strain, Shear Modulus. Relation between Modulus of Elasticity, Modulus of Rigidity and Bulk Modulus. Stresses in Composite Assemblies due to Axial Load and Temperature Change.

Effect of Transverse Force, Shear Force, Bending Moment and Axial Thrust Diagrams for A) Cantilever B) Simply Supported and C) Over Hanging Beams for various patterns of Loading. Relation between (i) Intensity of Loading (ii) Shear Force and (iii) Bending Moment at a Section.

Theory of Simple Bending: Flexural Normal Stress Distribution; Flexural Shear Stress Distribution for Various Shapes of Cross Section.

Stresses on Oblique Plane – Resultant Stress – Principal Stress and Maximum Shear Stress and Location of their Planes. Mohr's Circle for Various Cases of Stresses; Theory of Pure Torsion for Solid and Hollow Circular Sections – Torsional Shear Stress Distribution, Effect of Combined Torsion, Bending and Axial Thrust – Equivalent B.M and T.M.

Longitudinal and Hoop stresses in Thin Cylinders subjected to Internal Pressure. Wire Wound Thin Cylinders. Thick Cylinders – Lamme's Theory, Compound Tubes – Theory of Failure (i) Principal Stress Theory, (ii) Principal Strain Theory, (iii) Maximum Shear Stress Theory and (iv) Maximum Strain Energy Theory.

Columns and Struts: Combined Bending and Direct Stresses – Kern of a Section – Euler's Theory – End Conditions. Rankine-Gordon Formula – Eccentrically Loaded Columns. Open and Closed Coiled Helical Springs subjected to Axial Load.

Text books

1. Strength of materials by S.Ramamrutham and R.Narayana, Dhanpat Rai Publishing Company, New Delhi.
2. Mechanics of Materials by B.C.Punmia, Ashok Kumar Jain, Arun Kumar Jain, Lakshmi Publications.
3. Analysis of Structures, Vol. I, 1993 edition, by V.N.Vazirani and M.M.Ratwani, Khanna Publishers Books.

Reference Books

1. Strength of Materials (Elementary Theory and Problems) by S.Timoshenko and D.H.Young, CBS Publishers & Distributors Pvt. Ltd.
2. Introduction to Mechanics of Solids by Popov, Prentice-Hall.
3. Strength of Materials by Hyder, Universities Press.
4. Elementary Mechanics of Solids by P.N. Singer and P.K.Jha, New Age International Publishers.

CV2103 FLUID MECHANICS-I

Course Objectives:

1. To apply the fundamental laws of fluid mechanics to different problems.
2. To convert the units and solve the basic problems related to fluid properties.
3. To estimate velocities, accelerations, streamlines, velocity potential and applications of continuity equation.
4. To estimate rate of flow rate in flow through pipes, tanks and channels using energy principle.

Course Outcomes:

On completion of the course, the students will be able to:

1. Define fundamental concepts of fluid mechanics as applied to civil engineering and environmental problems.
2. Discuss and derive the fundamental mathematical equations of fluid mechanics.
3. Solve the problems of water conveyance in pipes, orifices, mouthpieces, notches and weirs.
4. Apply conservation laws to derive governing equations of fluid flows.

SYLLABUS

Fluid Properties and Fluid Statics: Introduction & Physical Properties of Fluids – Definition of Fluid, Fluid as Continuum; Mass Density, Specific Weight, Specific Gravity, Specific Volume, Bulk Modulus, Compressibility, Vapour Pressure, Cavitation, Viscosity – Newton's Law of Viscosity, Rheological Diagram ; Capillarity and Surface Tension.

Fluid Statics, Pressure and its Measurement – Forces acting on a Fluid Element – Pascal's law; Variation of Pressure in Static Fluid; Absolute, Gauge and Total Pressure; Pressure Measurement – Piezometers, Manometers, Micro-manometers, Mechanical Gauges and Pressure Transducers.

Forces on Immersed Bodies in Static Fluids – Force on a Plane Surface – Centre of Pressure; Pressure Diagram; Forces on Curved Surfaces; Forces on Radial Crest Gates and Lock Gates.

Buoyancy and Floatation – Archimedes Principle; Stability of Floating Bodies – Centre of Buoyancy, Metacentric Height and its determination.

Fluid Kinematics and Conservation of Mass: Types of Fluid Flow & Methods of Fluid Flow Analysis – Methods of Describing Fluid Motion; Types of Flow – Steady and Unsteady Flows, Uniform and Non-uniform Flows, free and forced vortex motions, Laminar and Turbulent Flows; Streamline, Path line, Streak line; Stream Surface – Stream Tube.

Fluid Kinematics – Translation, Deformation and Rotation of a Fluid Element in Motion; Local, Convective and Total Accelerations; One, Two and Three Dimensional Analysis of Flows.

Ideal Fluid Flow – Stream Function, Velocity Potential; Rotational & Irrotational Flows – Vorticity and Circulation; Laplace Equation in terms of Stream Function and Velocity Potential; Flow Nets.

Principle of Conservation of Mass – Concepts of System and Control Volume; Continuity Equation in three dimensional Cartesian coordinates; Continuity Equation for flow through a Stream tube.

Fluid Dynamics: Principle of Conservation of Energy – Equation of Motion for Ideal Fluids, Euler's Equation in Streamline Coordinates, Derivation of Energy Equation through integration of Euler's Equation, Bernoulli's Equation, Energy Correction Factor. Flow measuring devices – Flow Measurement in Pipes – Measurement of Static, Stagnation and Dynamic Pressures and Velocity – Pitot Tube, Prandtl Pitot Tube; Measurement of Discharge through a Pipe using Flow Meters – Venturimeter, Flow Nozzle meter and Orifice meter.

Flow through Tanks and Reservoirs – Measurement of Discharge from Tanks and Reservoirs – Steady and Unsteady Flow through Orifices and Mouthpieces – Small & Large Orifices – Different types of Mouthpieces; Discharge from tanks through Drowned Orifices, Time of Emptying Tanks, Discharge from a Tank with Inflow.

Flow Measurement in Channels – Flow Measurement in Open Channels, Flow Past Weirs and Notches, Sharp Crested and Broad Crested Weirs, Weirs with and without end contractions, Ventilation of Weirs, Triangular Notches, Cipolletti Weir.

Principle of Conservation of Momentum – Momentum of Fluids in Motion, Impulse Momentum Equation, Momentum Correction Factor. Application of Momentum Principle – Forces on Pipe Bends and Reducers, Flow through a Nozzle; Angular Momentum of Fluid Flow – Sprinkler Problems.

Laminar flow: Equation of Motion for Real Fluids – Modifications in Equation of Motion, Stress Strain Relationships, Tangential Stress Terms.

Steady Flow between Parallel Plates, Couette's and Poiseuille's Flows; Axisymmetric Flows, Flow without and with Pressure Gradient – Hagen-Poiseuille Equation; Relationship between Friction factor and Reynolds Number for Laminar Flow through Pipes; Stokes' law.

Text Books

1. Fluid Mechanics and Hydraulic Machinery by P.N.Modi and S.M. Seth, Standard Book House.
2. Fluid Mechanics by A.K.Jain, Khanna Publishers.

Reference Books

1. Engineering Fluid Mechanics by K.L.Kumar, S. Chand & Co.Ltd.
2. Engineering Hydraulics, H.Rouse, John Wiley & Sons Inc.
3. Mechanics of Fluids, I.H.Shames, McGraw-Hill Professional.

CV2104 STRUCTURAL ANALYSIS-I

Course Objectives:

- The student can understand the concepts analysis of deflection of beams and strain energy due to external load.

- The student can understand the concepts of deflection of statically determinate portal frames.
- The student can understand the concepts of shear force and bending moments due to moving loads on simple members.
- The student can understand the concepts of shear force and bending moments due to moving loads on truss members.

Course Outcomes:

- The students will have a clear and thorough understanding of the deflection of beams and strain energy due to external load.
- The students will have a clear and thorough understanding the concepts of deflection of statically determinate portal frames.
- The students will have a clear and thorough understanding the concepts of shear force and bending moments due to moving loads on simple members.
- The students will have a clear and thorough understanding the concepts of shear force and bending moments due to moving loads on truss members.

SYLLABUS

Deflections of Beams: (i) Cantilever (ii) Simply Supported and (iii) Over Hanging Beams, using (a) Double Integration and (b) Macaulay's Method.

Deflections of Beams Using (i) Moment Area Method, (ii) Conjugate Beam Method, (iii) Unit Load Method (iv) Castigliano's Theorem – 1.

Strain – Energy due to (i) Axial Load, (ii) Shear Force, (iii) Bending Moment and (iv) Torque;

Deflections of Statically Determinate Structures: (A) Single Storey, Single Bay Rectangular Portal Frames using (i) Unit Load Method, (ii) Castigliano's Theorem – 1. (B) Trusses (Having 9 Members or less) using (i) Unit Load Method and (ii) Castigliano's Theorem-1.

Analysis of (A) Fixed Beams, (B) Three Span Continuous Beams using (i) Theorem of Three Moments, (ii) Slope Deflection Method and (iii) Moment Distribution Method

Moving Loads: Maximum Shear Force and Bending Moment Diagrams for Different types of Loads. Maximum Bending Moment at a Section under a Wheel Load and Absolute Maximum Bending Moment in the case of several Wheel Loads. Equivalent Uniformly Distributed Live Load for Shear Force and Bending Moment. Reversal of Nature of Shear Force, Focal Length, Counter Bracing for Truss Panels, Influence Lines for (i) Beams and (ii) Members of Warren and Pratt Trusses.

Text books

1. Theory of Structures, Vol- I, by G.S.Pundit, S.P.Gupta and R.Gupta, McGraw-Hill Education India.

2. Mechanics of structures Vol- I by H.J.Shah and S.B.Junnarkar, Charotar Publishing House.

3. Strength of Materials by S.Ramamrutham and R.Narayanan, Dhanpat Rai Publishing House.

Reference Books

(1) Elementary Strength of Materials by S.Timoshenko and D.H.Young, Affiliated East-West Press.

(2) Analysis and Design of Structures Vol-I by V.N.Vazirani and M.M.Ratwani, Khanna Publishers.

(3) Intermediate Structural Analysis by C.K.Wang, McGraw-Hill.

(4) Strength of Materials by B.C.Punmia, Laxmi Publications.

CV2205 CONCRETE TECHNOLOGY

Course Objectives:

- The student can understand the concepts of application of chemical and mineral admixtures in concrete.
- The student can understand the concepts of dimensional stability, durability, creep and relaxation of concrete.
- The student can understand the concepts of design mix of concrete as per Indian Standards.
- The student can understand the concepts of properties and application of special concrete.

Course Outcomes:

- The students will have a clear and thorough understanding concept of application of chemical and mineral admixtures in concrete.
- The students will have a clear and thorough understanding the concepts of dimensional stability, durability, creep and relaxation of concrete.
- The students will have a clear and thorough understanding the concepts of design mix of concrete as per Indian Standards.
- The students will have a clear and thorough understanding the concepts of properties and application of special concrete.

SYLLABUS

Chemical and Mineral Admixtures: Water Reducers, Air Entrainers, Set Controllers, Special Admixtures – Structure, Properties and effects on Concrete Properties. Introduction to Supplementary Cementing Materials and Pozzolans – Fly ash, Blast Furnace Slag, Silica Fume, and Metakaolin–

their Production, Properties, and Effects on Concrete Properties; Other Mineral Additives –Reactive and Inert.

Dimensional Stability and Durability: Creep and Relaxation – Parameters Affecting; Shrinkage of Concrete –Types and Significance. Parameters affecting Shrinkage; Measurement of Creep and Shrinkage.

Durability of Concrete: Introduction to Durability; Relation between Durability and Permeability – Chemical Attack of Concrete; Corrosion of Steel Rebars; other Durability Issues.

Mix Design: Review of Methods and Philosophies of IS, BS and ACI Methods, Mix Design for Special Purposes. Acceptance Criteria for Compressive Strength of Concrete

Special Concretes: Properties and Applications of High Strength –High Performance Concrete, Reactive Powder Concrete, Lightweight, Heavyweight and Mass Concrete; Fibre Reinforced Concrete; Self-compacting Concrete; Shotcrete.

Text Book

1. Concrete Technology Theory and Practice by M.S.Shetty, S.Chand & Company Ltd, New Delhi.

Reference Books

1. Properties of Concrete by A.M.Neville, Longman 1995.
2. Concrete micro-structure, Properties and Materials by P.K.Mehta, J.M.Monteiro, Printice Hall INC & McGraw-Hill, USA.

2106 MECHANICS OF SOLIDS LAB

Course Objectives:

- The student can understand the concepts of application of tension test on steel materials.
- The student can understand the concepts of compression and buckling of wood members.
- The student can understand the concepts of hardness of different materials.
- The student can understand the concepts of bending of different materials for different end conditions.

Course Outcomes:

- The students will have a clear and thorough understanding of the tension test on steel materials.
- The students will have a clear and thorough understanding the concepts of compression and buckling of wood members.
- The students will have a clear and thorough understanding the concepts of hardness of different materials.

- The students will have a clear and thorough understanding the concepts of bending of different materials for different end conditions.

SYLLABUS

- (1) Tension Test on Mild steel/HYSD bars
- (2) Compression Test on Wood (Parallel and Perpendicular to Grains)
- (3) Tests on Springs for the Determination of Rigidity Modulus and Spring Constant
- (4) Brinell's and Rockwell Hardness Tests
- (5) Charpy and Izod Impact Tests
- (6) Double Shear Test on Mild Steel Specimen
- (7) Bending Test: Load Deflection Test for the Determination of Young's Modulus on Simply Supported and Cantilever Beams of Wood and Steel
- (8) Buckling of Wooden Column

CV2107 FLUID MECHANICS-I LAB

Course Objectives:

- To impart knowledge in measuring pressure, discharge and velocity of fluid flow
- To understand the flow measurement in tanks
- To determine the metacentric height of a floating body
- To determine the flow measurement in pipe flow
- To measure the discharge in a open channel flow
- To learn and practice writing technical reports

Course Outcomes:

On completion of the course, the students will be able to:

- Conduct experiments (in teams) in pipe flows and open-channel flows and interpreting data from model studies to prototype cases, as well as documenting them in engineering reports.
- Analyze a variety of practical fluid-flow devices and utilize fluid mechanics principles in design.
- To provide exposure to modern computational techniques in fluid mechanics.

List of experiments:

1. Study of Small Orifice by Constant Head Method and Time of Emptying a Tank through a Small Orifice.
2. Study of Cylindrical Mouthpiece by Constant Head Method and Time of Emptying a Tank through a Cylindrical Mouthpiece.

3. Determination of Metacentric Height of Floating Body.
4. Study of Surface Profiles in Free and Forced Vortex Motions.
5. Study of Venturimeter.
6. Study of Orifice meter.
7. Study of Flow Nozzle Meter.
8. Study of Sharp-crested Full Width and Contracted Weirs.
9. Study of V-Notch and Trapezoidal Notch.
10. Study of Broad-crested Weir.

CV2108 SURVEYING FIELD WORK

Course Objective

- To train the students in the usage of total station and other surveying instruments like compass, dumpy level, theodolite etc.
- To enhance the students ability to conduct survey work in large extent of area using Global positioning system.
- To enable the students to work on the Earth's natural terrain and mould it to the required datum surface.

Course outcomes:

- The students can conduct any extent of field work using Total station.
- The students will be in a position to fix the alignment of any route such as laying pipelines, railways, highways etc.
- The student can precisely assess the suitability of the different techniques of surveying appropriately.

SYLLABUS

- 1) Chain traversing: Plotting a chain traverse for a building.
- 2) Compass traversing: Measurement of bearings and determination of inaccessible distance using a compass.
- 3) Levelling: Determination of reduced levels of different points by Height of Instrument method and Rise & Fall method.
- 4) Theodolite traversing: Measurement of horizontal angles by Reiteration method and repetition method, Determination of inaccessible distance using a theodolite, Heights and Distances using vertical and horizontal angles.
- 5) Point positioning using GPS
- 6) Total station exercises:
 - i) Contour mapping using total station.
 - ii) Height of remote point using total station.

- iii) Position of hidden point using total station
- iv) Area & volume measurement using total station.

CV2109 COMPUTER AIDED DRAFTING TOOLS

Course Objective

To teach the students how to use computer aided drafting tools to produce 2D and 3D working drawings. The students will be shown how to create a new drawing, edit an existing drawing and also how to plot a drawing to a suitable printer or plotter.

Course outcomes

- Sketching and taking field dimensions.
- Transform data into graphic drawings.
- Know basic engineering drawing formats.
- Acquire skills to draw 2D and 3D drawings

SYLLABUS

Introduction: Introduction to computer drafting tools, Coordinate system, Setting up a drawing starting from scratch, Setting up a drawing using a Wizard, Using and creating a template file, Opening an existing drawing, saving a drawing file, Screen layout, Pull-down menus, Screen icons, Command line, Status bar, Dialogue boxes

2D Drawing: Point, Line, Ray, Construction Line, Multiline and Polylines, Rectangles, Arc, Circle and Ellipse, Polygon, Spline, etc. 2D Editing: Trim, Extend, Lengthen, Break, Move, Copy, Scale, Stretch, Mirror, Rotate, Fillet, Chamfer, Array, Hatch and gradient, Object snap, Direct distance entry, Polar tracking, Object snap tracking, Dynamic input, Properties, etc.

Layers and Text creation: Creating Layers, Text (multi-line & single line) and Formatting Text Styles

Dimension Command Formatting Dimension Style and Multi-leader Style, Drawing Settings and Aids,

Saving and Plotting : 3D Drawing: Introduction, 3D Coordinate system, UCS, 3D Orbit, Box, Wedge, Cone, Sphere, Cylinder, Torus, Helix, Loft, Revolve

Editing with 3D Space: Union, Subtract, Intersect, Extrude faces, Move faces, Rotate faces, Offset faces, Taper faces, Delete faces, Copy faces

CV2110 ENVIRONMENTAL SCIENCE

(Common for all Branches)

Course Objectives

The objectives of the Environmental Science course are to

- Familiarize the fundamental aspects of environment and the environmental management'
- Provide information of some of the important international conventions which will be useful during the future endeavors after graduation.
- Make realize the importance of natural resources management for the sustenance of the life and the society.
- Apprise the impact of pollution getting generated through the anthropogenic activities on the environment
- Provide the concept of Sustainable Development, energy and environmental management
- Impart knowledge on the new generation waste like e-waste and plastic waste.

Course Outcomes

After completion of the course the students will have

- Knowledge on the fundamental aspects of environment and the environmental management
- The knowledge on the salient features of the important international conventions
- Understanding of the importance of natural resources management for the sustenance of the life and the society.
- Familiarity on various forms of pollution and its impact on the environment.
- Understand the elements of Sustainable Development, energy and environmental management
- Knowledge on the new generation waste like e-waste and plastic waste.

SYLLABUS

Introduction: Structure and functions of Ecosystems-Ecosystems and its Dynamics-Value of Biodiversity-impact of loss of biodiversity, Conservation of bio-diversity. Environmental indicators - Global environmental issues and their impact on the ecosystems.

Salient features of International conventions on Environment: Montreal Protocol, Kyoto protocol, Ramsar Convention on Wetlands, Stockholm Convention on Persistent Organic Pollutants, United Nations Framework Convention on Climate Change (UNFCCC),

Natural Resources Management: Importance of natural resources management-Land as resource, Land degradation, Soil erosion and desertification, Effects of usage of fertilizer, herbicides and pesticide-watershed management.

Forest resources: Use and over-exploitation, Mining and dams – their effects on forest ecosystems and the living beings.

Water resources: Exploitation of surface and groundwater, Floods, droughts, Dams:benefits and costs.

Mineral Resources: Impact of mining on the environment and possible environmental management options in mining and processing of the minerals.

Sustainable resource management (land, water, and energy), and resilient design under the changing environment.

Environmental Pollution: Local and Global Issues. Causes, effects and control measures. Engineering aspects of environmental pollution control systems.

Air pollution: impacts of ambient and indoor air pollution on human health. Water pollution: impacts water pollution on human health and loss of fresh water resources. Soil pollution and its impact on environment. Marine pollution and its impact on blue economy. Noise pollution.

Solid waste management: Important elements in solid waste management- Waste to energy concepts. Air (prevention and control of pollution) Act, Water (prevention and control of pollution) Act and their amendments. Salient features of Environmental protection Act, 1986. Sustainable Development: Fundamentals of Sustainable Development– Sustainability Strategies and Barriers – Industrialization and sustainable development. Circular economy concepts in waste (solid and fluid) management.

Energy and Environment: Environmental Benefits and challenges, Availability and need of conventional energy resources, major environmental problems related to the conventional energy resources, future possibilities of energy need and availability. Solar Energy: process of photovoltaic energy conversion, solar energy conversion technologies and devices, their principles, working and applications, disposal of solar panel after their usage. Biomass energy: Concept of biomass energy utilization, types of biomass energy, conversion processes, Wind Energy, energy conversion technologies, their principles, equipment and suitability in context of India.

Management of plastic waste and E-waste: Sources, generation and characteristics of various e- and plastic wastes generated from various industrial and commercial activities; Waste management practices including onsite handling, storage, collection and transfer. E-waste and plastic waste processing alternatives. E-Waste management rules and Plastic waste management rules, 2016 and their subsequent amendments.

Text Books:

1. Bharucha, Erach (2004). Textbook for Environmental Studies for Undergraduate Courses of all Branches of Higher Education, University Grants Commission, New Delhi.

2. Basu, M., Xavier, S. (2016). Fundamentals of Environmental Studies, Cambridge University Press, India

3. Masters, G. M., & Ela, W. P. (1991). Introduction to environmental engineering and science. Englewood Cliffs, NJ: Prentice Hall.

4. Enger, E. and Smith, B., Environmental Science: A Study of Interrelationships, Publisher: McGraw-Hill Higher Education; 12th edition, 2010.

Reference Books:

1. Sharma, P. D., & Sharma, P. D. (2005). Ecology and environment. Rastogi Publications

2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.

3. Clark R.S. (2001). Marine Pollution, Clanderson Press Oxford (TB)

4. Jadhav, H & Bhosale, V.M. (1995). Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.

5. MoEF&CC, Govt. of India, CPCB: E-waste management rules, 2016 and its amendments 2018.

6. MoEF&CC, Govt. of India, CPCB: Plastic waste management rules, 2016.

IV Semester- Second Year

CV2201 ENVIRONMENTAL ENGINEERING – I

Course Objectives:

- Outline planning and the design of water supply systems for a community/town/city.
- Provide knowledge of water quality requirement for domestic usage.
- Understanding of importance of protection of water source quality and enlightens the efforts involved in converting raw water into clean potable water.
- Selection of valves and fixture in water distribution systems.
- Impart knowledge on design of water distribution network.
- Visit at least one Water Treatment Plant and supply system.

Course Outcomes:

- Plan and design the water and distribution networks and sewerage systems.
- Identify the water source and select proper intake structure.

- Design & estimation of water supply system of an apartment.
- Select the appropriate appurtenances in the water supply.
- Selection of suitable treatment flow for raw water treatments.

SYLLABUS

Introduction: Importance and Necessity of Protected Water Supply systems, Water borne diseases, Planning of public water supply system, components of public water supply systems. Per capita demand and factors influencing it, types of water demands and its variations, factors affecting water demand, Design Period, Factors affecting the Design period, estimation of water demand for a town or city, Population Forecasting.

Sources of Water: Various surface and subsurface sources considered for water supply and their comparison- Capacity of storage reservoirs, Types of subsurface water bearing formations, Yields from wells and infiltration galleries. Conveyance of Water from the source to the point of interest: Gravity and Pressure conduits, Types of Pipes, Pipe Materials, selection of pipe materials, Pipe joints.

Quality and Analysis of Water: Characteristics of water and their measurement or estimation or analysis: Physical, Chemical and Biological characteristics. Water quality criteria for different uses- Rural, Municipal, Industrial and Agricultural uses. Drinking water quality standards: IS and WHO guidelines.

Treatment of Water: Typical treatment flow of a municipal water treatment plant, Unit operations of water treatment: Theory and Design of Sedimentation, Coagulation, flocculation, Filtration, Water conditioning and softening, Disinfection, Removal of color and odors – Removal of Iron and manganese – Fluoridation and defluoridation – Ion Exchange - Ultra filtration- Reverse Osmosis.

Distribution of Water: Requirements- Methods of Distribution system, Layouts of Distribution networks, Pressures in the distribution layouts, Analysis of Distribution networks: Hardy Cross and equivalent pipe methods – Appurtenances of water distribution system – Laying and testing of pipe lines. Ideal water supply system.

TEXT BOOKS

1. Environmental Engineering – Howard S. Peavy, Donald R. Rowe, George George Tchobanoglous – Mc-Graw-Hill Book Company, New Delhi, 1985.

2. Water Supply Engineering. Dr. P.N. Modi, Standard Book House, Delhi.

3. Rural, Municipal and Industrial Water management, KVSG Murali Krishna, Reem Publications, New Delhi, 2012

REFERENCES

1. Elements of Environmental Engineering – K.N. Duggal, S. Chand & Company Ltd., New Delhi.
2. Water Supply Engineering.– Dr. B.C. Punmia, A.K. Jain and A.K. Jain. LaxmiPublicatgins(P) Ltd., NewDelhi.
3. Water Supply and Sanitary Engineering – G.S.Birdie and J.S.Birdie

CV2202 Fluid Mechanics-II

Course Objectives:

- To develop an understanding of fluid flow patterns and learns to use boundary layer theory application.
- To study in detail about drag and lift characteristics of immersed bodies.
- To understand the concepts of turbulent flows and their analysis in pipe flows.
- Design pipeline distribution network systems.
- To classify the types of flows in open channel and also to design open channel sections in a most economical fashion with minimum wetted perimeter and learn about critical flows.
- To study about non uniform flows in open channel and longitudinal slopes in open channel and also to learn about the characteristics of hydraulic jump.

Course Outcomes:

On completion of this course, the student will be able to get,

- Ability to analyse the boundary layer characteristics and concepts of drag and lift.
- Ability to deal with the design aspects of turbulent flow analysis in pipes.
- Ability to calculate discharge carrying capacity of open channels and design of most economical channel sections.
- Ability to calculate water surface profiles in open channels, hydraulic jump analysis.

SYLLABUS

Navier-Stokes Equations (No Derivation), Boundary Layer Theory: Theory of Boundary Layer – Characteristics of Laminar Boundary Layer – Boundary Layer growth over a Flat Plate (without pressure gradient) – Boundary Layer Thickness and its Characteristics – Displacement, Momentum and Energy Thicknesses; Stability Parameter; Laminar and Turbulent boundary layers.

Boundary Layer Separation – Mechanism of Separation, Control of B.L. Separation; Boundary Layer on Rough Surfaces – Laminar Sub layer, Shear Friction Velocity; Friction Drag.

Turbulent Flow: Critical Reynolds Number – Characteristics of Turbulent Flow – Mean and Fluctuating Components of Velocity. Shear Stress due to Turbulence –Velocity distribution for Hydro dynamically Smooth and Rough Pipes; Friction Factor for Commercial Pipes – Moody's diagram.

Flow through Pipes: Introduction to Pipe Flow and Laws of Friction – Reynolds Experiment; Steady Turbulent Flow through Pipes; Laws of Friction; Darcy-Weisbach Equation. Total Energy and Hydraulic Gradient – Energy and Hydraulic Gradient Lines; Minor Losses in Pipes; Pipes in Series and Parallel – Equivalent Length of Pipe.

Flow Between Two Reservoirs; Three Reservoir Problems; Distribution Mains; Working Pressures, Design Pressure And Test Procedures; Choice Of Pipe Material; Siphon; Pipe Network Analysis By Hardy–Cross Method; Hydraulic Power Transmission Through Pipes And Nozzles, Water Hammer (Only Concept).

Drag, Lift & Propulsion: Concepts of Drag and Pressure Distribution over Immersed Bodies – Drag and Lift – Deformation Drag, Friction Drag, Form Drag – Drag coefficient.

Distribution of Fluid Pressure on Immersed Bodies – Pressure Distribution for Flow Past a Circular Disk, Sphere; Distribution of Pressure for Two Dimensional Flow Past a Cylinder – von Kármán Vortex Trail, Eddy Shedding; Drag of Immersed Bodies – Variation of Drag Coefficient with Reynolds Number for sphere and cylinder; Drag Coefficient of Practical Bodies.

Lift and Propulsion – Effect of Circulation in Irrotational Flow, Generation of Lift around a Cylinder, Magnus Effect.

Open Channel Flows: Basic Concepts – Introduction, Classification of Open Channels – Classification of Flow; Channel Geometry – Geometric Elements of a Channel Section; Velocity Distribution in a Channel Section; Wide Open Channel; Measurement of Velocity; Velocity Distribution Coefficients; Pressure Distribution in a Channel Section – Effect of Slope on Pressure Distribution; Basic Equations – Chezy's Equation, Manning's Equation.

Uniform Flow Computation; Conveyance of a Channel Section – Section Factor and Hydraulic Exponent. Flow Characteristics in a Closed Conduit with Open Channel Flow; Determination of Normal Depth and Velocity; Design of Channels for Uniform Flow; Design of Non-erodible Channels; Best Hydraulic Section; Determination of Section Dimensions for Uniform Flow; Most Economical Channel Sections – Rectangular,

Trapezoidal, Circular and Critical Flow – Computation of Critical Flow, Section Factor for Critical Flow.

Application of Energy Principle in Open channels – Definition of Specific Energy, Specific Energy Diagram, Critical depth, Critical Velocity, Conjugate or Alternate Depths, Sub-critical, Critical and Super-critical Flows, Froude Number, Relationship between Critical depth and Specific Energy for Rectangular Section; Application of Momentum Principle in Open channels – Specific Force; Canal Transitions – Change of Depth in Channels with Change in Cross-section and Hump in the Bed; Control Sections; Venturi Flume and Parshall Flume.

Varied Flow in Open Channels: Analysis & computation of G.V.F: Definition of G.V.F. and Derivation of Governing Equation – Mild, Steep, Critical, Horizontal and Adverse Slopes – Backwater and Drawdown Curves – G.V.F. Profiles for Channels with Changing Slopes; Computation of G.V.F. Profiles – Method of Direct Integration (Procedures only), Direct Step Method – Computation of G.V.F. Profiles in rectangular channels using Direct and Single Step methods (Simple mild slope cases only).

Rapidly Varied Flow – Hydraulic Jump, Types of Jumps, Hydraulic Jump in Horizontal Rectangular Channels; Surges.

Text Books

1. Fluid Mechanics and Hydraulic Machinery by P.N.Modi and S.M. Seth, Standard Book House.
2. Flow in Open Channels by K.Subramanya, Tata McGraw-Hill Publishing Co. Ltd.

Reference Books

1. Fluid Mechanics by A.K.Jain, Khanna Publishers.
2. Engineering Fluid Mechanics by K.L.Kumar, S. Chand & Co.Ltd.
3. Flow through Open Channels by K.G.Ranga Raju, Tata McGraw-Hill Publishing Co. Ltd.
4. Open Channel Hydraulics by V.T.Chow, McGraw-Hill Ltd.

CV2203 HYDROLOGY AND WATER RESOURCES ENGINEERING

Course Objectives:

- To build knowledge in hydrology and hydraulics and understanding of water resources systems.
- To develop skills in the ground water flow, type of aquifer and yield from the well.
- To provide the knowledge of design of reservoir operation, sedimentation and flood routing techniques.
- To develop the skills in modeling of flood flows and flood routing.

- To study the effect, causes and remedial measures of water logging and canal systems.

Course Outcomes:

On completion of the course, the students will be able to:

- Demonstrate the concepts of hydrograph, S-hydrograph, Unit hydrograph and IUH
- Analysis of ground water flow hydraulics along with rain water harvesting methods.
- Demonstrate the basic types of irrigation, irrigation standards and crop water assessment.
- Identify various types of reservoirs and their design aspects along with flood routing techniques.
- Design aspects of canal systems and water logging remedies.

SYLLABUS

Introduction to Hydrological Aspects: Water Resources in India, Hydrology in Water Resources Planning – Hydrologic Planning –Water Budget Equation; Climate and Weather – Importance of Monsoon Rains, Clouds, Storms and Precipitation – Precipitation – Types, Measurement of Rainfall; Influence and Feedbacks of Hydrological Changes Due to Climate Change; Average Depth of Rainfall over an Area, Mean Annual Rainfall, Analysis of Rainfall Data – Consistency of Rainfall Record, Double Mass Curve, Depth –Intensity, Depth-Area-Duration Curves, Frequency of Point Rainfall – Intensity-Duration-Frequency (IDF) Curves, Probable Maximum Precipitation (PMP) Curves; Infiltration – Factors affecting and its Determination, Evaporation and Evapo-Transpiration – Pan Evaporation; Runoff – Factors Affecting Runoff, Methods of Determination of Runoff, Hydrograph Analysis, Base Flow Separation, Unit Hydrographs, Hydrograph of Different Durations, Applications of Unit Hydrograph; S-Hydrograph, Synthetic Unit Hydrograph; Stream Flow Measurement methods.

Groundwater Flow: Mechanics of Interstitial Flow, Definitions, Subsurface Distribution of Water, Ground Water Movement; Darcy's Law; Permeability – Intrinsic Permeability; Well Hydraulics – Steady Flow in Different Types of Aquifers and Wells; Determination of Hydraulic Properties of Aquifer; Well Losses; Specific Capacity of Well; Well Efficiency – Pumping Tests – Recuperation Test Method for Determination of Well Yield.

Rain Water Harvesting and Recharging of Underground Storage – Methods of Recharging – Infiltration Galleries, Infiltration Wells, Springs.

Methods of Construction of Open Well–Yield of an Open Well – Methods of Construction of Tube Wells, Well Shrouding and Well Development, Spacing of Tube Wells, Design of Tube Well; Pumping Requirements.

Reservoir Planning and Flood Routing: Types of Reservoir – Investigations for Reservoir Planning, Selection of Site for a Reservoir, Zones of Storage in a Reservoir; Purpose of Reservoir, Design Studies, Reservoir Regulation, Reservoir Yield, Mass Curve and Demand Curve, Determination of Reservoir Capacity, Yield From a Reservoir of given Capacity; Reservoir Losses – Measures To Reduce Evaporation Loss in Reservoirs, Control of Reservoir Sedimentation.

Flood Routing – Hydrologic Reservoir Routing by Pulse Method of Routing, Channel Routing by Muskingum Method.

Irrigation: Definition of Irrigation, Types of Irrigation Systems – Direct and Indirect, Lift and Inundation Irrigation Systems, Methods of Irrigation – Surface and Sprinkler Methods, Trickle or Drip Irrigation, Soil Moisture Constants, Depth of Water Held By Soil In Different Zones, Water Extraction – Quality of Irrigation Water, Irrigation Efficiencies – Soil Moisture – Irrigation Relationship – Estimating Depth and Frequency of Irrigation on the Basis of Soil Moisture Regime Concept; Water Requirements of Crops, Duty, Delta and Base Period – Their Relationship, Crops – Seasons, Factors Affecting Duty and Methods of Improving Duty, Consumptive Use of Water – Determination of Evapotranspiration – Blaney-Criddle and Penman Equations and Hargreaves Method(concepts only); Assessment of Irrigation Water Charges.

Canal Systems: Classification of Irrigation Canals – Canal Alignment, Design of Unlined Canals, Regime Theories – Kennedy's and Lacey's Theories, Critical Tractive Force Method, Design Problems – Balancing Depth; Regulation of Channel System – Canal Outlets, Requirements of a Good Outlet – Types of Outlets; Water Logging – Causes and Control – Land Drainage; Canal Lining – Methods, Design of Lined Canals, Canal Navigation – Requirements, Methods to make Navigability Feasible.

Text Books

1. Irrigation and Water Power Engineering by B.C.Punmia and P.B.B. Lal, Laxmi Publications Pvt. Ltd.
2. Irrigation and Water Resources & Water Power by P.N.Modi, Standard Book House.

Reference Books

1. Irrigation and Hydraulic Structures by S.K.Garg, Khanna Publishers.
2. Engineering Hydrology by K.Subramanya, Tata McGraw-Hill Education Private Limited.
3. Hand Book of Applied Hydrology by V.T.Chow, McGraw-Hill Book Co.
4. Impacts of Climate Change and Climate Variability on Hydrological Regimes by Jan C. van Dam, Cambridge University Press.

5. Hydrology: Principles, Analysis and Design by H.M.Raghuath, New Age International.

6. Ground Water by H.M.Raghuath, New Age International.

CV 2204 GEOTECHNICAL ENGINEERING - I

COURSE OBJECTIVES:

- To explain what Geotechnical Engineering is and how it is important to civil engineering
- To explain how three phase system is used in soil and how are soil properties estimated using three phase system.
- To explain role of water in soil behavior and how soil stresses, permeability and quantity of seepage including flow net are estimated
- To determine shear parameters and stress changes in soil due to foundation loads.
- To estimate the magnitude and time-rate of settlement due to consolidation

COURSE OUTCOMES:

- Carry out soil classification
- Solve three phase system problems
- Solve any practical problems related to soil stresses estimation, permeability and seepage including flow net diagram
- Estimate the stresses under any system of foundation loads.
- Solve practical problems related to consolidation settlement and time rate of settlement.

SYLLABUS

Introduction: Soil Formation, Minerals in Clays and Sand, Soil Structure, Physical properties of Soil : Void Ratio, Porosity, Degree of Saturation, Water Content, Unit Weights, Specific Gravity, Weight - Volume Relationships, Relative Density, Consistency Limits and Consistency Indices, Activity

Mechanical Analysis and Soil Classification: Sieve Analysis, Stoke's Law, Hydrometer and Pipette Analysis, Textural Classification, Classification based on size, Unified Soil Classification and Indian Standard Soil classification systems, Field Identification of Soils

Soil Hydraulics: Types of Soil Water, Capillary Rise and Surface Tension, Darcy's Law and its Limitations, Constant Head and Variable Head Permeability Tests, Factors effecting coefficient of permeability, Permeability of Stratified Soils. Total, Neutral and Effective Stresses, Effective stress principle, Upward flow conditions, Quick Sand Conditions, Critical Hydraulic Gradient.

Stress Distribution in Soils: Boussinesq's Theory for Determination of vertical stress, Assumptions and validity, Extension to line, strip, Rectangular and Circular loaded areas, Pressure Bulb and Influence Diagrams, Newmark's Influence Chart- Construction and Use, Westergaard's Theory, 2:1 Load Dispersion Method, Contact Pressure Distribution beneath Footings.

Compaction: Mechanism of Compaction, Factors Effecting Compaction, Laboratory Compaction Tests, Effect of Compaction on Soil Properties, Field Compaction: Compaction Equipment and Evaluation of Field Compaction.

Consolidation: Basic Definitions: Compression Index, Coefficient of Compressibility and Coefficient of volume decrease: Spring Analogy for Primary Consolidation: Initial compression, Primary compression and secondary compression, Generation of Effective Stress- Void Ratio relationship from consolidation test: Height of Solids Method and change in Void Ratio method: Determination of Preconsolidation Pressure, Normally consolidated, Over consolidated and under consolidated clays, Terzaghi's One Dimensional Consolidation Theory - Assumptions, Derivation of differential equation and Solution, Laboratory Determination of coefficient of consolidation by time fitting methods.

Shear Strength of Soils: Stress at Point, Mohr circle of stress, Mohr-Coulomb Failure Theory, Shear Parameters, Laboratory Shear Tests- Shear Box, Triaxial and Unconfined Compression Tests, Laboratory and Field Vane Shear Tests, Sensitivity of Clays, Types of Shear Tests based on Drainage Conditions, Total stress analysis and effective stress analysis, Shear Strength of Sands, Critical Void Ratio and Dilatancy, Liquefaction of Soils, Factors affecting Shear Strength of Clays and Sands.

TEXT BOOKS:

1. Soil Mechanics and Foundation Engineering by K.R.Arora, Standard Publishers
2. Basic and Applied Soil Mechanics by Gopal Ranjan and A.S.R Rao, New Age International Publishers.
3. Geotechnical Engineering by P.Purushothama Raj, Pearson Publishers.
4. Principals of Geotechnical Engineering by Braja.M.Das, Cengage Learning Publishers.

REFERENCES:

1. Gopal Ranjan and Rao, P. Basic and Applied Soil Mechanics, New Age International Pvt. Limited, New Delhi, 2002.
2. Murthy, V.N.S., A text book of Soil Mechanics and Foundation Engineering, UBS PublishersDistributors Ltd., New Delhi, 1999

3. Punmia, B.C. Soil Mechanics and Foundation Engineering, Laxmi Publications Pvt. Ltd., New Delhi,1995.

4. Braja M. Das, Fundamentals of Geotechnical Engineering, Thomson Asia Pvt. Ltd., Singapore,2005.

CV2205 MANAGERIAL ECONOMICS

(Common for all Branches)

Course Objectives:

- To bring about an awareness about the nature of Managerial Economics and its linkages with other disciplines.
- To understand the Micro and Macro Environment of Business.
- To familiarize the prospective engineers with the concepts and tools of Managerial Economics with an objective to understand the real world of business.

Course Outcomes:

After completion of the course, student will be able to:

- Understand the various economic activities in business and industry.
- Analyse the real world business problems.
- Make optimal business decisions for the effective and efficient management of Organisations.

SYLLABUS

Significance of Economics and Managerial Economics:

Economics: Definitions of Economics- Wealth, Welfare and Scarcity definitions Classification of Economics- Micro and Macro Economics.

Managerial Economics: Definition, Nature and Scope of Managerial Economics, Differences between Economics and Managerial Economics, Main areas of Managerial Economics, Managerial Economics with other disciplines.

Demand and Utility Analysis: Demand - Definition, Meaning, Nature and types of demand, Demand function, Law of demand - Assumptions and limitations. Exceptional demand curve.

Elasticity of demand - Definition, Measurement of elasticity, Types of Elasticity (Price, Income, Cross and Advertisement), Practical importance of Price elasticity of demand, Role of income elasticity in business decisions, Factors governing Price Elasticity of demand.

Utility Analysis: Utility- Meaning, Types of Economic Utilities, Cardinal and Ordinal Utility, Total Utility, Marginal Utility, The law of Diminishing Marginal Utility and its Limitations.

Theory of Production and Cost analysis: Production - Meaning, Production function and its assumptions, use of production function in decision making; Cost analysis - Nature of cost, Classification of costs - Fixed vs. Variable costs, Marginal cost, Controllable vs. Non - Controllable costs, Opportunity cost, Incremental vs. Sunk costs, Explicit vs. Implicit costs, Replacement costs, Historical costs, Urgent vs. Postponable costs, Escapable vs. Unavoidable costs, Economies and Diseconomies of scale.

Market Structures : Definition of Market, Classification of markets; Salient features or conditions of different markets - Perfect Competition, Monopoly, Duopoly , Oligopoly, Importance of kinked demand curve ;Monopolistic Competition.

Pricing and Business Cycles: Pricing Analysis : Pricing – Significance; Different Pricing methods- Cost plus pricing, Target pricing, Marginal cost pricing, Going -rate pricing, Average cost pricing, Peak load pricing , Pricing of joint Products, Pricing over the life cycle of a Product, Skimming pricing Penetration pricing, Mark- up and Mark- down pricing of retailers. Business cycles - Definition, Characteristics, Phases, Causes and Consequences; Measures to solve problems arising from Business cycles.

Text Books:

1. Sankaran,S., Managerial Economics,Marghan Publications, 2015, Chennai.
2. Aryasri, A.R., Managerial Economics and Financial Analysis, MC Graw Hill Education, New Delhi,2015.

Reference Books:

1. Dwivedi, D.N., Managerial Economics,Vikhas Publishing House Pvt. Ltd. 6th Edition, New Delhi,2004.
2. Dewett, K.K., **Modern Economic Theory**, S.Chand& Company Ltd., New Delhi 2005.

CV2206 BUILDING PLANNING AND DRAWING

COURSE OBJECTIVES

- To render the student understand different types of residential buildings.
- To render the student understand the principles of planning of residential buildings.
- To equip the students with building bye laws
- To render the student understand the functional and furniture requirements of different rooms in a residential building.

COURSE OUTCOMES

- The student will be able to interpret conventional signs and symbols used in civil engineering drawings

- The students will be able to plan residential buildings as per climatic conditions

- The students will be able to understand basic principles of building design and planning

- The student will be able to prepare detailed drawings for residential buildings

SYLLABUS

Residential Buildings: Different types of Residential Buildings, Selection of Site for Residential Building. Brief Information of Housing Colonies for Different Income Groups in India–Sizes of Plots – Public Spaces, Evolutionary Housing Concept.

Climatology: Elements of Climate: Sun, Wind, Relative Humidity, Temperature effects, Comfort Conditions for House, various types of Macro Climatic Zones. Design of Houses and Layouts with Reference to Climatic Conditions. Orientation of Buildings. Solar Charts, Ventilation. Principles of Planning Anthropometric Data

Preliminary Drawings: (a) Conventional Signs of Materials various Equipment used in a Residential Building (copying exercise) (b) Plan, Section and Elevation of a Small House (one room and verandah) (copying exercise) (c) Plan, Section and Elevation of Two Bed Room House (copying exercise) (d) (e) (f) Plan, Section and Elevation of Three Bed Room House in Hot and Humid Zone, Hot and Arid Zone, Cold Zone (copying exercises)

(a) Design of Individual Rooms with Particular Attention to Functional and Furniture Requirements. Building Regulations and Bye-laws of Residential Buildings; Drawing the Plan, Section and Elevation of Houses with given Functional Requirements and Climatic Data. (Emphasis may be given to Hot and Humid zones.)

Text Books

1. Building Planning and Drawing by N. Kumara Swamy and A.Kameswara Rao, Charotar Publishing House.

2. Building Planning Drawing and Scheduling by Gurucharansingh and Jagadish Singh, Standard Publishers Distributors

Reference Books

1. Civil Engineering Drawing by Sharma and Gurucharan Singh, Standard Publishers.

2. Civil Engineering Drawing Series 'B' by R.Trimurty, M/S Premier Publishing House.

3. Building Drawing with an Integrated Approach to Built Environment by M.G.Shah, C.M.Kale and S.Y.Patki, McGraw-Hill Publishing Company Limited.

CV2207 BUILDING MATERIALS LAB

Course Objectives:

- The student can understand the concepts of physical properties of concrete ingredients.
- The student can understand the concepts of physical properties of tiles, different bricks and paver blocks.
- The student can understand the concepts of hardness physical properties of green concrete.
- The student can understand the concepts of different tests on hardened concrete.

Course Outcomes:

- The students will have clear and thorough understanding concept physical properties of concrete ingredients.
- The students will have a clear and thorough understanding the concepts of physical properties of tiles, different bricks and paver blocks.
- The students will have a clear and thorough understanding the concepts of hardness physical properties of green concrete.
- The students will have a clear and thorough understanding the concepts of different tests on hardened concrete.

SYLLABUS

- 1) Determination of Specific Gravity and Unit Weight of Cement
- 2) Determination of Specific Gravity and Unit Weight of Coarse and Fine Aggregates
- 3) Determination of Normal Consistency of Cement
- 4) Determination of Initial and Final Setting Time
- 5) Determination of Fineness of Cement.
- 6) Determination of Compressive Strength of Cement (for different grades of cement).
- 7) Determination of flexural strength and water absorption for different tiles.
- 8) Determination of compressive strength and water absorption for burnt clay and fly ash bricks.
- 9) Determination of crushing strength and water absorption for different paver blocks.
- 10) Determination of Bulking Characteristics of Sand.
- 11) Sieve Analysis of Coarse and Fine Aggregates and Classification as per IS 383.

12) Workability Tests on Green Concrete by using: Slump Cone, Compaction Factor Apparatus, Flow Table, Vee-Bee Consistometer.

13) Tests on Hardened Concrete.

- a. Determination of Compressive Strength
- b. Determination of Split tensile strength
- c. Determination of Modulus of rupture

14) Design of Concrete Mix by using IS Code Method (for class work only)

CV2208 COMPUTER AIDED BUILDING DRAWING

Course Objectives:

- The student can understand the concepts of for creating, modifying or correcting Civil Engineering drawings towards improving their graphic capabilities by using software tools.
- The student can understand the concepts of foundation, damp proof course and wall thickness with drawings.
- The student can understand the concepts of different arches and with detail drawings.
- The student can understand the concepts of house plans, elevation and sectional elevations.

Course Outcomes:

- The students will have clear and thorough understanding concept of for creating, modifying or correcting Civil Engineering drawings towards improving their graphic capabilities by using software tools.
- The students will have a clear and thorough understanding the concepts of foundation, damp proof course and wall thickness with drawings.
- The students will have a clear and thorough understanding the concepts of different arches and with detail drawings.
- The students will have a clear and thorough understanding the concepts of house plans, elevation and sectional elevations.

SYLLABUS

Details of spread footing foundations for a load bearing and non-load bearing wall for given thickness of walls with the help of given data or rule of the thumb, showing offsets, position of DPC. The details of the concrete and brick apron have to be shown in the drawing.

Plans of 'T' and Corner junction of walls of 1 Brick, 1-1/2 Brick and 2 brick thick in English bond Drawing plan, elevation of arches: circular arch, segmental arch Elevation, sectional plan and sectional side elevation of flush door, fully glazed door, fully panelled door with wire gauge shutter. Partly panelled and partly glazed door.

Drawing plan, elevation of a small building by measurement and foundation detail and sectional elevation.

Drawing detailed working plan, elevation and section of a residential building from a given line plan or given data showing details of foundations, roof and parapet Drawing of flat roof, showing the heat/thermal insulation provisions.

Drawing details of damp proofing arrangement of roofs and walls as per BIS Code. Show the rain water drainage arrangement also.

CV2209 PROFESSIONAL ETHICS AND UNIVERSAL HUMAN VALUES

(Common for all Branches)

Course Objectives:

The objective of the course is Six fold:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- This course will illuminate the students in the concepts of laws and its applicability to engineers
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection, Development of commitment and courage to act and also enable the students to imbibe and internalize the Values and Ethical Behaviour in the personal and professional lives
- To enable the students to imbibe the Values and Ethical Behavior in the personal and Professional lives
- The students will learn the rights and responsibilities Individual, employee, team member and a global citizen

Course Outcomes:

By the end of the course Student will be able to:

- Grasp the meaning of the concept – Law and also Get an overview of the laws relating to Engineers andalso Apprehend the importance of being a law abiding person and They would have better critical ability
- Self-explore by using different techniques to live in harmony at various levels
- Analyze themselves and understand their position with respect to the moral and ethical character needed for a successful and satisfactory work life
- Students are expected to become more aware of themselves and their surroundings (family, society, nature)
- They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.

·They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society)

SYLLABUS

Need, Basic Guidelines, Content and Process for Value Education, Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation - as the process for self-exploration, Continuous Happiness and Prosperity - A look at basic Human Aspirations,Right understanding, Relationship and Physical Facility - the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels. Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking, Include practice sessions and case studies.

Understanding Harmony in the Human Being - Harmony in Myself : Understanding human being as: a co-existence of the sentient 'I' and the material 'Body', the needs of Self ('I') and 'Body' - happiness and physical facility, the Body as an instrument of 'I' (I being the doer, seer and enjoyer), the characteristics and activities of 'I' and harmony in 'I', the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail, P to ensure Sanyam and Health, Include practice sessions and case studies.

Understanding Harmony in the Family and Society - Harmony in Human – Human Relationship Understanding values in human-human relationship: meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship, the meaning of Trust; Difference between intention and competence, the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship, the harmony in the society (society being an extension of family), Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society, Universal Order from family to world family, Include practice sessions and case studies.

Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature recyclability and self-regulation in nature, Understanding Existence as Co-existence of mutually

interacting units in all – pervasive space, Holistic perception of harmony at all levels of existence, Include practice sessions and case studies.

Concept of Law and Law of Torts : Understanding Essentials of a Valid Contract and the basics of contract law protecting rights and obligations, Introduction to the Law of Torts and the basics to protect oneself and the company Law affecting the Workplace Employers Responsibilities/Duties Hiring Practices, Introduction to Intellectual Property Law, Professional Code of Conduct for Engineers, Relationship between Law and Ethics, Include practice sessions and case studies. Implications of the above Holistic Understanding of Harmony on Professional Ethics Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations, Include practice sessions and case studies.

Text Books

1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. R R Gaur, R Asthana, G P Bagaria, "Teachers' Manual for A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2
3. R. Subramanian, "Professional Ethics", Oxford University Press.
4. S.B. Srivastha, "Professional Ethics & Human Values", SciTech Publications (India) Pvt. Ltd. New Delhi.
5. D.R. Kiran, "Professional Ethics & Human Values", TATA Mc Graw Hill Education. Saroj Kumar, "Business Law" and Avtar Singh, "Law of Contract"

Reference Books

1. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan VidyaPrakashan, Amar kantik, 1999.
2. A. N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book), MohandasKaramchand Gandhi "The Story of My Experiments with Truth", E. F.Schumacher. "Small is Beautiful", Slow

is Beautiful –Cecile Andrews, J C Kumarappa "Economy of Permanence", PanditSunderlal "Bharat Mein Angreji Raj" and Dharampal, "Rediscovering India

4. G K Kapoor, "Business Law" and Sen & Mitra, "Business & Commercial Laws" and Calvin Frank Allen, "Business law for Engineers"

5. Hilgard, E. R.; Atkinson, R. C. & Atkinson, R.L. (1975). Introduction to Psychology. 6th Edition. New Delhi: Oxford and IBH Publishing Co. Pvt. Ltd.

6. Govindarajan, M; Natarajan, G. M. & Senthilkumar, V.S. (2013). Professional Ethics & Human Values. Prentice Hall: New Delhi

7. Gogate, S. B. (2011). Human Values & Professional Ethics. Vikas Publishing: New Delhi.

8. Charles E Harris Jr., Michael S Pritchard, Michael J Rabins, "Engineering Ethics, Concepts Cases: 4e, Cengage learning, 2015.

9. Caroline Whitbec, " Ethics in Engineering Practice & Research: 2e, Cambridge University Press 2015.

CV2210 NCC/NSS

MARINE ENGINEERING

B. Tech (Naval Architecture and Marine Engineering)

(Effective from 2020 -21 admitted Batch - As per APSCH Scheme)

B. Tech - II Year- I Semester

Code No	Category	Course Title	Hours per week			Internal Marks	Extrnal Marks	TotalCredits	
			L	T	P				
NM 2101	BS	Mathematics - III	3	0	0	30	70	100	3
NM 2102	PC	Engineering Mechanics – I (Statics)	3	0	0	30	70	100	3
NM 2103	PC	Mechanics of Materials - I	3	0	0	30	70	100	3
NM 2104	PC	Basic Thermodynamics	3	0	0	30	70	100	3
NM 2105	PC	Advanced Ship Theory	3	0	0	30	70	100	3
NM 2106	HSS	Managerial Economics	3	0	0	30	70	100	3
NM 2107	PC	Ship Drawing - I	0	0	3	50	50	100	1.5
NM 2108	SC	DelftShip Software Practice	1	0	2	50	50	100	2
NM 2109	MC	Professional Ethics & Moral Values	0	0	0	0	0	0	0
NM 2110	MC	NSS/NCC	0	0	2	0	0	0	0
Total Credits									21.5

B. Tech -II Year- II Semester

Code No	Category	Course Title	Hours per week			Internal Marks	Extrnal Marks	TotalCredits	
			L	T	P				
NM 2201	ES	Electrical Technology	3	0	0	30	70	100	3

NM 2202	PC	Engg Mechanics – II (Dynamics)	3	0	0	30	70	100	3
NM 2203	PC	Mechanics of Materials - II	3	0	0	30	70	100	3
NM 2204	PC	Engineering Thermodynamics	3	0	0	30	70	100	3
NM 2205	PC	Material Science	3	0	0	30	70	100	3
NM 2206	PC	Electrical Tech Lab	0	0	3	50	50	100	1.5
NM 2207	PC	Autocad Lab	0	0	3	50	50	100	1.5
NM 2208	SC	Intellectual Property Rights	1	0	2	50	50	100	2
NM 2209	MC	Environmental Science	0	0	0	0	100	100	0
Total credits									20

Summer Internship(Community Service)

SYLLABUS – II Year - I Semester

NM 2101 Mathematics – III

OBJECTIVES: In general, the students are introduced with a knowledge on the topics: Vector Calculus, Partial differential equations, their applications and Integral Transforms (Fourier transforms, FST, FCT) so as to facilitate them to use these concepts in core subjects.

The objectives, in particular are to learn:

1. The basic knowledge and applications of Vector Calculus used in Engineering problems.
2. About the gradient, divergence and curl under the differentiation of scalar and vector point functions, also on Line-, Surface- and Volume integrals under the integration of point functions along with their applications in Engineering issues.
3. Transformation theorems such as Green's theorem in the plane, Stoke's theorem, Gauss Divergence theorem and their applications.
4. How to formulate the Partial Differential Equations from the relation between the dependent and independent variables, the methods of solving first order first degree linear, non-linear Partial Differential Equations, Homogeneous and Non homogeneous linear partial differential equations with constant coefficients .
5. The procedure to find out the solutions of Partial Differential Equations by using the method of separation of variables (product method) about the formulation of one dimensional wave (string equation), one-and two-dimensional Heat flow equations, Laplace's equation in Cartesian and polar coordinates, and how to solve these equations using the method of separation of variables.
6. The concept of integral transforms, namely, Fourier transforms, Fourier Sine, Cosine and related inversetransforms, and their applications in solving several Physical and Engineering problems.

OUTCOMES: After going through this course , the students would be able to:

1. Operate the differential operator 'del' to the scalar and vector point functions, Calculate the Gradient, Divergence and Curl, Vector normal to a surface, maximum rate of change of a scalar field, test whether two surfaces are to cut orthogonally or not .

2. find the rate per unit volume at which the physical quantity is issuing from a point, the rate of inflow minus out flow using the Divergence and the angular velocity of rotation at any point of the vector field using the Curl.

3. Test whether the given motion is irrotational or rotational, whether a vector force acting on a particle is conservative or not

4. find out the potential function from a given vector field.

5. obtain the well known Laplace and poisson equations from an irrotational field

6. understand to determine the work done by a force field and circulation using a Line integral

7. find out the Line, Surface and Volume integrals, find flux using surface integral and volumes using the volume integral.

8. apply the vector integral theorems (Green's theorem in the plane, Stoke's and Divergence theorems) for evaluating the double and triple integrals as these are used to find areas and volumes.

9. know the methods of solving Linear and Non linear first order and first degree partial differential equations.

10. solve the Linear Partial Differential Equations with constant coefficients (homogeneous and non homogeneous) and know the procedure for finding the complementary function and particular integrals

11. apply the method of separation of variables to obtain solutions to the boundary value problems involving Linear partial differential equations occurred in engineering studies

12. solve wave equation, heat flow equation and the Laplace's equations in Cartesian and polar coordinates using the method of separation of variables.

13. apply and extend the knowledge of Fourier transform techniques in solving several Initial and Boundary value problems of Engineering, such as in Conduction of heat / Thermodynamics, Hydraulics transverse vibrations of a string, oscillations of an elastic beam, bending of beams, electrical circuits, free and forced vibrations of a membrane and transmission lines , etc.

Detailed Syllabus

VECTOR CALCULUS-DIFFERENTIATION

Differentiation of vectors, curves in space, velocity and acceleration, relative velocity and relative acceleration, scalar and vector point functions,

vector operator ∇ applied to scalar point functions- gradient, ∇ applied to vector point functions- divergence and curl. Physical interpretation of gradient, divergence and curl (i.e., $\nabla \cdot \mathbf{F}$), Irrotational and Solenoidal fields, the relations obtained after ∇ applied twice to point functions, ∇ applied to products of two functions.

VECTOR INTEGRATION

Integration of vectors, line integral, circulation, work done, surface integral-flux, Green's theorem in the plane, Stoke's theorem, volume integral, Gauss Divergence theorem. (All theorems without proofs)

Introduction of orthogonal curvilinear coordinates, cylindrical and spherical polar coordinates

PARTIAL DIFFERENTIAL EQUATIONS

Formation of partial differential equations, solutions of partial differential equations- equations solvable by direct integration, linear equations of first order: Lagrange's Linear equation, non-linear equations of first order, Charpit's method. Homogeneous linear equations with constant coefficients- rules for finding the complementary function, rules for finding the particular integral (working procedure), non- homogeneous linear equations.

APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS

Method of separation of variables, One dimensional wave equation- vibrations of a stretched string, one dimensional Heat flow equation, Two dimensional heat flow in steady state - solution of Laplace's equation in Cartesian and polar coordinates (two dimensional).

INTEGRAL TRANSFORMS (Fourier Transform)

Introduction, definition, Fourier integral, Sine and Cosine integrals, Complex form of Fourier integral, Fourier transform, Fourier Sine and Cosine transforms, Finite Fourier Sine and Cosine transforms, properties of Fourier transforms. Convolution theorem for Fourier transforms, Parseval's identity for Fourier transforms, Fourier transforms of the derivatives of a function, simple applications to Boundary value problems.

TEXT BOOKS:

Scope and treatment as in "Higher Engineering Mathematics", by Dr. B.S.Grewal, **43rd Edition**, Khanna Publishers.

REFERENCE BOOKS:

1. Graduate Engineering Mathematics by V B Kumar Vatti, I.K.International publications
2. Advanced Engineering Mathematics by Erwin Kreyszig.
3. A text book of Engineering Mathematics by N.P. Bali and Dr. Manish Goyal, Lakshmi Publications.
4. Mathematical Methods of Science & Engineering aided with MATLAB by Kanti B.Dutta, Cengage Learning India Pvt. Ltd.

5. Higher Engineering Mathematics by B. V. Ramana, Tata McGraw Hill Company.

6. Advanced Engineering Mathematics by H.K.Dass. S.Chand Company.

NM 2102 Engineering Mechanics-I (Statics)

Course Objectives

The objectives of the course are

1. To teach the student how to determine the resultant force and moment for a given force system.
2. To Teach the student how to Analyze planar and spatial systems to determine the forces in members of trusses, frames and problems related to friction.
3. To Teach the student how to determine the centroid and second moment of area
4. To Teach the student the method of Virtual Work for the solution of Engg Mechanic problems

Course outcomes:

At the end of the course, the student will be able to:

1. Determine the resultant force and moment for a given force system.
2. Analyze planar and spatial systems to determine the forces in members of trusses, frames and problems related to friction.
3. Determine the centroid and second moment of area
4. Learn the method of Virtual Work for the solution of Engg Mechanic problems

Detailed Syllabus

General Principles : Fundamental concepts, Units of Measurement, SI Units Force Vectors. Vector Operations, vector addition of forces, Coplanar forces, Cartesian vectors, Position vectors, Force vector directed along a line, dot product Equilibrium of a Particle Condition for the equilibrium of a particle, coplanar force system, Three-dimensional force systems

Force System Resultants Moment of a force, scalar and vector formulation, principle of moments, moment of a force about a specified axis, moment of a couple, equivalent system, resultants of a force and couple system, further reduction of force and couple systems, distributed loading

Equilibrium of a Rigid Body Conditions for equilibrium of a rigid body, free body diagrams, equations of equilibrium, two and three force members, equilibrium in 3-D, constraints for a rigid body

Structural Analysis Simple Trusses, method of joints, zero force members, method of sections, space trusses, frames and machines

Friction Characteristics of dry friction, problems involving dry friction, wedges, screws, flat belts Center of Gravity and Centroid Centre of gravity, centre of mass, centroid, composite bodies, pappus Guldinus theorem, distributed loading resultants.

Moments of Inertia I , parallel axis theorem, I of area by integration, I of composite areas, product of inertia, Mass I

Virtual Work Principle of VW for particle and rigid body, and system of connected bodies, conservative forces, PE, PE criterion for equilibrium, stability of equilibrium

Textbook:

R C Hibbeler, "Engineering Mechanics – Statics and Dynamics- 14th Edition," Pearson

References:

1. Vector Mechanics for Engineers: Statics and Dynamics, by Ferdinand P. Beer & E. Russell Johnston Jr., McGraw Hill
2. Engineering Mechanics by S. P. Timoshenko and D.H.Young, Mc.Graw-Hill.
3. Engineering *Mechanics Statics and Dynamics* 4thed Irving H Shames, Prentice Hall

NM 2103 : Mechanics of Materials – I

Course Objectives:

1. To provide the student with an understanding of Stress and Strain, thermal stresses, Mohr's circle for the solution of stress in 2-D
2. To teach the student regarding the structural elements like trusses and frames and their analyses
3. Teach the student to Draw the BM and SFD
4. To determine the deflection in beams subjected to various loadings
5. To understand the concept of Torsion and evaluate the stresses in shafts and springs

Course Outcomes

At the end of the course the student will be able to

1. Calculate the state of stress including thermal stresses.
2. Design structural elements like trusses and frames and beams
3. Determine the state of stress in beams and the deflection of beams.
4. Design shafts and springs

Detailed Syllabus

General concepts: stress, strain, lateral strain, stress-strain diagram. Generalisation of Hooke's law. Temperature stresses. Stresses in axially loaded bars. Strain energy Impact loads. Relation between elastic constants.

Stress transformation: Transformation of stresses in 2-D problems. Principal stresses in 2-d problems. Maximum shear stresses in 2-d problems. Mohr's circle for stress transformation and principal stresses.

Bending moments and shear forces: Types of beams, Types of loads, Types of supports. S.F. and B.M. diagrams for statically determinate beams. Relation between bending moment, shear stress and intensity of loading.

Stresses in beams: Simple theory of bending, Flexural formula, Shear stress in beams. Principal stresses in beams.

Deflection of beams: Relation between curvature, slope and deflection. Double integration method.

Torsional stresses in shafts: Analysis of torsional stresses, power transmitted by circular shafts. Combined bending and torsion. Principal stresses in shafts.

Closed and opened coiled helical springs: Analysis of principal stresses in open and closed coiled helical springs.

Thin walled cylindrical and spherical vessels: Analysis of stresses and strains.

Text Books:

Engineering mechanics of solids by E.P.Popov,second edition ,PHI.

Reference:

1. Mechanics of solids by R.C.Hibbler.
2. Analysis of structures by Vazirani and Ratwani Vol 1,1993 edition.

NM 2104 Basic Thermodynamics

Course Objectives:

The objectives of the course is to teach the student

1. Fundamental concepts of continuum, system, control volume, thermodynamic properties, thermodynamic equilibrium, work and heat.
2. The various laws of thermodynamics so that he can analyze systems like boilers, heat pumps, refrigerators, heat engines, compressors and nozzles.
3. Evaluate the performance of vapour power cycles.

Course Outcomes:

At the end of the course, the student will be able to:

1. Understand the concepts of continuum, system, control volume, thermodynamic properties, thermodynamic equilibrium, work and heat.

2. Apply the laws of thermodynamics to analyze boilers, heat pumps, refrigerators, heat engines, compressors and nozzles.

3. Evaluate the performance of vapour power cycles.

Detailed Syllabus

Introduction: Basic concepts- Thermodynamic systems, Micro & Macro systems- Homogeneous and heterogeneous systems- Pure substance- Thermodynamic equilibrium, State Property, Path, Process- Reversible and irreversible cycles- Energy as a property of the systems

Thermodynamic Laws: Zeroth law _First law - Corollaries- Isolated systems and steady flow systems- Specific heats - First law applied to flow systems- Systems undergoing a cycle and change of state- First law applied to steady flow processes- Limitations of first law of thermodynamics.

Second law- Kelvin Plank statement and Classius statement and their equivalence, Corollaries- PMM 1 & PMM 2 - Reversibility and irreversibility- Causes of irreversibility- Carnot cycle- Heat engines and heat pumps- Carnot efficiency- Classius theorem- Classius inequality- Concept of entropy

Properties of steam: Use of steam tables- Measurement of dryness fraction- T-S and H-S diagrams.

Vapor Power Cycles: Vapor power cycle- Rankine cycle- Reheat cycle and Regenerative cycles- Improvements of efficiency. Binary vapor power cycle.

Steam Nozzles: Type of nozzles- Flow through nozzles- Condition for maximum discharge- Nozzle efficiency- Super saturated flow in nozzles- Steam injectors.

Steam Turbines: Classification of steam turbines- Impulse turbine and reaction turbine- Compounding in turbines- Velocity diagrams in impulse and reaction turbines- Degree of reaction- Condition for maximum efficiency of reaction turbines

Condensers: Classification of condensers - Sources of air leakage in condensers- Condenser efficiency

Text Books:

1. Engineering Thermodynamics, by P.K.Nag, Tata McGraw Hill Publications company.

2. Thermodynamics (SI Version) by William Z Black & James G Hartley

3. Thermal Engineering, by M.L.Mathur and F.S.Mehta, Jain Brothers.

References:

1. Thermodynamics, by Spalding and Cole.

2. Engineering Thermodynamics Work and Heat Transfer, by G.F.C.Rogers and Y.R.Mathew, ELBS publication.

3. Fundamentals of Engineering Thermodynamics By E Radhakrishnan

NM 2105 Advanced Ship Theory

Course Objectives:

The objectives of the course are

1. Teach the student about the various hazards during the life of a marine engineer and the protection that should be provided against those Hazards

2. Teach the students how to design a Ship Girder

3. Teach the student how to design internal members like panel etc

4. Teach the student about the internal and external factors of marine engineers life.

Course Outcomes

At the end of the course the student will

1. Be in a position to know about Various Hazards and protection and the environmental pollution aspects of ship's life

2. Be capable of performing simple standard calculation for the ship girder,

3. Be capable of structural Design of Stiffened plating, panels plating frameworks etc

4. Know about the internal and external environmental aspects of the Ship Environment

Detailed Syllabus

Hazards and Protection - Flooding and collision Safety of Life at Sea (SOLAS), Abnormal Waves, Environmental Pollution

The Ship Girder - Standard calculation for the ship girder, materials considerations,

Structural Design and Analysis - Stiffened plating, panels plating, frameworks, realistic assessment of structural elements, Fittings

The Ship Environment and Human Factors - The external environment - sea, waves, climate, physical limitations, internal environment, motions, vibration and noise

Textbook

Basic Ship Theory by Rawson and Tupper – B&H

References

Muckle's Naval Architecture, by Eric Tupper – B&H

Principles of Naval Architecture – SNAME Publications

NM 2106 Managerial Economics

(Common for all Branches)

Course Objectives:

1. To bring about an awareness about the nature of Managerial Economics and its linkages with other disciplines.
2. To understand the Micro and Macro Environment of Business.
3. To familiarize the prospective engineers with the concepts and tools of Managerial Economics with an objective to understand the real world of business.

Course Outcomes:

After completion of the course, student will be able to:

1. Understand the various economic activities in business and industry.
2. Analyse the real world business problems.
3. Make optimal business decisions for the effective and efficient management of Organisations.

SYLLABUS

Significance of Economics and Managerial Economics:

Economics: Definitions of Economics- Wealth, Welfare and Scarcity definitions Classification of Economics- Micro and Macro Economics.

Managerial Economics: Definition, Nature and Scope of Managerial Economics, Differences between Economics and Managerial Economics, Main areas of Managerial Economics, Managerial Economics with other disciplines.

Demand and Utility Analysis: Demand - Definition, Meaning, Nature and types of demand, Demand function, Law of demand - Assumptions and limitations. Exceptional demand curve.

Elasticity of demand - Definition, Measurement of elasticity, Types of Elasticity (Price, Income, Cross and Advertisement), Practical importance of Price elasticity of demand, Role of income elasticity in business decisions, Factors governing Price Elasticity of demand.

Utility Analysis: Utility- Meaning, Types of Economic Utilities, Cardinal and Ordinal Utility, Total Utility, Marginal Utility, The law of Diminishing Marginal Utility and its Limitations.

Theory of Production and Cost analysis:

Production - Meaning, Production function and its assumptions, use of production function in decision making;

Cost analysis - Nature of cost, Classification of costs - Fixed vs. Variable costs, Marginal cost, Controllable vs. Non - Controllable costs, Opportunity cost, Incremental vs. Sunk costs, Explicit vs. Implicit costs, Replacement costs, Historical costs, Urgent vs. Postponable costs, Escapable vs. Unavoidable costs, Economies and Diseconomies of scale.

Market Structures : Definition of Market, Classification of markets; Salient features or conditions of different markets - Perfect Competition, Monopoly, Duopoly , Oligopoly, Importance of kinked demand curve ;Monopolistic Competition.

Pricing and Business Cycles:

Pricing Analysis : Pricing – Significance; Different Pricing methods- Cost plus pricing, Target pricing, Marginal cost pricing, Going -rate pricing, Average cost pricing, Peak load pricing , Pricing of joint Products, Pricing over the life cycle of a Product, Skimming pricing Penetration pricing, Mark-up and Mark- down pricing of retailers. Business cycles - Definition, Characteristics, Phases, Causes and Consequences; Measures to solve problems arising from Business cycles.

Text Books:

1. Sankaran,S., Managerial Economics, Marghan Publications, 2015, Chennai.
2. Aryasri, A.R., Managerial Economics and Financial Analysis, MC Graw Hill Education, New Delhi,2015.

Reference Books:

1. Dwivedi, D.N., Managerial Economics, Vikhas Publishing House Pvt. Ltd. 6th Edition, New Delhi,2004.
2. Dewett, K.K., Modern Economic Theory, S.Chand & Company Ltd., New Delhi, 2005.

NM 2107 Ship drawing – I

Theory

Lines plan: Drawing instruments and other equipment uses. Delineation of lines plan, Drawing of lines plan, Drawing of ship lines from basic Naval Arch Principles. Drawing of ship lines using series data. Special features and characteristics of ship lines. Mathematical representation of ship lines. Computer aided drawing and design. Use of scales and fairing of ship lines. Capacity calculations, capacity plan, scales, Bonjean curves, sectional area curves and their properties.

Practical:

Lines plan, capacity plan, Bonjean curves, sectional area curves, special features of ship drawing tables, paper, area curves, tracing paper, pencil drawing and ink tracing techniques. Drawing of curved lines with

battens, types of battens. Dos and Don'ts while using battens. Use of French curves and paper strips for fairing lines.

NM 2108 SC DelftShip Software Practice

Course Objectives

1. The objectives of the course are to provide training and provide hands on experience to the students on Delftship software for the purpose of hydrostatic calculations and resistance calculations

Course Outcomes

Course Outcomes

1. At the end of the course, the student will be in a position to model a ship using the software
2. perform a detailed hydrostatic calculation
3. Obtain the ship resistance

Detailed Syllabus

Delftship Main window features, Project Settings, Hull Modelling, Hydrostatic Calculations, Design Hydrostatics, Hydrostatics, Resistance, Report writing and explanation

SC 2109 Professional Ethics and Universal Human Values

(Common for all Branches)

Course Objectives:

The objective of the course is Six fold:

1. Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
2. This course will illuminate the students in the concepts of laws and its applicability to engineers
3. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
4. Strengthening of self-reflection, Development of commitment and courage to act and also enable the students to imbibe and internalize the Values and Ethical Behaviour in the personal and professional lives
5. To enable the students to imbibe the Values and Ethical Behavior in the personal and Professional lives
6. The students will learn the rights and responsibilities Individual, employee, team member and a global citizen

Course Outcomes:

By the end of the course Student will be able to:

1. Grasp the meaning of the concept – Law and also Get an overview of the laws relating to Engineers and also Apprehend the importance of being a law abiding person and They would have better critical ability

2. Self-explore by using different techniques to live in harmony at various levels

3. Analyze themselves and understand their position with respect to the moral and ethical character needed for a successful and satisfactory work life

4. Students are expected to become more aware of themselves and their surroundings (family, society, nature)

5. They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.

6. They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society)

Detailed Syllabus

Need, Basic Guidelines, Content and Process for Value Education Self-Exploration—what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation - as the process for self-exploration, Continuous Happiness and Prosperity - A look at basic Human Aspirations, Right understanding, Relationship and Physical Facility - the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels. Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking, Include practice sessions and case studies.

Understanding Harmony in the Human Being - Harmony in Myself!

Understanding human being as: a co-existence of the sentient 'I' and the material 'Body', the needs of Self ('I') and 'Body' - happiness and physical facility, the Body as an instrument of 'I' (I being the doer, seer and enjoyer), the characteristics and activities of 'I' and harmony in 'I', the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail, ensure Sanyam and Health, Include practice sessions and case studies.

Understanding Harmony in the Family and Society - Harmony in Human – Human Relationship Understanding values in human-human relationship: meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the

foundational values of relationship, the meaning of Trust; Difference between intention and competence, the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship, the harmony in the society (society being an extension of family), Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society, Universal Order from family to world family, Include practice sessions and case studies.

Understanding Harmony in the Nature and Existence - Whole existence as Coexistence Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature recyclability and self-regulation in nature, Understanding Existence as Co-existence of mutually interacting units in all – pervasive space, Holistic perception of harmony at all levels of existence, Include practice sessions and case studies.

Concept of Law and Law of Torts

Understanding Essentials of a Valid Contract and the basics of contract law protecting rights and obligations, Introduction to the Law of Torts and the basics to protect oneself and the company Law affecting the Workplace Employers Responsibilities/Duties Hiring Practices, Introduction to Intellectual Property Law, Professional Code of Conduct for Engineers, Relationship between Law and Ethics, Include practice sessions and case studies.

Implications of the above Holistic Understanding of Harmony on Professional Ethics

Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations, Include practice sessions and case studies.

Text Books

1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1

2. R R Gaur, R Asthana, G P Bagaria, "Teachers' Manual for A Foundation Course in Human

Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

3. R. Subramanian, "Professional Ethics", Oxford University Press.

4. S.B. Srivastha, "Professional Ethics & Human Values", SciTech Publications (India) Pvt. Ltd. New Delhi.

5. D.R. Kiran, "Professional Ethics & Human Values", TATA Mc Graw Hill Education.

6. Saroj Kumar, "Business Law" and Avtar Singh, "Law of Contract"

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.

2. A. N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, 2004.

3. The Story of Stuff (Book), Mohandas Karamchand Gandhi "The Story of My Experiments with Truth", E. F. Schumacher. "Small is Beautiful", Slow is Beautiful – Cecile Andrews, J C Kumarappa "Economy of Permanence", Pandit Sunderlal "Bharat Mein Angreji Raj" and Dharampal, "Rediscovering India

4. G K Kapoor, "Business Law" and Sen & Mitra, "Business & Commercial Laws" and Calvin Frank Allen, "Business law for Engineers"

5. Hilgard, E. R.; Atkinson, R. C. & Atkinson, R.L. (1975). *Introduction to Psychology*. 6th Edition. New Delhi: Oxford and IBH Publishing Co. Pvt. Ltd.

6. Govindarajan, M; Natarajan, G. M. & Senthilkumar, V.S. (2013). *Professional Ethics & Human Values*. Prentice Hall: New Delhi

7. Gogate, S. B. (2011). *Human Values & Professional Ethics*. Vikas Publishing: New Delhi.

8. Charles E Harris Jr., Michael S Pritchard, Michael J Rabins, "Engineering Ethics, Concepts Cases: 4e, Cengage learning, 2015.

9. Caroline Whitbec, " Ethics in Engineering Practice & Research: 2e, Cambridge University Press 2015.

II Year II Semester Syllabus

NM 2201 Electrical Technology

Course Objectives:

1. Impart a basic knowledge of electrical quantities such as current, voltage, power, energy and frequency to understand the impact of technology in a global and societal context.

2. Provide working knowledge for the analysis of basic DC and AC circuits used in electrical and electronic devices.

3. To explain the working principle, construction, applications of DC machines, AC machines & measuring instruments.

4. Highlight the importance of transformers in transmission and distribution of electric power.

Course Outcomes:

On completion of the course students will be able to

1. Predict the behavior of electrical and magnetic circuits.
2. Formulate and solve complex AC, Dc circuits.
3. Identify the type of electrical machine used for that particular application.
4. Realize the requirement of transformers in transmission and distribution of electric power and other applications

Detailed Syllabus

Magnetic Circuits: Definitions of magnetic circuit, Reluctance, Magneto motive force (m.m.f.), Magnetic flux, Simple problems on magnetic circuits, Hysteresis loss. (Chapter-8, Pages 155-175).

Electromagnetic Induction: Faraday's laws of Electromagnetic induction, Induced E.M.F., Dynamically induced E.M.F., Statically induced E.M.F., Self inductance, Mutual inductance. (Chapter-9, Page 176-190).

D.C. Generators: D.C. generator principle, Construction of D.C. generator, E.M.F. equation of D.C. generator, Types of D.C. generators, Armature reaction, Losses in D.C. generator, Efficiency, Characteristics of D.C. generators, Applications of D.C. generator. (Chapter-10, 11, Pages 208-238).

D.C. Motors: D.C. motor principle, Working of D.C. motors, Significance of back E.M.F., Torque equation of D.C. motors, Types of D.C. motors, Characteristics of D.C. motors, Speed control methods of D.C. motors, Applications of D.C. motor. Testing of D.C. machines: Losses and efficiency, Direct load test and Swinburne's test. (Chapter-12,13, Pages 239-267).

A.C. Circuits: Introduction of steady state analysis of A.C. circuits, Single and balanced 3-phase circuits. (Chapter-16, pages 323-348).

Transformers: Transformer principle, EMF equation of transformer, Transformer on load, Equivalent circuit of transformer, Voltage regulation of transformer, Losses in a transformer, Calculation of efficiency and regulation by open circuit and short circuit tests. (Chap-20, p 423-455).

Three Phase Induction Motor: Induction motor working principle, Construction of 3-phase induction motor, Principle of operation, Types of 3-phase induction motor, Torque equation of induction motor, Slip-torque characteristics, Starting torque, Torque under running condition, Maximum

torque equation, Power stages of induction motor, Efficiency calculation of induction motor by direct loading. (Chapter-21, pages 463-489).

Alternator: Alternator working principle, EMF equation of alternator, Voltage regulation by sync. impedance method. (Chapter-23, pages 505-515).

Synchronous Motor: Synchronous motor principle of operation, Construction, Methods of starting of synchronous motor. (Chapter-24, pages 516-526).

Electrical Measurements: Principles of measurement of current, voltage, power and energy, Types of Ammeters, Voltmeters, Watt-meters, Energy meters, Electrical conductivity meter, Potentiometer, Megger.

Text Book:

Elements of Electrical Engineering and Electronics by V.K. Mehta, S. Chand & Co.

Reference:

First Course in Electrical Engineering by Kothari.

NM 2202 Engineering Mechanics – II (Dynamics)

Course Objectives:

The objectives of the course are

1. To introduce the concepts of position, displacement, velocity, and acceleration
2. To analyze the accelerated motion of a particle using the equation of motion with different coordinate systems.
3. To develop the principle of work and energy
4. To study the conservation of linear momentum for particles.
5. To introduce the concept of angular impulse and momentum.
6. To discuss applications of these equations to bodies undergoing translation, rotation about a fixed axis, and general plane motion.
7. To show how the conservation of energy can be used to solve rigid-body planar kinetic problems.
8. To apply the principles of linear and angular impulse and momentum to solve rigid-body planar kinetic problems that involve force, velocity, and time.

Course Outcomes

At the end of the course the student will be in a position to

1. Understand the concepts of position, displacement, velocity, and acceleration
2. Analyze the accelerated motion of a particle

3. Solve problems in kinetics using Newton's Second law as well as principle of work and energy and conservation of linear momentum and angular momentum for particles

4. Write the equations on motion for a plane body in translation, rotation about a fixed axis, and general plane motion.

5. Use various techniques to solve kinetic problems in Plane motion.

Kinematics of a Particle

Introduction. Rectilinear Kinematics: Continuous Motion. Rectilinear Kinematics: Erratic Motion. General Curvilinear Motion. Curvilinear Motion: Rectangular Components. Motion of a Projectile. Curvilinear Motion: Normal and Tangential Components. Curvilinear Motion: Cylindrical Components. Absolute Dependent Motion Analysis of Two Particles. Relative-Motion Analysis of Two Particles Using Translating Axes.

Kinetics of a Particle: Force and Acceleration

Newton's Laws of Motion. The Equation of Motion. Equation of Motion for a System of Particles. Equations of Motion: Rectangular Coordinates. Equations of Motion: Normal and Tangential Coordinates. Equations of Motion: Cylindrical Coordinates. Central-Force Motion and Space Mechanics.

Kinetics of a Particle: Work and Energy The Work of a Force. Principle of Work and Energy. Principle of Work and Energy for a System of Particles. Power and Efficiency. Conservative Forces and Potential Energy. Conservation of Energy

Kinetics of a Particle: Impulse and Momentum Principle of Linear Impulse and Momentum. Principle of Linear Impulse and Momentum for a System of Particles. Conservation of Linear Momentum for a System of Particles. Impact. Angular Momentum. Relation Between Moment of a Force and Angular Momentum. Angular Impulse and Momentum Principles.

Planar Kinematics of a Rigid Body Rigid-Body Motion. Translation. Rotation About a Fixed Axis. Absolute General Plane Motion Analysis. Relative-Motion Analysis: Velocity. Instantaneous Center of Zero Velocity. Relative-Motion Analysis: Acceleration. Relative-Motion Analysis Using Rotating Axes.

Planar Kinetics of a Rigid Body: Force and Acceleration Moment of Inertia. Planar Kinetic Equations of Motion. Equations of Motion: Translation. Equations of Motion: Rotation About a Fixed Axis. Equations of Motion: General Plane Motion.

Planar Kinetics of a Rigid Body: Work and Energy Kinetic Energy. The Work of a Force. The Work of a Couple. Principle of Work and Energy. Conservation of Energy. Planar Kinetics of a Rigid Body: Impulse and Momentum Linear and Angular Momentum. Principle of Impulse and Momentum. Conservation of Momentum. Eccentric Impact.

Textbook:

R C Hibbeler, "Engineering Mechanics – Statics and Dynamics- 14th Edition," Pearson

References:

4. Vector Mechanics for Engineers: Statics and Dynamics, by Ferdinand P. Beer & E. Russell Johnston Jr., McGraw Hill

5. Engineering Mechanics by S. P. Timoshenko and D.H.Young, Mc.Graw-Hill.

6. Engineering *Mechanics Statics and Dynamics* 4thed Irving H Shames, Prentice Hall

NM 2203 : Mechanics of Materials – II

Course objectives:

1. To provide basic knowledge in mechanics of materials so that the students can solve real engineering problems and design engineering systems.

2. Analyze and design components and structural members subjected to tension, compression, torsion, bending and combined loads using fundamental concepts of stress, strain, elastic and inelastic behavior.

Course Outcomes:

1. Understand the fundamental concepts of stress and strain and the relationship between both through the strain-stress equations in order to solve problems for simple tridimensional elastic solids.

2. Calculate and represent the stress diagrams in bars and simple structures Solve problems relating to pure and non-uniform bending of beams and other simple structures.

3. Solve problems relating to torsional deformation of bars and other simple tri-dimensional structures.

4. Understand the concept of buckling and be able to solve the problems related to isolated bars.

Statically indeterminate Beams :

Fixed Beams: Fixing moments of a fixed beam of uniform cross section. Effect of sinking of supports, Slope and deflection.

Continuous beams : Analysis of continuous beams ,Reaction at the supports, Effect of sinking of supports. B.M. and S.F. diagrams.

Columns and struts: Introduction, Examples of instability, Criteria for stability of equilibrium. Euler's buckling theory –columns with pinned ends, Columns with different end restraints, Limitations of Euler's formulae. Column carrying eccentric loads, Empirical formulae.

Bending of curved bars: Stresses due to bending of curved bars of circular, rectangular and trapezoidal sections, curved bars subjected to eccentric loads such as crane hook.

Thick cylinders: Subjected to internal and external pressure cylinders.

Theories of failure: Application to design of shafts.

Text Books :

1. Engineering mechanics of solids by E.P.Popov,second edition ,PHI.
2. Mechanics of solids by R.C.Hibbeler.
3. Strength of materials by L.B.Shah and DrR.T.Shah

NM 2204 Engineering Thermodynamics

Course objectives:

1. To develop the student's ability to apply the principles of thermodynamics to the optimal design of the basic energy conversion systems: power generation, refrigeration, air-conditioning, and combustion.
2. To develop the student's ability to use thermodynamic relations and the property tables and charts for the analysis of energy conversion systems in the course of their operation.
3. To provide the students with some knowledge and analysis skills associated with the principles and techniques of the design of energy conversion systems.
4. To develop the student's ability to communicate effectively the knowledge of thermodynamics and energy conversion systems

Course Outcomes

1. Students will demonstrate an ability to apply thermodynamic principles to the design, analysis, and optimization of the basic energy conversion systems: power generation, refrigeration, air-conditioning, and combustion.
2. Students will demonstrate an ability to use thermodynamic relations and the physical property tables and charts for the analysis of gas and vapor power mixtures, phase transformations, chemical reactions, and combustions processes.
3. Students will demonstrate an ability to apply the first and the second laws of thermodynamics to the analysis and optimization of the power generation, refrigeration, air-conditioning, combustion, and gas flow processes.
4. Students will demonstrate an ability to determine engineering design quantities and estimate their effects on the basic performance characteristics of the energy conversion systems.
5. Students will demonstrate an ability to communicate effectively the knowledge of thermodynamic principles, energy balance equations, and the

use of the physical property tables and charts for the analysis of the energy conversion systems.

Detailed Syllabus

1. I.C. engines: classification, comparison of two stroke and four stroke engines, comparison of S.I. and C.I. engines. Air cycles- Otto, Diesel, Dual, Sterling, Ericson and Atkinson cycles and their analysis. Valve timing and port timing diagrams Various Efficiencies. Basic principles of carburetion and fuel injection.

2. Combustion in I.C. Engines: S.I. engines- Normal combustion and abnormal combustion- Importance of flame speed and effect of engine variables, types of abnormal combustion pre-ignition and knock, Fuel requirements and fuel rating, anti-knock additions- Combustion chamber requirements and Types of combustion chamber

3. Reciprocating and Rotary Compressors: Reciprocating compressors, effect of clearance volume in compressors, volumetric efficiency, single stage and multi stage compressors, effect of inter cooling in multi stage compressors. Centrifugal compressor- Adiabatic efficiency- Diffuser- Axial flow compressors

4. Gas Turbines: Simple gas turbine plant- closed cycle and open cycle for gas turbines. Efficiency, work ratio and optimum pressure ratio for simple gas turbine cycle. Parameters of performance- regeneration, Inter-cooling and reheating, closed and semi-closed cycle. Jet propulsion and Rockets.

5. Refrigeration & Air Conditioning: Bell Coleman cycle, Vapor compression cycle. Vapor absorption system, Principles of psychrometry – psychrometric Chart and terminology, air conditioning systems.

Text Books:

1. Internal Combustion Engine fundamentals by Heywood J B, ISBN0-07-100499-8 Mc. Graw Hill Company.
2. Applied Thermodynamics-II by R. Yadav.
3. A Treatise on Heat Engineering by Vasandhani and Kumar.

References:

1. I.C. Engines by V. Ganesan.
2. Thermal Engineering, by R.K.Rajput.
3. I.C. Engines, by Mathur and Nehata.
4. Gas Turbines, by Cohen and Rogers.
5. Fluid Flow Machines, by M.S. GovindaRao, Tata McGraw Hill pub co Ltd.
6. Refrigeration and Air-conditioning, by C.P.Arora and Domkundwar.

NM 2205 : Material Science (BS)

Course Objectives:

1. To describe the basics of crystal structure and its types
2. To gain a thorough knowledge about crystal defects
3. To gain a knowledge about electrical and electronic properties of materials

4. To gain knowledge of magnetic and optical properties of materials

Course Outcomes:

At the end of the course Student would be able

1. To use and apply basics of material science in his own branch of engineering.
2. The student will be able to justify the materials behaviour and their properties
3. To get basic foundation for learning material technology
4. Understand the advances in the materials development .

Detailed Syllabus

Space lattice and unit cells. Crystal systems. Indices for planes and directions. Structures of common metallic materials. Crystal defects: Point, Line and Surface defects & effects on properties.

Solid solutions. Intermediate phases. Inter metallic compounds. Gibbs rule. Binary phase diagrams. Lever rule. Invariant reactions. Iron-Iron Carbide phase diagram. Heat treatment of steel. Isothermal transformation curves. Annealing, Normalizing, Hardening, Tempering, Austempering and martempering of steels. Surface hardening of steels. Carburizing, Nitriding, Cyaniding, Flame and Induction hardening methods.

Classification of steels: I.S., AISI - SAE classifications. Use and limitations of plain-carbon steels. Alloy steels. Plain carbon and low alloy steels. Tool steels. Cemented carbides. Stainless steels. Maraging steels. Hadfield steel. Cast irons. Grey, White, Malleable and SG irons. Alloy cast-irons. Non-ferrous metals and alloys. Copper and copper-base alloys. Brasses and the bronzes. Copper nickel and Monel alloys. Properties and applications. Aluminium, its uses. Wrought and cast alloys of aluminium.

Plastic deformation: Slip, twinning critical resolved shear stress. Ductile and Brittle fracture. Mechanism of Creep and Fatigue. High temperature alloys. Metals at low temperature. Effect of low temperature on properties: Low temperature metals. Powder Metallurgy. Basic steps in and typical applications of powder metallurgy.

Composite materials. Classification. Matrices and reinforcements. Fabrication methods. Examples and applications.

Text Books:

1. Materials Science and Engineering, by V.Raghavan.
2. Physical Metallurgy, by S.H.Avner.

References:

1. Materials Science & Engg by L.H.VanVleck, Fifth Edition, Addison-Wesley (1985).
2. Structure and Properties of Materials by R.M.Rose, L.A.Shepard and J.Wulff, Vol.1-4, John Wiley (1966).
3. Essentials of Materials Science by A.G.Guy, McGraw-Hill (1976).
4. The Science and Engineering of Materials by D.R.Askeland, Second Edition, Chapman and Hall (1990).

NM 2206 – Electrical Technology Lab

List of Experiments:

1. Study and Calibration of wattmeter and energy meter.
2. Measurement of armature resistance, field resistance and filament resistance.
3. Verification of KCL and KVL.
4. Superposition theorem.
5. Parameters of a choke coil.
6. OC and SC tests on transformer.
7. Load test on D.C. shunt machine.
8. O.C. test on D.C. separately excited machine.
9. Swinburnes test.
10. 3 phase induction motor (No load and rotor block tests) load tests.
11. Alternator regulation by Syn. Impedance method.

NM 2207 AUTOCAD Lab

1. Getting Started with AutoCAD Opening and Creating Drawings Exploring the AutoCAD interface Zooming and Panning
2. Basic Drawing & Editing Commands Using the Mouse, Keyboard, and Enter Key to work quickly and efficiently in AutoCAD Lines Circles Rectangles
3. Projects - Creating a Simple Drawing Creating Simple Drawings Using Object Snap Tracking to extrapolate a projected top view Using Modify tools to arrange an office layout
4. Drawing Precision in AutoCAD Polar and Ortho Tracking Entering Coordinates and Angles Object Snaps and Tracking

5. Making Changes in Your Drawing Move Copy Rotate Mirror Scale Using the reference option with the Scale Tool
6. Drawing Templates Using Template Files (.dwt) to Make New Drawing Exploring what Settings and Elements are saved with Templates
7. Organizing Your Drawing with Layers Layer States Properties by Layer Tools
8. Advanced Object Types Polylines Arcs Polygons Ellipses
9. Analyzing Model and Object Properties The Properties Palette Quick Select Similar Measure Geometry Tools
10. Advanced Editing Commands Trim and Extend Fillet and Chamfer Polyline Edit and Spline Offset and Explode Join
11. Inserting Blocks The Insert Block Command Inserting Blocks with Tool Palettes Dynamic Blocks Migrating Blocks and other Elements between Drawings with Design Center
12. Projects - Creating More Complex Objects

NM 2208 Intellectual property RightsSkill development Course

Course Objectives:

1. To introduce the students to Intellectual Property Rights (IPR) which is a key component in modern knowledge management processes
2. To create consciousness on IPR in students at an early stage of their education so that they develop an appreciation for ethical and rightful use of existing knowledge
3. To make them understand how to take ownership of knowledge they may develop as a result of their creative innovations, take ownership and either drive themselves in becoming entrepreneurs or become responsible knowledge users in society
4. To expose students some of the recent debates on the societal implications of IPR and its role in national/international trade and socio-economic development.

Course outcome:

Learners will be able to

1. Identify the types of intellectual property protection available for their research outcome
2. conduct patent search and analyze patentability of the invention
3. understand the basic structure of Patent document
4. understand the registration and prosecution of different IPs
5. understand the basics of IP commercialization and techno/commercial/legal issues in IPR commercialization

SYLLABUS

Introduction : Concept of property, Intellectual Property (IP) and Intellectual Property Rights (IPR), Importance of IP, Value creation through IP, Advantages of IP protection, Competitive advantage, Promotion of social good, Prevention of duplicates, counterfeit products and IP

Evolution of IP system : Historical view of IP system in India and abroad, Legal basis and rationale behind development of IP system, WTO and TRIPS agreement, Role of WIPO

Types of IPR : Major forms of IP in India and globally, Acts enacted in India related to IP

Patent : Concept, Life of patent, Rights of Patentee, Criteria of patentability- novelty, non-obviousness, and utility, Non-patentable inventions

Patent filing and prosecution : Prior art search, Process of obtaining a patent in India, Provisional and complete specification, Convention application, Patent Cooperation Treaty (PCT), Patent Infringement and Enforcement

Trademark : Types of trademarks, Trademark and Brand, Trademark Registration, Trademark Infringement

Copyright : Copyrights and related rights, Copyright registration, Copyright infringement, Section 52 of Indian Copyright Act

Industrial Design : What is Industrial design, Design registration, Design infringement

Trade Secret : What are Trade Secrets, How trade secrets are maintained in trade and business

Other forms of IP : Semiconductor Integrated Circuits Layout Design, Geographical Indications, Protection of Plant Varieties & Farmers' right, Traditional knowledge

IP commercialization : Licensing & Royalty; Technology Transfer; IP assignment, Compulsory License

Emerging areas : Patinformatics, IP and bank loan, IP insurance, IP audit, IP valuation, IP management, Use of artificial intelligence in IP enforcement, Open innovation

Text Books

1. Ganguli Prabuddha, Gearing up for Patents The Indian Scenario", Universities Press (1998)
2. Ganguli Prahuddha "Intellectual Property Rights-Unleashing the Knowledge Economy". Tata McGraw Hill (2001)

3. Geographical Indications of Goods Act 1990 Ganguli Piabaddha "Geographical Indications-its evolving contours accessible in http://ips.nminsoda/files/2012/05/main_book_pdf (2009)

Reference Books

1. Ganguli Prabuddha and Jahade Siddharth, "Nanotechnology Intellectual Property Rights Research, Design, and Commercialisation", CRC Press, Taylor and Francis Group, USA (2012)
2. Beyond Intellectual Property: Toward Traditional Resource Rights for Indigenous Peoples and Local Communities [Paperback J, Darrell A. Posey and Graham Dotfield, IDRC Books; annotated edition (June (1996)
3. Netand Neil Weinstock, Copyright's Paradox, Oxford University Press (2010)
4. The Indian Patents Act 1970 (as amended in 2005)
5. The Indian Copyright Act 1950 as amended in 2017)
6. Indian Trademarks Act 1999
7. The Indian Industrial Designs Act 2000
8. The Protection of Plant Varieties and Farmers' Right Act 2001
9. Inventing the Future: An Introduction to Patents for small and medium sized enterprises, WIPO publication No 917 www.wipo.int/ebookshop
10. Looking Good: An Introduction to Industrial Designs for Small and Medium sized Enterprises; WIPO publication No.498 www.wipo.int/ebookshop

NM 2209 MC ENVIRONMENTAL Science

(Common for all Branches)

Course Objectives

The objectives of the Environmental Science course are to

1. Familiarize the fundamental aspects of environment and the environmental management'
2. Provide information of some of the important international conventions which will be useful during the future endeavors after graduation.
3. Make realize the importance of natural resources management for the sustenance of the life and the society.
4. Apprise the impact of pollution getting generated through the anthropogenic activities on the environment
5. Provide the concept of Sustainable Development, energy and environmental management

6. Impart knowledge on the new generation waste like e-waste and plastic waste.

Course Outcomes

After completion of the course the students will have

1. Knowledge on the fundamental aspects of environment and the environmental management
2. The knowledge on the salient features of the important international conventions
3. Understanding of the importance of natural resources management for the sustenance of the life and the society.
4. Familiarity on various forms of pollution and its impact on the environment.
5. Understand the elements of Sustainable Development, energy and environmental management
6. Knowledge on the new generation waste like e-waste and plastic waste.

SYLLABUS

Introduction: Structure and functions of Ecosystems-Ecosystems and its Dynamics-Value of Biodiversity-impact of loss of biodiversity, Conservation of bio-diversity. Environmental indicators - Global environmental issues and their impact on the ecosystems.

Salient features of International conventions on Environment: Montreal Protocol, Kyoto protocol, Ramsar Convention on Wetlands, Stockholm Convention on Persistent Organic Pollutants, United Nations Framework Convention on Climate Change (UNFCCC),

Natural Resources Management: Importance of natural resources management-Land as resource, Land degradation, Soil erosion and desertification, Effects of usage of fertilizer, herbicides and pesticide-watershed management.

Forest resources: Use and over-exploitation, Mining and dams – their effects on forest ecosystems and the living beings.

Water resources: Exploitation of surface and groundwater, Floods, droughts, Dams:benefits and costs.

Mineral Resources: Impact of mining on the environment and possible environmental management options in mining and processing of the minerals. Sustainable resource management (land, water, and energy), and resilient design under the changing environment.

Environmental Pollution: Local and Global Issues. Causes, effects and control measures. Engineering aspects of environmental pollution control systems.

Air pollution: impacts of ambient and indoor air pollution on human health. Water pollution: impacts water pollution on human health and loss of fresh water resources. Soil pollution and its impact on environment. Marine pollution and its impact on blue economy. Noise pollution.

Solid waste management: Important elements in solid waste management- Waste to energy concepts. Air (prevention and control of pollution) Act, Water (prevention and control of pollution) Act and their amendments. Salient features of Environmental protection Act, 1986.

Sustainable Development: Fundamentals of Sustainable Development– Sustainability Strategies and Barriers – Industrialization and sustainable development. Circular economy concepts in waste (solid and fluid) management.3

Energy and Environment: Environmental Benefits and challenges, Availability and need of conventional energy resources, major environmental problems related to the conventional energy resources, future possibilities of energy need and availability. Solar Energy: process of photovoltaic energy conversion, solar energy conversion technologies and devices, their principles, working and applications, disposal of solar panel after their usage. Biomass energy: Concept of biomass energy utilization, types of biomass energy, conversion processes, Wind Energy, energy conversion technologies, their principles, equipment and suitability in context of India.

Management of plastic waste and E-waste: Sources, generation and characteristics of various e- and plastic wastes generated from various industrial and commercial activities; Waste management practices including onsite handling, storage, collection and transfer. E-waste and plastic waste processing alternatives. E-Waste management rules and Plastic waste management rules, 2016 and their subsequent amendments.

Text Books:

1. Bharucha, Erach (2004). Textbook for Environmental Studies for Undergraduate Courses of all Branches of Higher Education, University Grants Commission, New Delhi.
2. Basu, M., Xavier, S. (2016). Fundamentals of Environmental Studies, Cambridge University Press, India
3. Masters, G. M., & Ela, W. P. (1991). Introduction to environmental engineering and science. Englewood Cliffs, NJ: Prentice Hall.

4. Enger, E. and Smith, B., Environmental Science: A Study of Interrelationships, Publisher: McGraw-Hill Higher Education; 12th edition, 2010.

Reference Books:

1. Sharma, P. D., & Sharma, P. D. (2005). Ecology and environment. Rastogi Publications
2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
3. Clark R.S. (2001). Marine Pollution, Clanderson Press Oxford (TB)
4. Jadhav, H & Bhosale, V.M. (1995). Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
5. MoEF&CC, Govt. of India, CPCB: E-waste management rules, 2016 and its amendments 2018.
6. MoEF&CC, Govt. of India, CPCB: Plastic waste management rules, 2016.

NAM 3210 : Mandatory Course (MC):

Indian Constitution/Essence of Indian Traditional Knowledge

UNDER GRADUATE DEGREE COURSE

B.Tech in COMPUTER SCIENCE & ENGINEERING

(Scheme and Syllabus for : 2nd Year 1st & 2nd Semesters)

COMMON SCHEME OF INSTRUCTION & EXAMINATION

III/IV B.TECH (FOUR YEAR COURSE) &

II/VI B.TECH (SIX YEAR DOUBLE DEGREE COURSE)

(With effect from 2020-2021 admitted batch onwards)

B.TECH. (CSE) II YEAR I-SEMESTER SCHEME OF INSTRUCTION AND EXAMINATION

Course Category	CreditsC	Course Title	Hours per week			Internal Marks	External Marks	Total Marks	
			L	T	P				
CS2101	BS	Probability, Statistics And Queuing Theory	3	1	0	30	70	100	3
CS 2102	PC	Elements of Electronics Engineering	3	1	0	30	70	100	3
CS 2103	PC	Computer Organization And Architecture	3	1	0	30	70	100	3
CS 2104	PC	Operating Systems	3	1	0	30	70	100	3
CS 2105	PC	Object Oriented Programming through Java	3	1	0	30	70	100	3
CS 2106	PC	Computer Organization Lab	0	0	3	50	50	100	1.5

CS 2107	PC	Object Oriented Programming (through Java) Lab	0	0	3	50	50	100	1.5
CS 2108	PC	Operating Systems Lab	0	0	3	50	50	100	1.5
CS 2109	SC	Intellectual Property Rights (MC)	1	0	2	50	50	100	2
CS 2110	MC	Environmental Science	0	0	0	-	100	100	0
Total Credits									21.5

CS 2101 : PROBABILITY, STATISTICS & QUEUING THEORY

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 Hours Credits: 3
 Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Courseobjectives

1. to provide foundation of probabilistic and statistical analysis
2. to provide an understanding on concepts of probability, random variables, probability distributions, sampling, estimation, hypothesis testing, regression, correlation, multiple regression, hypothesis testing, sample test, queuing methods
3. to explore applications of probabilistic and statistical tools to solve real world problems.

Course outcomes

After completion of the course the student should be able to:

1. define and explain basic concepts in probability theory and how to translate real-world problems into probability models
2. solve standard problems that include random variables, discrete and continuous probability distributions
3. perform Test of Hypothesis and construct a confidence interval to estimate population parameters
4. compute and interpret the results of Correlation Analysis, Multivariate Regression, Chi-Square test for Independence and Goodness of Fit
5. explain basic concepts in Markov processes, M/M/1 and M/M/C queueing systems.

SYLLABUS

1. Probability: Definitions of probability, Addition theorem, Conditional probability, Multiplication theorem, Bayes Theorem of Probability and Geometric Probability.
2. Random variables and their properties: Discrete Random Variable, Continuous Random Variable, Probability Distribution, Joint Probability

Distributions their Properties, Transformation Variables, Mathematical Expectations, Probability Generating Functions.

3. Probability Distributions: Discrete Distributions: Binomial, Poisson Negative Binomial Distributions And Their Properties; Continuous Distributions: Uniform, Normal, Exponential Distributions And Their Properties.

4. Multivariate Analysis: Correlation, Correlation Coefficient, Rank Correlation, Regression Analysis, Multiple Regression, Attributes, Coefficient Of Association, Chi Square Test For Goodness Of Fit, Test For Independence.

5. Estimation: Sample, Populations, Statistic, Parameter, Sampling Distribution, Standard Error, Un-biasedness, Efficiency, Maximum Likelihood Estimator, Notion & Interval Estimation.

6. Testing of Hypothesis: Formulation of Null hypothesis, critical region, level of significance, power of the test;

7. Sample Tests: Small Sample Tests : Testing equality of means, testing equality of variances, test of correlation coefficient, test for Regression Coefficient; Large Sample tests: Tests based on normal distribution

8. Queuing Theory: Queue description, characteristics of a queueing model, study statesolutions of M/M/1: Model, M/M/1; N Model, M/M/C: Model, M/M/C: N Model, Case studies

Text Books

1. Probability & Statistics for Engineers and Scientists, Walpole, Myers, Myers, Ye. Pearson Education.

2. Probability, Statistics and Random Processes T.Veerarajan Tata McGraw-Hill

Reference Book

1. Probability & Statistics with Reliability, Queuing and Computer Applications, Kishor S.Trivedi, Prentice Hall of India, 1999

CS 2102 : ELEMENTS OF ELECTRONICS ENGINEERING

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 Hours Credits: 3
 Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives

1. Introduce students to basics of semiconductors, their classification and properties
2. To provide theory of PN junction diode, its characteristics and applications

3. To introduce basics of rectifying circuits and bipolar junction transistor

4. To provide basics of transistor biasing, transistor amplifiers and field effect transistors

Course Outcomes

By the end of the course, the student should be able to:

1. Explain the basics of semiconductors and their classification
2. Understand the theory of PN junction diode, rectifying circuits and bipolar junction transistor
3. Explain the concepts of transistor biasing, transistor amplifiers and field effect transistors

1. Introduction to Electronics and Semiconductors: Energy band theory, Conduction in Insulators, Semiconductors and metals, Electron emission from metals, Classification of semiconductors, Carrier concentration in an intrinsic semiconductor, Properties of intrinsic semiconductor, Drift and diffusion currents.

2. Semiconductor Diode: Theory of PN junction diode, Open circuited PN junction, V-I characteristics of a PN diode, Diode current equation, Transition and diffusion capacitances, Break down in PN diode, Applications of PN diodes. Zener diode, Zener regulator, Tunnel diode, Schottky diode.

3. Rectifying circuits: Half wave and full wave rectifiers, Bridge rectifiers, Efficiency, Ripple and regulation of each rectifier, Capacitor filters.

4. Bipolar Junction Transistor :- Introduction, construction, Operation of PNP and NPN Transistors – Transistor Circuit configurations- Characteristics of a CE configurations – h parameters, low frequency small signal equivalent circuit of a Transistor.

5. Transistor Biasing and thermal stabilization: Transistor Biasing, Stabilization, Different methods of transistor biasing – Fixed bias, Collector feedback bias – self bias – Bias compensation.

6. Transistor Amplifiers: CE, CB, CC amplifier configurations – Multistage amplifier – A Two Stage RC coupled amplifier – frequency response curve and bandwidth.

7. Field Effect Transistors: Junction Field Effect Transistors (JFET) – JFET characteristics, JFET Parameters, Small signal equivalent circuit – MOSFETs – Depletion and Enhancement MOSFETs.

Text Books:

1. Electronic Device and Circuits by Sanjeev Gupta.

Reference Books:

1. Electronic Device and Circuits Theory by Robert L. Boylestad
Electronic Device and Circuits by David. A. Bell

CS 2103 : COMPUTER ORGANIZATION AND ARCHITECTURE

Common with 6 years integrated B.Tech(CSE)+M.Tech

Instruction: 3 Periods/week, Univ. Exam: 3 Hours Credits: 3
Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives:

1. To study about structure and functional components of a computer.
2. Understanding the hierarchical organization of a computer system which consists of instruction set of commands.
3. Learn about the architecture of a computer from a programming view.
4. To design a balance system that minimizes performance and utilization of all elements.

Course Outcomes:

1. Knowledge about major components of a computer such as processor, memory and I/O modules along with their interconnections internally with outside world.
2. Detailed idea about architecture of central processing unit, functions of control unit, memory, I/O devices and their issues.
3. simple and multiple processor organization and their issues.

SYLLABUS

1. Register Transfer and Micro operations: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Micro operations, Logic Micro operations, Shift Micro operations, Arithmetic Logic Shift Unit.

2. Basic Computer Organization and Design : Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instructions, Input- Output and Interrupt, Complete Computer Description, Design of Basic Computer, Design of Accumulator Logic.

3. Micro programmed Control: Control Memory, Address Sequencing, Micro program Example, Design of Control Unit.

4. Central Processing Unit: Introduction, General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer (RISC), Architecture and Programming of 8085 Microprocessor.

5. Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processors.

6. Input/output Organization: Peripheral Devices, I/O interface, Asynchronous data transfer, Modes of transfer, priority Interrupt, Direct memory access, Input-Output Processor(IOP), Serial Communication.

7. Memory Organization: Memory Hierarchy, Main memory, Auxiliary memory, Associate Memory, Cache Memory, and Virtual memory, Memory Management Hardware.

Text Books:

1. Computer System Architecture, M. Morris Mano, Prentice Hall of India Pvt. Ltd., Third Edition, Sept. 2008.
2. Computer Architecture and Organization, P. Chakraborty.
3. Microprocessor Architecture, Programming and Applications with the 8085 by Ramesh S Gaonkar

Reference Books:

1. Computer Architecture and Organization, William Stallings, PHI Pvt. Ltd., Eastern Economy Edition, Sixth Edition, 2003.
2. Computer Organization and Architecture, Linda Null, Julia Lobur, Narosa Publications ISBN 81-7319-609-5
3. Computer System Architecture", John. P. Hayes.

CS 2104: OPERATING SYSTEMS

Common with 6 years integrated B.Tech(CSE)+M.Tech

Instruction: 3 Periods/week,	Univ. Exam: 3 Hours	Credits: 4
Internal: 30 Marks	University Exam: 70 Marks	Total: 100 Marks

Course objectives:

1. To understand evolution of Operating System.
2. To understand operating system as a layer of abstraction above physical hardware that facilitates usage convenience and efficient resource management of computer system resources.
3. To learn design and implementation of policies and mechanisms for OS subsystem.
4. To investigate case studies to understand the design philosophies / paradigm for popular multiuser or single user operating system.

Course Outcomes:

1. The student understands OS evolution, its structure and services provided by it.
2. Learn process life cycle, process scheduling objectives, policies and mechanisms, process synchronization, inter process communication, deadlocks and other process subsystem related concepts.

3. Learn memory hierarchy, allocation and deallocation policies and mechanism for main and auxiliary memory, file system design and implementation issues.

4. Investigate UNIX/ LINUX and Windows OS platforms w.r.t similarities and differences in design philosophies.

SYLLABUS

1. Introduction to Operating Systems: Over View of Operating Systems, Types of Operating Systems, Operating System Structures, Operating System Services, System Calls, Virtual Machines, Operating System Design and Implementation.

2. Process Management: Process Concepts, Operations on Processes, Cooperating Processes, Threads, Inter Process Communication, Process Scheduling, Scheduling Algorithms, Multiple-Processor Scheduling, Thread Scheduling.

3. Process Synchronization: The Critical Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classical Problems of Synchronization, Critical Regions, Monitors.

4. Deadlocks: System Model, Deadlock Characterization, Methods For Handling Deadlocks, Deadlock Prevention, Avoidance, Deadlock Detection, Recovery from Deadlocks

5. Memory Management: Logical versus Physical Address, Swapping, contiguous memory allocation, paging, structure of the page table, segmentation, Virtual Memory, Demand Paging, Page Replacement, Allocation of Frames, Thrashing, Memory-Mapped files

6. File Systems, Implementation, and Secondary-storage Structure: Concept of a file, Access Methods, Directory Structure, Protection, File System Structure, Allocation Methods, Free Space Management, Directory Management, Device Drivers, overview of Mass-storage structure, Disk structure, disk attachment, disk scheduling, swap-space management.

7. Case study: Overview of LINUX, Windows Operating systems

Text Book:

1. Operating Systems, Abraham Silberschatz, Peter Baer Galvin, and Greg Gagne, John Wiley Publ., Seventh Edition.

1. Operating Systems; A Practical Approach. Rajiv Chopra.

Reference Books:

1. Modern Operating Systems, Andrew S. Tanenbaum, 2nd edition, 1995, PHI.

2. Operating Systems, William Stallings 5th Edition - PHI

3. Operating Systems: A Design-Oriented Approach', Charles Crowley, 'Tata Hill Co., 1998 edition.

CS2105 : OBJECT ORIENTED PROGRAMMING through JAVA

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods+1Tut/week, Univ. Exam: 3 Hours Credits: 4
Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Learning Objectives :

* This subject will help to improve the analytical skills of object-oriented programming

* Over all development of problem solving and critical analysis

* Formal introduction to Java programming language

Learning Outcome:

On successful completion of this course, the students should be able to:

* Show competence in the use of the Java programming language in the development of small to medium-sized application programs that demonstrate professionally acceptable coding and performance standard

* Understand the basic principles of the object-oriented programming

* Demonstrate an introductory understanding of graphical user interfaces, multi-threaded programming, and event-driven programming.

SYLLABUS

1. Introduction to Java: Basics of Java programming, Data types, Variables, Operators, Control structures including selection, Looping, Java methods, Overloading, Math class, Arrays in java.

2. Objects and Classes: Basics of objects and classes in java, Constructors, Finalizer, Visibility modifiers, Methods and objects, Inbuilt classes like String, Character, String Buffer, File, this reference

3. Inheritance and Polymorphism: Inheritance in java, Super and sub class, Overriding, Object class, Polymorphism, Dynamic binding, Generic programming, Casting objects, Instance of operator, Abstract class, Interface in java, Package in java, UTIL package.

4. Event and GUI programming: Event handling in java, Event types, Mouse and key events, GUI Basics, Panels, Frames, Layout Managers: Flow Layout, BorderLayout, GridLayout, GUI components like Buttons, Check Boxes, Radio Buttons, Labels, Text Fields, Text Areas, Combo Boxes, Lists, Scroll Bars, Sliders, Windows, Menus, Dialog Box, Applet and its lifecycle, Introduction to Swing

5. I/O programming: Text and Binary I/O, Binary I/O classes, Object I/O, Random Access Files.

6. Multi-threading in java: Thread life cycle and methods, Runnable interface, Thread synchronization, Exception handling with try-catch-

finally, Collections in java, Introduction to Java Beans and Network Programming.

Reference Books:

1 Introduction to Java Programming (Comprehensive Version), Daniel Liang, Seventh Edition, Pearson.

2 Programming in Java, Sachin Malhotra & Saurabh Chaudhary, Oxford University Press.

3 Murach's Beginning Java2, Doug Lowe, Joel Murach and Andrea Steelman, SPD.

4 Core Java Volume-I Fundamentals, Eight Edition, Horstmann & Cornell, Pearson Education.

5 The Complete Reference, Java2 (Fourth Edition), Herbert Schild, TMH.

6 Java Programming, D.S. Malik, Cengage Learning.

CS 2106 : DIGITAL ELECTRONICS & MICROPROCESSORS LAB

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 Hours Credits: 2
Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

Course Objective:

1. To learn about logic gates, half adders, full adders and flip-flops.

2. To learn about the microprocessor programming.

3. To learn about the microprocessor interfacing with stepper motor, R-2R ladder.

Course Outcomes:

1. The student understands the logic gates, half adders, full adders and flip-flops to design a circuit.

2. The student develops the skill of writing microprocessor programming.

3. The student understands the interfacing of microprocessor with stepper motor, R-2R ladder.

1. DIGITAL EXPERIMENTS

a. Verification of truth tables of OR, AND, NOT, NAND, NOR, EX-OR gates (By using 7400-series)

b. Construction of gates using NAND, NOR gates.

c. Construction of Half and Full adders and verifying their truth tables.

d. Operation and verifying truth tables of flip-flops- RS, D, and JK using ICs.

- e. Construction of Decade counters (7490).
- f. 4-bit parallel adder using combinational circuits.
- g. Decade counter using JK flip flops.
- h. Up/Down counter using JK flip flop.
- i. Up/Down counter using 7493.

2. MICROPROCESSOR (Intel 8085) Programming

- a. Binary addition & subtraction. (8-bit & 16-bit)
- b. Multiplication & division.
- c. Picking up largest/smallest number.
- d. Arranging –ascending/descending order.
- e. Decimal addition (DAA) & Subtraction.
- f. Time delay generation

Text Book:

8. Microprocessor Architecture, Programming and Applications with the 8085 by Ramesh Gaonkar

9. Computer System Architecture, M. Morris Mano, Prentice Hall of India Pvt. Ltd., Third Edition, Sept. 2008.

CS 2107 : OBJECT ORIENTED PROGRAMMING Through JAVA LAB

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 Hours Credits: 1.5
Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

Course Objectives:

1. To develop programs using basic OOPS concepts such as classes and objects.
2. To implement programs using Inheritance concepts.
3. To implement programs using Exception handling.
4. To develop programs using operator overloading concepts.

Course Outcomes:

1. Student will be able to use OOPs concepts.
2. Ability to apply Inheritance concepts to several problems.
3. Ability to use Exception Handling concepts.

List of Programs:

1. Program to define a structure of a basic JAVA program
2. Program to define the data types, variable, operators, arrays and control structures.
3. Program to define class and constructors. Demonstrate constructors.

4.

Program to define class, methods and objects. Demonstrate method overloading.

5. Program to define inheritance and show method overriding.

6. Program to demonstrate Packages.

7. Program to demonstrate Exception Handling.

8. Program to demonstrate Multithreading.

9. Program to demonstrate I/O operations.

10. Program to demonstrate Network Programming.

11. Program to demonstrate Applet structure and event handling.

12. Program to demonstrate Layout managers.

CS 2108 : OPERATING SYSTEMS LAB

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 Hours Credits: 1.5

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

Course Objectives:

1. To learn about UNIX/LINUX operating system, its intervals.
2. To learn system programming for UNIX/LINUX Operating System.
3. To understand UNIX/LINUX shell and its programming.
4. To understand resource management policies and mechanisms and their performance evaluation.

Course Outcomes:

1. The student practices UNIX commands, Vi editor, shell commands.
2. The student develops skill in writing C programs using system calls for process management, inter process communication and other aspects.
3. The student learns shell programming and develops skill for writing scripts for batch level tasks.
4. The student learns to simulate OS resource management aspects like process scheduling, page replacement and others to evaluate performance.

Module I

1. OS lab familiarization, Home Assignment on Unix commands, Vi editor
2. Simple C programs using command line arguments, system calls, library function calls, make utility
3. C programs using fork system call to create processes and study parent, child process mechanism
4. C programs to create process chaining, spawning
5. C programs to handle errors using errno, perror() function

6. C programs to use pipe system call for inter process communication

Module II

1. Familiarization of Unix shell programming
2. Simple shell programming exercises
3. Shell programming using decision making constructs
4. Shell programming using loop constructs
5. Shell programming for file and directory manipulation

Module III

1. C programs to study process scheduling implementing FCFS, Shortest Job First, and Round Robin algorithms
2. C programs to study page replacement implementing FIFO, Optimal, and LRU page replacement algorithms
3. C programs to study deadlock avoidance and detection
4. C Programs to simulate free space management

References:

1. Unix concepts and applications by Sumitabha Das, TMH Publications.
2. Unix programming by Stevens, Pearson Education.
3. Shell programming by Yashwanth Kanetkar.
4. Operating System Concepts by Silberschatz, and Peter Galvin.

CS 2109 : INTELLECTUAL PROPERTY RIGHTS

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 Hours Credits: 2

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objective:

1. To introduce the students to Intellectual Property Rights (IPR) which is a key component in modern knowledge management processes
2. To create consciousness on IPR in students at an early stage of their education so that they develop an appreciation for ethical and rightful use of existing knowledge
3. To make them understand how to take ownership of knowledge they may develop as a result of their creative innovations, take ownership and either drive themselves in becoming entrepreneurs or become responsible knowledge users in society
4. To expose students some of the recent debates on the societal implications of IPR and its role in national/international trade and socio-economic development.

Course outcome:

Learners will be able to

1. identify the types of intellectual property protection available for their research outcome
2. conduct patent search and analyze patentability of the invention
3. understand the basic structure of Patent document
4. understand the registration and prosecution of different IPs
5. understand the basics of IP commercialization and techno/commercial/legal issues in IPR commercialization

SYLLABUS

1. Introduction : Concept of property, Intellectual Property (IP) and Intellectual Property Rights (IPR), Importance of IP, Value creation through IP, Advantages of IP protection, Competitive advantage, Promotion of social good, Prevention of duplicates, counterfeit products and IP
2. Evolution of IP system : Historical view of IP system in India and abroad, Legal basis and rationale behind development of IP system, WTO and TRIPS agreement, Role of WIPO
3. Types of IPR : Major forms of IP in India and globally, Acts enacted in India related to IP
4. Patent : Concept, Life of patent, Rights of Patentee, Criteria of patentability- novelty, non-obviousness, and utility, Non-patentable inventions
5. Patent filing and prosecution : Prior art search, Process of obtaining a patent in India, Provisional and complete specification, Convention application, Patent Cooperation Treaty (PCT), Patent Infringement and Enforcement
6. Trademark : Types of trademarks, Trademark and Brand, Trademark Registration, Trademark Infringement
7. Copyright : Copyrights and related rights, Copyright registration, Copyright infringement, Section 52 of Indian Copyright Act
8. Industrial Design : What is Industrial design, Design registration, Design infringement
9. Trade Secret : What are Trade Secrets, How trade secrets are maintained in trade and business
10. Other forms of IP : Semiconductor Integrated Circuits Layout Design, Geographical Indications, Protection of Plant Varieties & Farmers' right, Traditional knowledge
11. IP commercialization : Licensing & Royalty; Technology Transfer; IP assignment, Compulsory License

12. Emerging areas : Patinformatics, IP and bank loan, IP insurance, IP audit, IP valuation, IP management, Use of artificial intelligence in IP enforcement, Open innovation

Text Books

1. GanguliPrabuddha, Gearing up for Patents The Indian Scenario", Universities Press (1998)
2. GanguliPrahuddha "Intellectual Property Rights-Unleashing the Knowledge Economy". Tata McGraw Hill (2001)
3. Geographical Indications of Goods Act 1990 GanguliPiabaddha "Geographical Indications-its evolving contours accessible in http://ips.nminsoda/files/2012/05/main_book_pdf (2009)

Reference Books

1. GanguliPrabuddha and JahadeSiddharth, "Nanotechnology Intellectual Property Rights Research, Design, and Commercialisation", CRC Press, Taylor and Francis Group, USA (2012)
2. Beyond Intellectual Property: Toward Traditional Resource Rights for Indigenous Peoples and Local Communities [Paperback J,Darrell A. Posey and Graham Dotfield, IDRC Books; annotated edition (June (1996)
3. Netancl Neil Weinstock, Copyright's Paradox, Oxford University Press (2010)
4. The Indian Patents Act 1970 (as amended in 2005)
5. The Indian Copyright Act 1950 as amended in 2017)
6. Indian Trademarks Act 1999
7. The Indian Industrial Designs Act 2000
8. The Protection of Plant Varieties andFarmers' Right Act 2001
9. Inventing the Future: An Introduction to Patents for small and medium sized enterprises, WIPOpublication No 917 www.wipo.int/ebookshop
10. Looking Good: An Introduction to Industrial Designs for Small and Medium sized Enterprises; WIPOpublication No.498 www.wipo.int/ebookshop

CS 2110 : ENVIRONMENTAL SCIENCE

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 2Periods/week, Univ. Exam: 3 Hours Credits: 0

Internal: 0 Marks University Exam: 100 Marks Total: 100 Marks

Course Objectives

The objectives of the Environmental Science course are to

- Familiarize the fundamental aspects of environment and the environmental management'
- Provide information of some of the important international conventions which will be useful during the future endeavors after graduation.
- Make realize the importance of natural resources management for the sustenance of the life and the society.
- Apprise the impact of pollution getting generated through the anthropogenic activities on the environment
- Provide the concept of Sustainable Development, energy and environmental management
- Impart knowledge on the new generation waste like e-waste and plastic waste.

Course Outcomes

After completion of the course the students will have

- Knowledge on the fundamental aspects of environment and the environmental management
- The knowledge on the salient features of the important international conventions
- Understanding of the importance of natural resources management for the sustenance of the life and the society.
- Familiarity on various forms of pollution and its impact on the environment.
- Understand the elements of Sustainable Development, energy and environmental management
- Knowledge on the new generation waste like e-waste and plastic waste.

SYLLABUS

1. Introduction: Structure and functions of Ecosystems-Ecosystems and its Dynamics-Value of Biodiversity-impact of loss of biodiversity, Conservation of bio-diversity. Environmental indicators - Global environmental issues and their impact on the ecosystems.

Salient features of International conventions on Environment: Montreal Protocol, Kyoto protocol, Ramsar Convention on Wetlands, Stockholm Convention on Persistent Organic Pollutants, United Nations Framework Convention on Climate Change (UNFCCC),

2. Natural Resources Management: Importance of natural resources management-Land as resource, Land degradation, Soil erosion and desertification, Effects of usage of fertilizer, herbicides and pesticide-watershed management.

3. Forest resources: Use and over-exploitation, Mining and dams – their effects on forest ecosystems and the living beings.

4. Water resources: Exploitation of surface and groundwater, Floods, droughts, Dams:benefits and costs.

5. Mineral Resources: Impact of mining on the environment and possible environmental management options in mining and processing of the minerals.Sustainable resource management (land, water, and energy), and resilient design under the changing environment.

6. Environmental Pollution: Local and Global Issues. Causes, effects and control measures. Engineering aspects of environmental pollution control systems.

7. Air pollution: impacts of ambient and indoor air pollution on human health. Water pollution: impacts water pollution on human health and loss of fresh water resources. Soil pollution and its impact on environment.Marine pollution and its impact on blue economy.Noise pollution.

8. Solid waste management: Important elements in solid waste management- Waste to energy concepts. Air (prevention and control of pollution) Act, Water (prevention and control of pollution) Act and their amendments. Salient features of Environmental protection Act, 1986.

9. Sustainable Development: Fundamentals of Sustainable Development– Sustainability Strategies and Barriers – Industrialization and sustainable development. Circular economy concepts in waste (solid and fluid) management.

10. Energy and Environment: Environmental Benefits and challenges, Availability and need of conventional energy resources, major environmental problems related to the conventional energy resources, future possibilities of energy need and availability. Solar Energy: process of photovoltaic energy conversion, solar energy conversion technologies and devices, their principles, working and applications, disposal of solar panel after their usage. Biomass energy: Concept of biomass energy utilization, types of biomass energy, conversion processes, Wind Energy, energy conversion technologies, their principles, equipment and suitability in context of India.

11. Management of plastic waste and E-waste: Sources, generation and characteristics of various e- and plastic wastes generated from various industrial and commercial activities; Waste management practices including onsite handling, storage, collection and transfer. E-waste and plastic waste processing alternatives. E-Waste management rules and Plastic waste management rules, 2016 and their subsequent amendments.

Text Books:

1. Bharucha,Erach (2004). Textbook for Environmental Studies for Undergraduate Courses of all Branches of Higher Education, University Grants Commission, New Delhi.

2. Basu, M., Xavier, S. (2016). Fundamentals of Environmental Studies, Cambridge University Press, India

3. Masters, G. M., &Ela, W. P. (1991). Introduction to environmental engineering and science. Englewood Cliffs, NJ: Prentice Hall.

4. Enger, E. and Smith, B., Environmental Science: A Study of Interrelationships, Publisher: McGraw-Hill Higher Education; 12th edition, 2010.

Reference Books:

1. Sharma, P. D., & Sharma, P. D. (2005). Ecology and environment. Rastogi Publications

2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.

3. Clark R.S. (2001). Marine Pollution, Clanderson Press Oxford (TB)

4. Jadhav, H &Bhosale, V.M. (1995). Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.

5. MoEF&CC, Govt. of India, CPCB: E-waste management rules, 2016 and its amendments 2018.

6. MoEF&CC, Govt. of India, CPCB: Plastic waste management rules, 2016.

COMMON SCHEME OF INSTRUCTION & EXAMINATION

II/IV B.TECH (FOUR YEAR COURSE) &

II/VI B.TECH (SIX YEAR DOUBLE DEGREE COURSE)

(With effect from 2020-2021 admitted batch onwards)

B.TECH. (CSE) II YEAR II-SEMESTER SCHEME OF INSTRUCTION AND EXAMINATION

Course Category	CreditsC	Course Title	Hours per week						
			L	T	P	Marks	Internal	External	Total
CS2201	ES	Microprocessors	3	1	0	30	70	100	3
CS2202	PC	Design and Analysis of Algorithms	3	1	0	30	70	100	3
CS2203	PC	Database Management Systems	3	1	0	30	70	100	3
CS2204	PC	Formal Languages and Automata Theory	3	1	0	30	70	100	3
CS2205	HSS	Managerial Economics	3	1	0	30	70	100	3
CS2206	PC	Algorithms Lab	0	0	3	50	50	100	1.5
CS2207	PC	Database Management Systems Lab	0	0	3	50	50	100	1.5
CS 2208	SC	Java Technologies	1	0	2	50	50	100	2

CS2209	MC	Professional Ethics And Universal Human Values	0	0	0	0	100	100	0
CS2210	MC	NSS / NCC	0	0	2	-	-	-	0
Total Credits									20

Summer Internship (Community Service)

CS2201 : MICROPROCESSORS

Instruction: 3Periods/week, Univ. Exam: 3 Hours Credits: 3
Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives:

1. To discuss the architectures of 8085, 8086 microprocessors, their instruction sets and related ALP programs.
2. To discuss interfacing semiconductor memories, interfacing peripheral to Intel 8086.
3. To study interfacing data converters to 8086 and discuss about micro controller 8051 architecture.

Course Outcomes:

1. Understand the basic architectures of 8085 and 8086 microprocessors.
2. Ability to write ALP programs using instruction sets.
3. Understand the various interfacing concepts and micro controllers.

SYLLABUS

1. Introduction to Microprocessors and Microcomputers: A Brief Architecture and Programming of 8085Microprocessor.
2. Architecture: Instruction Set and Programming of 8086Microprocessor
3. Interfacing Semiconductor Memories and I/O Devices: Semiconductor Memories:ClassificationInternalOrganization& Functional Description, Interfacing SRAMs and EPROMs to8086, Interfacing Characteristics of I/Devices, I/O Device addressing methods, I/O DeviceProgramming Methods.
4. Interfacing Peripherals to Intel8086 -1: Parallel I/O Interface-8255,Serial I/O Interface –8251, Timer Interface -8253/8254
5. Interfacing Peripheral to Intel8086 -2: Keyboard / Display Interface-8279, Interrupt Controller Interface –8259
6. Interfacing Data Converters to 8086: D/A Conversion Methods, A/D Conversionmethods, Interfacing DAC, InterfacingADC.
7. Introduction to Micro controllers: Intel 8051Architecture andProgramming

TextBooks:

1. Microprocessor Architecture, Programming, and Applications with the8085 Ramesh S.Gaonkar, 4thEdition, PenramInternational,1999
2. The 80x86 Family, Design, Programming and Interfacing, John E.Uffenbeck, 3rdEdition,Pearson Education Inc.,2002
3. KennethJ.Ayala, 8051 Microcontroller Architecture, Programming AndApplications,2ndEdition, Penram InternationalPublications,1999

Reference Books:

1. BARRYB.BREY, The Intel Microprocessors8086/8088,80186/80188,80286,80386 and 80486,Pentium, PentiumPro Processor, Pentium II, Pentium III, Pentium 4, Architecture, Programming and Inter facing, 8thEdition,PearsonEducationInc.,2009
2. WalterA.TribelandAvtarSingh, The8088and8086 Microprocessors, Programming,interfacing,Software, Hardware, and Applications, 4thEdition, Pearson Education Inc.,20033.MicroprocessorsandInterfacing, Programming and Hardware, 2ndEdition, Douglass V. Hall,TMH Edition,1999
3. SanjayK Bose, Hardware and Software of Personal Computers, New Age International (P)Ltd.,1991MykePredko, Programming and Customizing the 8051 Microcontroller, TMH,1999

CS 2202 : DESIGN&ANALYSISOFALGORITHMS

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods + 1 tutorial/week, Univ. Exam: 3 Hours Credits: 4
Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives:

On completing this course student will be able to

1. Solve problems using algorithm design methods such as the greedy method, divide and conquer, dynamic programming, backtracking, and branch and bound and writing programs for these solutions
2. Analyze the asymptotic performance of algorithms.
3. Demonstrate a familiarity with major algorithms and data structures.
4. Synthesize efficient algorithms in common engineering design situations.

Course Outcomes:

1. Students will be able to justify the correctness of algorithms using inductive proofs and invariants
2. Analyze worst-case running times of algorithms using asymptotic analysis.
3. Describe various paradigms of design use them appropriately when an algorithmic design situation calls for it.

4. Students will be able to Compare between different data structures. Pick an appropriate data structure for a design situation.

SYLLABUS

1. Introduction– Fundamentals of algorithmic problem solving – important problemtype. Fundamentals of analysis of algorithms and efficiency – Analysis framework– Asymptotic Notations and Basic Efficiency classes – Mathematical Analysis ofNon- recursiveAlgorithms–Mathematical Analysis ofrecursive Algorithms–Empirical Analysis of Algorithms – AlgorithmVisualization

2. BruteForce–SelectionSortandBubblesort–Sequential SearchandBrute– ForceString Matching – Closest Pair and Convex-Hull Problems by Brute Force – ExhaustiveSearchDivide-and-Conquer–Merge sort–Quick sort–BinarySearch–BinaryTreeTraversals and Related Properties – Multiplication of large integers and Strassen’s Matrix Multiplication– Closest- Pair Convex-Hull Problems by Divide- and –Conquer

3. Decrease – and – Conquer – Insertion Sort – Depth-First Search and Breadth-FirstSearch- TopologicalSorting–Algorithmsfor Generating Combinatorial Objects–Decrease-by-a- Constant-Factor Algorithms – Variable-Size-DecreaseAlgorithms.

4. Transform-and-Conquer – Presorting – Gaussian Elimination – Balanced Search Trees– Heaps and Heap sort – Horner’s Rule and Binary Exponentiation – ProblemReduction Space and Time Tradeoffs – Sorting by Counting – Input Enhancement in stringMatching – Hashing –B-Trees

5. Dynamic Programming – Computing a Binomial Coefficient – Warshall’sandFloyd’s Algorithm – Optimal Binary Search Trees - The Knapsack Problem and MemoryFunctions

6. Greedy Technique – Prim’s Algorithm – Kruskal’s Algorithm – Dijkstra’s Algorithm– Huffman Trees Limitations of Algorithm Power – Lower-Bound Arguments –Decision Trees – P, NP and NP – complete problems – Challenges of NumericalAlgorithms

7. Coping with the Limitations of Algorithms Power – Backtracking – Branch-and-Bound– Approximation Algorithms for NP-hard Problems – Algorithms for solvingNonlinear Equations.

TextBook:

1. Introduction to Design & Analysis of Algorithms by AnanyLevitin, Pearson Education, New Delhi, 2003

2. Fundamentals of Computer Algorithms, Horowitz and Sahni, Galgothiapublications.

ReferenceBooks:

1. Introduction to Algorithms by Thomas H. Corman, Charles E. Leiserson, Ronald R. Rivest & Clifford Stein, Prentice Hall of India, New Delhi, New Delhi.

CS 2203 : DATABASE MANAGEMENT SYSTEMS

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 Hours Credits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives:

1. To learn the evolution of DBMS Versus File systems, data models, and layers of abstraction.
2. To understand conceptual and physical aspects of database design.
3. To learn formal and commercial query language specifications.
4. To understand concurrency control, recovery management, and other related issues.

Course Outcomes:

1. The student will understand ER-modeling for conceptual database design and relational model.
2. The student is introduced to formal and commercial query languages : Relational Algebra, calculus and SQL.
3. The student will learn schema refinement and normalization.
4. The Student understands locking protocols concurrency control, and crash recovery methods.

SYLLABUS

1. Introduction: File system versus a DBMS , Advantages of a DBMS, Describing and Storing Data ina DBMS, The Relational model, Levels of abstraction, Data Independence, Transaction management, Structure of a DBMS.

2. Introduction to Database Design and The Relational Model: Database Design and ER Diagrams,Entities, Attributes and Entity Sets, Relationships & Relationship Sets, Additional Features of the ER Model, Conceptual Design with ER Model, Introduction to the Relational Model, Integrity Constraints over Relations, Enforcing Integrity Constraints, Querying Relational Data, Logical Database Design: ER to Relational, Introduction to Views, Destroying/ Altering Tables and Views.

3. Relational Algebra and SQL: Preliminaries, Relational Algebra, The form of a Basic SQL Query,UNION, INTERSECT and EXCEPT, Nested Queries, Aggregate Operators, Null Values, Complex Integrity Constraints in SQL, Triggers and Active Databases, Embedded SQL, Dynamic SQL, JDBC.

4. Database Design: Schema Refinement and Normal Forms, Introduction to Schema Refinement,Functional Dependencies, Reasoning

about FD's, Normal Forms, Properties of Decomposition, Normalization, Other kinds of Dependencies.

5. Transaction Management: The ACID Properties, Transactions & Schedules, Concurrent Execution of Transactions, Lock-Based Concurrency Control.

6. Concurrency Control: 2PL, Serializability and Recoverability, Introduction to Lock Management, Lock Conversions, Dealing with Deadlocks, Specialized Locking Techniques, Concurrency Control without Locking.

7. Crash Recovery: Introduction to ARIES, The Log, Other Recovery-Related Structures, The Write-Ahead Log Protocol, Check pointing, Recovering from a System Crash, Media Recovery.

Text Books:

1. Database Management Systems; Raghu Ramakrishnan, Johannes Gehrke 4th Edition, McGraw- Hill

2. Database Management Systems; Raghu Ramakrishnan, Johannes Gehrke.

Reference:

1. Database System Concepts; A. Silberschatz, H. Korth 5th Edition, McGraw-Hill

CS2204 : FORMAL LANGUAGES & AUTOMATA THEORY

Common with 6 years integrated B.Tech(CSE)+M.Tech

Instruction: 3 Periods/week, Univ. Exam: 3 Hours Credits:3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course objectives:

1. To introduce the concepts in automata theory and theory of computation to design grammars and recognizers for different formal languages.

2. To employ finite state machines to solve problems in computing.

3. To introduce finite state machines, context free grammars and Turing Machines and their properties as the basis for the formal expressivity of computer languages for solving linguistic decision problems.

4. To understand the concepts of tractability and decidability, the concepts of NP-completeness and NP-hard problem and also the challenges for Theoretical Computer Science and its contribution to other sciences.

Course outcomes:

1. Ability to think analytically and intuitively for problem solving situations in related areas of theory in computer science

2. Ability to describe the language accepted by an automata or generated by a regular expression or a context-free grammar;

3. Ability to Understand the functioning of Finite-State Machines, Deterministic Finite-State Automata, Nondeterministic Finite-State Automata and Pushdown Automata and Turing Machines.

SYLLABUS

1. Definitions of alphabet, strings, language, grammar, types of grammar, types of machines, generation of languages from grammar, construction of grammar from the given description of languages

2. Definition of finite state machine, Definite state machine, indefinite state machine, representations in mathematical diagram, tabular etc., id of finite state machine's, design of finite state machine from the given description, elimination of ϵ -transitions, indefinite state machine to definite state machine, optimization of finite state machine

3. Conversion of regular grammar to finite state machine, finite state machine to regular grammar, discussion of pumping lemma, systematic way of construction of finite state machine

4. Definition of regular expression, regular algebra, minimization of regular expressions, closure properties, construction of regular expression from the given description, regular expression to finite state machine, finite state machine to regular expression, construction of regular expression for the given finite state machine- a systematic way using Arden's theorem

5. Definition of push down machine, push down machine, types of push down machine's, push down machine to context free grammar, context free grammar to push down machine, design methodology of various push down machine's, push down machine by empty stack, push down machine by final states, conversion from one type to other type, applications of push down machine's

6. Parsing tree, bottom-up parsing, top-down parsing, types of context free grammar's, left-most and right most derivations, productions, reductions, optimization of context free grammar's, elimination of ϵ productions, unit productions, normal forms- cnf, gnf

7. Definition of Turing machine, ways of representing Turing machine's- tabular form, diagram, mathematical form, quintuples etc., design of Turing machine, id of Turing machine, types of Turing machine, halting problem, church's thesis, universal Turing machine, Gödel number, definitions of recursive functions- prf, rf, decidability. NOTE: Theorem proofs are eliminated

Text books:

1. Introduction to automata theory, languages and computation, John.E.H.P croft/ Rajeev Motwani& JD Ullman—pearson education- III edition

2. Theory of computation, K.L.P.Mishra and N.Chandrasekhar, PHI

Reference Books :

1. Theory of computation, formal languages and automata theory, G P SaradhiVarma, B.ThirupathiRao –Sci Tech publications.

CS 2205 : MANAGERIAL ECONOMICS

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 Hours Credits:3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives:

- To bring about an awareness about the nature of Managerial Economics and its linkages with other disciplines.
- To understand the Micro and Macro Environment of Business.
- To familiarize the prospective engineers with the concepts and tools of Managerial Economics with an objective to understand the real world of business.

Course Outcomes:

After completion of the course, student will be able to:

- Understand the various economic activities in business and industry.
- Analyse the real world business problems.
- Make optimal business decisions for the effective and efficient management of Organisations.

SYLLABUS

Significance of Economics and Managerial Economics: Economics: Definitions of Economics- Wealth, Welfare and Scarcity definitions Classification of Economics- Micro and Macro Economics.

Managerial Economics: Definition, Nature and Scope of Managerial Economics, Differences between Economics and Managerial Economics, Main areas of Managerial Economics, Managerial Economics with other disciplines.

Demand and Utility Analysis: Demand - Definition, Meaning, Nature and types of demand, Demand function, Law of demand - Assumptions and limitations. Exceptional demand curve. Elasticity of demand - Definition, Measurement of elasticity, Types of Elasticity (Price, Income, Cross and Advertisement), Practical importance of Price elasticity of demand, Role of income elasticity in business decisions, Factors governing Price Elasticity of demand.

Utility Analysis: Utility- Meaning, Types of Economic Utilities, Cardinal and Ordinal Utility, Total Utility, Marginal Utility, The law of Diminishing Marginal Utility and its Limitations.

Theory of Production and Cost analysis: Production - Meaning, Production function and its assumptions, use of production function in decision making; Cost analysis - Nature of cost, Classification of costs - Fixed vs. Variable costs, Marginal cost, Controllable vs. Non - Controllable costs, Opportunity cost, Incremental vs. Sunk costs, Explicit vs. Implicit costs, Replacement costs, Historical costs, Urgent vs. Postponable costs, Escapable vs. Unavoidable costs, Economies and Diseconomies of scale.

Market Structures : Definition of Market, Classification of markets; Salient features or conditions of different markets - Perfect Competition, Monopoly, Duopoly, Oligopoly, Importance of kinked demand curve ;Monopolistic Competition.

Pricing and Business Cycles: Pricing Analysis : Pricing – Significance; Different Pricing methods- Cost plus pricing, Target pricing, Marginal cost pricing, Going -rate pricing, Average cost pricing, Peak load pricing , Pricing of joint Products, Pricing over the life cycle of a Product, Skimming pricing Penetration pricing, Mark- up and Mark- down pricing of retailers.

Business cycles - Definition, Characteristics, Phases, Causes and Consequences; Measures to solve problems arising from Business cycles.

Text Books:

1. Sankaran,S., Managerial Economics,Marghan Publications, 2015, Chennai.

2. Aryasri, A.R., Managerial Economics and Financial Analysis, MC Graw Hill Education, New Delhi,2015.

Reference Books:

1. Dwivedi, D.N., Managerial Economics,Vikhas Publishing House Pvt. Ltd. 6th Edition, New Delhi,2004.

2. Dewett, K.K., Modern Economic Theory, S.Chand& Company Ltd., New Delhi,2005.

CS 2206 : ALGORITHMS LAB

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 Hours Credits: 1.5

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

Laboratory Outcomes:

The student should be able to:

- Design algorithms using appropriate design techniques (brute-force, greedy, dynamic programming, etc.)
- Implement a variety of algorithms such as sorting, graph related, combinatorial, etc., in a high level language.
- Analyze and compare the performance of algorithms using language features.
- Apply and implement learned algorithm design techniques and data structures to solve real-world problems.

The laboratory component will emphasize two areas:

Implementation of algorithms covered in class: This will involve running the algorithms under varying input sets and measuring running times, use of different data structures for the same algorithm (wherever applicable) to see its effect on time and space, comparison of different algorithms for the same problem etc.

Design of Algorithms: This will involve design and implementation of algorithms for problems not covered in class but related to topics covered in class.

The exact set of algorithms to design and implement is to be decided by the instructor. In addition, there will be at least one significantly large design project involving some real world application. An efficient design of the project should require the use of multiple data structures and a combination of different algorithms/techniques.

Programs List:

1. a. Create a Java class called Student with the following details as variables within it.
 - (i) USN
 - (ii) Name
 - (iii) Programme
 - (iv) Phone

Write a Java program to create nStudent objects and print the USN, Name, Programme, and Phone of these objects with suitable headings.

b. Write a Java program to implement the Stack using arrays. Write Push(), Pop(), and Display() methods to demonstrate its working.

2.a. Design a superclass called Staff with details as StaffID, Name, Phone, Salary. Extend this class by writing three subclasses namely Teaching (domain, publications), Technical (skills), and Contract (period). Write a Java program to read and display at least 3 staff objects of all three categories.

b. Write a Java class called Customer to store their name and date_of_birth. The date_of_birth format should be dd/mm/yyyy. Write methods to read customer data as and display as using StringTokenizer class considering the delimiter character as “/”.

3. a. Write a Java program to read two integers a and b. Compute a/b and print, when b is not zero. Raise an exception when b is equal to zero.

b. Write a Java program that implements a multi-thread application that has three threads. First thread generates a random integer for every 1 second; second thread computes the square of the number and prints; third thread will print the value of cube of the number.

4. Sort a given set of n integer elements using Quick Sort method and compute its time complexity. Run the program for varied values of n > 5000 and record the time taken to sort. Plot a graph of the time taken versus n on graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using Java how the divide-and-conquer method works along with its time complexity analysis: worst case, average case and best case.

5. Sort a given set of n integer elements using Merge Sort method and compute its time complexity. Run the program for varied values of n > 5000, and record the time taken to sort. Plot a graph of the time taken versus n on graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using Java how the divide-and-conquer method works along with its time complexity analysis: worst case, average case and best case.

6. Implement in Java, the 0/1 Knapsack problem using (a) Dynamic Programming method (b) Greedy method.

7. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm. Write the program in Java.

8. Find Minimum Cost Spanning Tree of a given connected undirected graph using Kruskal's algorithm. Use Union-Find algorithms in your program

9. Find Minimum Cost Spanning Tree of a given connected undirected graph using Prim's algorithm.

10. Write Java programs to

(a) Implement All-Pairs Shortest Paths problem using Floyd's algorithm.

(b) Implement Travelling Sales Person problem using Dynamic programming.

11. Design and implement in Java to find a subset of a given set $S = \{S_1, S_2, \dots, S_n\}$ of n positive integers whose SUM is equal to a given positive integer d. For example, if $S = \{1, 2, 5, 6, 8\}$ and $d = 9$, there are two solutions $\{1, 2, 6\}$ and $\{1, 8\}$. Display a suitable message, if the given problem instance doesn't have a solution. 12. Design and implement in Java to find all Hamiltonian Cycles in a connected undirected Graph G of n vertices using backtracking principle.

REFERENCES:

1. T. H. Cormen, C. L. Leiserson, R. L. Rivest, and C. Stein, Introduction to Algorithms, MIT Press.
2. J. Kleinberg and E. Tardos, Algorithm Design, Addison-Wesley.
3. Harry R. Lewis and Larry Denenberg, Data Structures and Their Algorithms, Harper Collins.
4. A. Gibbons, Algorithmic Graph Theory, Cambridge University Press.
5. Michael T. Goodrich and Roberto Tamassia, Algorithm Design: Foundations, Analysis, and Internet Examples, John Wiley.
6. R. Sedgewick, Algorithms in C (Parts 1-5), Addison Wesley.
7. M. H. Alsuwaiyel, Algorithm Design Techniques and Analysis, World Scientific.
8. Gilles Brassard and Paul Bratley, Algorithmics : theory and practice, Prentice-Hall.
9. Udi Manber, Introduction to Algorithms: A Creative Approach, Addison-Wesley.
10. Sara Baase and Allen Van Gelder, Computer Algorithms: Introduction to Design and Analysis, Addison-Wesley.

CS 2207 : DATABASE MANAGEMENT SYSTEMS LAB

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 Hours Credits: 1.5

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

Course Objectives:

1. To introduce to a commercial DBMS such as ORACLE.
2. To learn and practice SQL commands for schema creation, data manipulation.
3. To learn conceptual and physical database design based on a case study.
4. To apply database design stages by studying a case study.

Course Outcomes:

1. The student is exposed to a commercial RDBMS environment such as ORACLE.
2. The student will learn SQL commands for data definition and manipulation.
3. The student understands conceptual through physical data base design.

4. The student takes up a case study and applies the design steps. Features of a commercial RDBMS package such as ORACLE/DB2, MS Access, MYSQL & Structured Query Language (SQL) used with the RDBMS.

I. Laboratory Exercises Should Include:

- a. Defining Schemas for Applications,
- b. Creation of Database,
- c. Writing SQL Queries,
- d. Retrieve Information from Database,
- e. Creating Views
- f. Creating Triggers
- g. Normalization up to Third Normal Form
- h. Use of Host Languages,
- i. Interface with Embedded SQL,
- j. Use of Forms
- k. Report Writing

II. Some sample applications are given below:

1. Accounting Package for Shops,
2. Database Manager for Magazine Agency or Newspaper Agency,
3. Ticket Booking for Performances,
4. Preparing Greeting Cards & Birthday Cards
5. Personal Accounts - Insurance, Loans, Mortgage Payments, Etc.,
6. Doctor's Diary & Billing System
7. Personal Bank Account
8. Class Marks Management
9. Hostel Accounting
10. Video Tape Library,
11. History of Cricket Scores,
12. Cable TV Transmission Program Manager,
13. Personal Library.
14. Sailors Database
15. Suppliers and Parts Database
10. Computer Architecture and Organization, P. Chakraborty.

CS 2209 : PROFESSIONAL ETHICS AND UNIVERSAL HUMAN VALUES

Common with 6years integrated B.Tech(CSE)+M.Tech and B.Tech(IT)

Instruction: 3Periods/week, Univ. Exam: 3 Hours Credits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives:

The objective of the course is Six fold:

- Development of a holistic perspective based on self-exploration about themselves (humanbeing), family, society and nature/existence.

- This course will illuminate the students in the concepts of laws and its applicability to engineers

- Understanding (or developing clarity) of the harmony in the human being, family, societyand nature/existence

- Strengthening of self-reflection, Development of commitment and courage to act and also enable the students to imbibe and internalize the Values and Ethical Behaviour in the personal and professional lives

- To enable the students to imbibe the Values and Ethical Behavior in the personal and Professional lives

- The students will learn the rights and responsibilities Individual, employee, team member and a global citizen

Course Outcomes:

By the end of the course Student will be able to:

- Grasp the meaning of the concept – Law and also Get an overview of the laws relating to Engineers and also Apprehend the importance of being a law abiding person and They would have better critical ability

- Self-explore by using different techniques to live in harmony at various levels

- Analyze themselves and understand their position with respect to the moral and ethical character needed for a successful and satisfactory work life

- Students are expected to become more aware of themselves and their surroundings (family, society, nature)

- They would become more responsible in life, and in handling problems with sustainable

- solutions, while keeping human relationships and human nature in mind.

- They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society

SYLLABUS

Need, Basic Guidelines, Content and Process for Value Education Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation - as the process for self-exploration, Continuous Happiness and Prosperity - A look at basic Human Aspirations,Right understanding, Relationship and Physical Facility - the basic requirements for fulfillment of aspirations of every human being with their correct priority,

Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understandingand livinginharmonyatvarious levels. Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking, Include practice sessions and case studies.

Understanding Harmony in the Human Being - Harmony in Myself!

- Understanding human being as: a co-existence of the sentient 'I' and the material 'Body', the needs of Self ('I') and 'Body' - happiness and physical facility, the Body as an instrument of 'I' (I being the doer, seer and enjoyer), the characteristics and activities of 'I' and harmony in 'I', the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail, P to ensure Sanyam and Health, Include practice sessions and case studies.

Understanding Harmony in the Family and Society - Harmony in Human – Human Relationship ·Understanding values in human-human relationship: meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship, the meaning of Trust; Difference between intention and competence, the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship, the harmony in the society (society being an extension of family), Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society, Universal Order from family to world family, Include practice sessions and case studies.

Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

- Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature recyclability and self-regulation in nature, Understanding Existence as Co-existence of mutually interacting units in all – pervasive space, Holistic perception of harmony at all levels of existence, Include practice sessions and case studies.

Concept of Law and Law of Torts

- Understanding Essentials of a Valid Contract and the basics of contract law protecting rights and obligations, Introduction to the Law of Torts and the basics to protect oneself and the company Law affecting the Workplace Employers Responsibilities/Duties Hiring Practices, Introduction to Intellectual Property Law, Professional Code of Conduct for Engineers, Relationship between Law and Ethics, Include practice sessions and case studies.

Implications of the above Holistic Understanding of Harmony on Professional Ethics

· Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations, Include practice sessions and case studies.

Text Books

1.R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019.ISBN 978-93-87034-47-1

2. R R Gaur, R Asthana, G P Bagaria, "Teachers' Manual for A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

3. R. Subramanian, "Professional Ethics", Oxford University Press.

4. S.B. Srivastha, "Professional Ethics & Human Values", SciTech Publications (India) Pvt. Ltd. New Delhi.

5. D.R. Kiran, "Professional Ethics & Human Values", TATA McGraw Hill Education.

6. Saroj Kumar, "Business Law" and Avtar Singh, "Law of Contract"

Reference Books

1.JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amar kantik, 1999.

2. A. N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, 2004.

3. The Story of Stuff (Book), MohandasKaramchand Gandhi "The Story of My Experiments with Truth", E. F.Schumacher. "Small is Beautiful", Slow is Beautiful –Cecile Andrews, J C Kumarappa"Economy of Permanence", PanditSunderlal "Bharat Mein Angreji Raj" and Dharampal, "Rediscovering India

4. G K Kapoor, "Business Law" and Sen&Mittra, "Business & Commercial Laws" and Calvin Frank Allen, "Business law for Engineers"

5. Hilgard, E. R.; Atkinson, R. C. & Atkinson, R.L. (1975). *Introduction to Psychology*. 6th Edition. New Delhi: Oxford and IBH Publishing Co. Pvt. Ltd.

6. Govindarajan, M; Natarajan, G. M. &Senthikumar, V.S. (2013). *Professional Ethics & Human Values*. Prentice Hall: New Delhi

7. Gogate, S. B. (2011). *Human Values & Professional Ethics*. Vikas Publishing: New Delhi.

8. Charles E Harris Jr., Michael S Pritchard, Michael J Rabins, "Engineering Ethics, Concepts Cases: 4e, Cengage learning, 2015.

9. Caroline Whitbec, " Ethics in Engineering Practice & Research: 2e, Cambridge University Press 2015.

Appendix "U" Item No.40

B.TECH (FOUR YEAR COURSE) &

B.TECH (SIX YEAR DOUBLE DEGREE COURSE)

(With effect from **2019-2020** admitted batches onwards) Under Choice Based Credit System.

B.Tech – INSTRUMENTATION ENGINEERING

B.TECH. 3/4: SEMISTER -I

Code		Course				Hours per week			University	
Examinations	C									
Number		L	T	P	Tot. Hrs.	Ses. Marks	Ext. Marks	Marks	Time	
INE 311	Control Systems	3	0	0	3	30	70	100	3 Hrs	3
INE 312	Microprocessor and Micro Controllers	3	0	0	3	30	70	100	3 Hrs	3
INE 313	Industrial Electronics	3	0	0	3	30	70	100	3 Hrs	3
INE 314	Analytical Instrumentation	3	0	0	3	30	70	100	3 Hrs	3
INE 315	Advanced Sensors	3	0	0	3	30	70	100	3 Hrs	3
INE 316	Elective-I	3	0	0	3	30	70	100	3 Hrs	3
INE 317	Constitution of Indian/Essence — of Indian traditional Knowledge	—	—	—	—	—	—	—	—	—
INE 318	Industrial Instruments Lab- II	0	0	4	4	50	50	100	3 Hrs	2
INE 319	Control System Lab	0	0	4	4	50	50	100	3 Hrs	2
Total		18	0	8	26	280	520	800		22

INE 316: **Elective-I**

- a) Computer organization & OS. b) Analog Signal Processing.
c) Virtual Instrumentation.

B.TECH. 3/4: SEMISTER -II

Code		Course				Hours per week			University	
Examinations	C	L	T	P	Tot. Hrs.	Ses. Marks	Ext. Marks	Marks	Time	
INE 321	Digital Signal Processing	3	0	0	3	30	70	100	3 Hrs	3
INE 322	Process Control AndControl Components	3	0	0	3	30	70	100	3 Hrs	3
INE 323	Elective –II	3	0	0	3	30	70	100	3 Hrs	3
INE 324	Elective-III	3	0	0	3	30	70	100	3 Hrs	3
INE 325	Open Elective - 1	3	0	0	3	30	70	100	3 Hrs	3
INE 326	Open Elective II- VLSI	0	0	4	4	30	70	100	3 Hrs	3
INE 327	Micro process Lab	0	0	4	4	50	50	100	3 Hrs	2
INE 328	Virtual InstrumentationLab	0	0	4	4	50	50	100	3 Hrs	2
Total	15	0	12	27	300	500	800		22	

INE 323: Elective –II

a) Power Plant Instrumentation. b) Non-Destructive Testing. C) Fundamentals of Nano Sensors.

INE 324: Elective –III

a) Advance Control Theory. b) Advanced Sensing Techniques. C) Design of Instrument Systems.

INE 325: Open Elective - 1 Humanities and Management Course.

INE 326: Open Elective – II

VLSIB.TECH. 4/4: SEMISTER -I

Code		Course				Hours per week			University	
Examinations	C	L	T	P	Tot. Hrs.	Ses. Marks	Ext. Marks	Marks	Time	
INE 411	Elective- IV	3	1	0	4	30	70	100	3 Hrs	3
INE 412	Elective- V	3	1	0	4	30	70	100	3 Hrs	3
INE 413	Open Elective -III	3	1	0	4	30	70	100	3 Hrs	3
INE 414	BiomedicalInstrumentation	3	1	0	4	30	70	100	3 Hrs	3
INE 415	Elective VI -	3	1	0	4	30	7	100	3 Hrs	3
INE 416	Open Elective IV- Programmable control system	3	1	0	4	30	70	100	3 Hrs	3
INE 417 2	BiomedicalInstrumentation Lab		0	0	3	3	50	50	100	3 Hrs
INE 418	Process Control Lab	0	0	3	3	50	50	100	3 Hrs	2
Total		12	4	18	34	280	520	800		22

INE 411:Elective –IV

A) Instrument Data Networks. B) Digital Image Processing C) Micro and Nano Sensors.

INE 412: Elective –V

A) Telemetry B) Artificial Intelligence C) Fiber Optics and Sensors.

INE 413: Open Elective - III IoT Sensors and Devices.

INE 415: Elective- VI

a) Steel Plant Instrumentation b) Industrial Safety Instruments c) Robots & Computer Control of Machine Parts

INE 422: Open Elective- IV Programmable Control System

B.TECH. 4/4: SEMISTER -II

Code		Course				Hours per week			University	
Examinations	C	L	T	P	Tot.	Ses.	Ext.	Marks	Time	
Number					Hrs.	Marks	Marks			
INE 425	Project	-	-	12	12	50	50	100	3 Hrs	15
	Total	9	3	15	27	190	310	500		15

Course Total Credits 160

INE: 311 CONTROL SYSTEMS

L	T	PD	TOTAL Pds	Univ Exam Hrs	Sessnl Marks	Total Marks
3	1	—	4	3	70	100

Unit 1:The control systems, closed loop control, open loop control, servo mechanisms, Differential equations of physical systems

Unit 2:Transfer functions, procedure for deriving transfer functions, Block diagram, algebra, signal flow graphs, Mason's gain formula, application of signal flow graph to control systems.

Unit 3:Time Response: Time domain specifications, types of test inputs, 1 and II order system response, error coefficients, steady state error. The Root locus concept, construction of root loci, construction rules, determination of roots from root locus.

Unit 4:The concept of stability, necessary conditions for stability, Hurwitz stability criterion, Routh stability criterion, application of a Routh stability criterion to Linear feedback systems, Relation between time and frequency response, polar plots.

Unit 5:Bode plots, Nyquist stability criterion, gain margin and phase margin, closed loop frequency response.

TEXT BOOKS:

1. Nagarath IJ and Gopal M – Control systems and Engineering, Willey Eastern, 1985.

2. Ogata K – Modern control Engineering 2nd Edition PHI – 1995.

INE: 312 MICROPROCESSOR AND MICRO CONTROLLERS

L	T	PD	TOTAL Pds	Univ Exam Hrs	Marks	Sessnl Marks	Total Marks
3	1	—	4	3	70	30	100

Unit I: introduction to microprocessors- microprocessor architecture-address, data and control buses-8bit microprocessors -8085- architecture-addressing modes- instruction set – programming –stacks and subroutines-interrupts of 8085.

Unit II: Interfacing concepts-memory interfacing-I/O interfacing methods-memory mapped I/O and direct I/O-types of I/O-simple, polled and interrupt I/O-DMA. Interfacing, keyboard and led interfacing data converter interfacing - (hardware and software).

Unit III: Data communication with parallel and serial devices-8255A PPI, 8253-programmable interval timer, 8257 programmable DMA controller interface-8259 programmable interrupt controller-8251 USART serial interfacing device.

Unit IV: 16-bit microprocessors-8086 architecture-instruction set-80286 microprocessor-Real and PVAM mode of operation -80386 microprocessor and its features-paged addressing mode- 80486 processor and its cache organization.

UNIT V: Microcontrollers- 8bit microcontrollers-8051 architecture-program memory-data memory organization-addressing modes-Timers/Counters organization, serial I/O organization- Interrupt handling-advanced microcontrollers-8096-PIC microcontrollers-AT mega controllers and their features.

REFERENCE BOOKS:

1. Microprocessors architecture, programming and applications – R. S. Goankar – Wiley Eastern India Publications.
2. Microprocessors and digital systems – 2nd edition – D.V. Hall, McGraw Hill Publications.
3. Fundamentals of microprocessors and microcomputers – Badri Ram Dhanpat Rai & sons publications.

INE: 313 INDUSTRIAL ELECTRONICS

L	T	PD	TOTAL Pds	Univ Exam Hrs	Marks	Sessnl Marks	Total Marks
3	1	—	4	3	70	30	100

INTRODUCTION TO INDUSTRIAL ELECTRONICS: Scope of Industrial Electronics, Main task of Power Electronics, Applications, Advantages, Disadvantages, Applications, Block diagram of Power Electronic System, PNP device- Basic structure, two transistor version, Volt Ampere Characteristics, Holding current. Latching current, Gate circuit of Thyristor, Thyristor gate characteristics, Design of firing circuit, Triggering methods of thyristor, thyristor connected in series and parallel, Thyristor ratings, Silicon Controlled Switch(SCS): Basic structure, Two transistor equivalent, characteristics, Uni-junction transistor- Basic structure, Potential divider equivalent, Static emitter characteristics, delay firing of SCR by UJT. Bilateral PNP diode switch(DIAC): Basic structure, Volt-Ampere characteristics, Traic- Basic structure, Volt- Ampere characteristics.

POLYPHASE RECTIFIERS: Introduction, uses of Polyphase Rectifiers, Three phase half wave delta-wye rectifier with resistive load, Six -phase star Half wave rectifier with resistive load, Delta line to line double wye half wave rectifier with inter phase transformer and with resistive load, Three phase delta wye bridge rectifier with resistive load, General m-phase rectifier DC power outputs, efficiencies and ripple factors, Transformer utility factor, Rectifier performance, Commutation in Polyphase rectifiers.

ELECTRIC WELDING AND HIGH FREQUENCY HEATING: Methods of high frequency heating, Welding: Plastic Welding, Fusion Welding, Basic block diagram for a.c. resistance welding, types: Spot welding. Projection welding. Butt welding, Seam welding and Pulsating welding arrangements. Induction Heating: Principle of induction heating. Applications. Dielectric Heating: Principle of dielectric heating. Electrodes used in dielectric heating. Methods of coupling of Electrodes to R.F. Generator. Applications.

VOLTAGE CONTROLLED RECTIFIERS: (outlines of topics only): Single-Phase Half- wave controlled rectifier with resistance load. Single-Phase Full-wave controlled rectifier with resistance load. Three-Phase Half wave controlled rectifier with resistance load. Six-phase half- wave Controlled rectifier with resistance load.

ELECTRONIC SPEED CONTROL OF MOTORS: (outlines of topics only): DC Motor speed Control: single phase dc drives, single phase half wave converter drives, phase control, SCR feedback circuit for series motor drive. Half wave controlled SCR bridge for series motor drive. Chopper controlled dc drives. AC motor speed control- Speed control by variation of stator voltage using SCRs, Variable-frequency A.C motor drive, Voltage-fed inverter control.

P.W.M. control scheme, Current-fed inverter control, chopper controlled wound rotor Induction motor, rotor resistance control.

TEXT BOOKS:

1. Industrial Electronics and by Power Electronics G.K.mithal, Khanna publishers.

2. Power Electronics by P.C.Sen, T.M.H.
3. Power Electronics by Dr.P.S.Bimbira, Khanna publishers

INE: 314 : ANALYTICAL INSTRUMENTATION

L	T	PD	TOTAL Pds	Univ Exam Hrs	Marks	Sessnl Marks	Total Marks
3	1	—	4	3	70	30	100

Introduction, laboratory and industrial analyzers classification of the methods of analysis block diagram of an analysing system. Colorimeters & Spectrophotometers (visible & ultraviolet) electromagnetic radiation, the Beer Lambert law. Infra - red spectrophotometers types of instruments, principles of operation, basic components of the systems.

Nuclear magnetic resonance spectrophotometer (NMR) principle, construction, details Fourier transform NMR, spectroscopy computerized NMR. Electro spin resonance spectrometer (ESR), principle of operation construction of the ESR spectrometer.

X- ray spectrometer: X-ray spectrum, instrumentation for X-ray spectrometry X-ray diffractometers X-ray absorption meters X-ray fluorescence spectrometers. Gas & liquid chromatographic systems: Principles of chromatography, Schemes and constructional details and functions of chromatographic system components.

Systems working on thermal conductivity. Principle of operation-conductivity cell construction- Measuring circuits. electro-chemical cell, construction. conductivity meters, polarography.

PH MEASURING SYSTEMS: Principles of PH measuring electrodes, measuring-reference- selective ion type measuring circuits, industrial PH-meters

INDUSTRIAL GAS ANALYZERS: Types of gas analyzers- flue gas analyzers, paramagnetic oxygen analyzers, electrochemical gas analyzers. Hydrogen gas analyzers-IR gas analyzers, analyzers based on gas density systems based on ionization of gases.

ENVIRONMENTAL POLLUTION MONITORING INSTRUMENTS : Air pollution monitoring, instrument systems for-carbon monoxide-Sulphur dioxide-nitrogen oxides-hydro carbons-ozone automated wet chemical analyzers water pollution monitoring.

TEXT BOOKS:

1. R.S. Khandpur, Handbook of Analytical Instruments, Tata McGraw Hill publishing Co. Ltd., 2nd edition, 2006.
2. Instrumental methods of analysis - HH Willard, Jr., JADean, FASettle, JR, CBS Publications.
3. Instrument engineers Handbook. Instrumentation and Analysis-GB Liptak Edition- Charge Chilton book Company.

INE: 315 : ADVANCED SENSORS

L	T	PD	TOTAL Pds	Univ Exam Hrs	Marks	Sessnl Marks	Total Marks
3	1	—	4	3	70	30	100

Chemical Sensors: Amperometry-Potentiometry-Conductivity sensors-Semi conductive sesors- MEMS sensors. Materials for sensors-Electrical conducting materials- Ionic conductors-zirconia- alumina-NASICON. Semiconductor materials-Titania-tin oxide-zinc oxide. Insulating materials-Ferroelectric Materials-Negative temperature ceramic thermistors.

Thin and Thick film sensors: Thick film processes-Thin film processes-Thin film deposition methods- thin film characterization methods-thin film delineation techniques-compatibility issues- Longmuir-Blodgett films for sensor materials-film forming apparatus-dipping-ion sensors-gas sensors. Applications of thin and thick film sensors.

Biosensors: Colorimetric- Optical- Potentiometric- Amperometric-Conductometric- Semiconductor- Mechanical and Molecular electronic based sensors. Chemiluminescence based biosensors. Applications of biosensors in medical and health care- food and agricultural- Industrial process and environmental monitoring.

Integrated Magnetic Sensors: Overview of magnetic field sensor Technology-AMR-GMR- SQUIDS-Optoelectronic MFS- Semiconductor magnetic effects-materials and figure of merit- Standard MFS technologies-limitations and applications.

Sensor Applications: Automotive Sensors- Environmental Sensors-Sensors for Medical Diagnosis and patient monitoring- Aerospace sensors.

REFERENCE BOOKS

1. Sensors- A Comprehensive study-W.Gopal, J Hesse, J N Zemel – VHC Press, 1989.
2. Sensors Handbook-SabreeSoloman—McGraw Hill Publishers-1998
3. Electro Optical Instrumentation- SilvanoDonati, Pearson Education 2005.
4. Introduction to Medical Equipment Technology: Carr and Brown- Addison Weseley- 2001.

INE: 316 – ELECTIVE – 1(A)

COMPUTER ORGANIZATION AND OPERATING SYSTEMS

L	T	PD	TOTAL Pds	Univ Exam Hrs	Marks	Sessnl Marks	Total Marks
3	1	—	4	3	70	30	100

UNIT - I:Basic Structure of Computers: Computer Types, Functional UNIT, Basic Operational Concepts, Bus, Structures, Software, Performance,

Multiprocessors and Multi Computers, Data Representation, Fixed Point Representation, Floating - Point Representation.

Register Transfer Language and Micro Operations: Register Transfer Language, Register Transfer Bus and Memory Transfers, Arithmetic Micro Operations, Logic Micro Operations, Shift Micro Operations, Arithmetic Logic Shift Unit, Instruction Codes, Computer Registers Computer Instructions - Instruction Cycle. Memory - Reference Instructions, Input - Output and Interrupt, STACK Organization, Instruction Formats, Addressing Modes, DATA Transfer and Manipulation, Program Control, Reduced Instruction Set Computer.

UNIT - II:Micro Programmed Control: Control Memory, Address Sequencing, Microprogram Examples, Design of Control Unit, Hard Wired Control, Microprogrammed Control.

The Memory System: Basic Concepts of Semiconductor RAM Memories, Read-Only Memories, Cache Memories Performance Considerations, Virtual Memories secondary Storage, Introduction to RAID.

UNIT -III:Input-Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer Modes, Priority Interrupt, Direct Memory Access, Input-Output Processor (IOP), Serial Communication; Introduction to Peripheral Components, Interconnect (PCI) Bus, Introduction to Standard Serial Communication Protocols like RS232, USB, IEEE1394.

UNIT - IV:Operating Systems Overview: Overview of Computer Operating Systems Functions, Protection and Security, Distributed Systems, Special Purpose Systems, Operating Systems Structures-Operating System Services and Systems Calls, System Programs, Operating System Generation.

Memory Management: Swapping, Contiguous Memory Allocation, Paging, Structure of the Page Table, Segmentation, Virtual Memory, Demand Paging, Page-Replacement Algorithms, Allocation of Frames, Thrashing Case Studies - UNIX, Linux, Windows Principles of Deadlock: System Model, Deadlock Characterization, Deadlock Prevention, Detection and Avoidance, Recovery from Deadlock.

UNIT - V:File System Interface: The Concept of a File, Access Methods, Directory Structure, File System Mounting, File Sharing, Protection.

File System Implementation: File System Structure, File system Implementation, Directory Implementation, Allocation Methods, Free-Space Management.

TEXT BOOKS:

1. Computer Organization - Carl Hamacher, ZvonksVranesic, SafeaZaky, 5th Edition, McGraw Hill.

2. Computer System Architecture - M. morismano, 3rd edition, Pearson

3. Operating System Concepts - AbrehamSilberchatz, Peter B. Galvin, Greg Gagne, 8th Edition, John Wiley.

REFERENCE BOOKS:

1. Computer Organization and Architecture - William Stallings 6th Edition, Pearson

2. Structured Computer Organization - Andrew S. Tanenbaum, 4th Edition, PHI

3. Fundamentals of Computer Organization and Design - SivaraamaDandamudi, Springer Int. Edition

4. Operating Systems - Internals and Design Principles, Stallings, 6th Edition - 2009, Pearson Education.

5. Modern Operating Systems, Andrew S Tanenbaum 2nd Edition, PHI

6. Principles of Operating System, B. L. Stuart, Cengage Learning, India Edition.

INE: 316 ELECTIVE – 1(B) ANALOG SIGNAL PROCESSING

L	T	PD	TOTAL Pds	Univ Exam Hrs	Sessnl Marks	Total Marks
3	1	—	4	3	70	100

Unit1:Introduction to domains and the analogue/digital trade off, Introduction to basic building blocks: null or, voltage feedback amplifier, operation transconductance amplifier, current conveyor, current feedback amplifier. Analog signal filtering: introduction to bilinear transfer functions and active realizations. First-order and second-order filter realization, filter design parameters (Q and ω_0), frequency response, effect of finite gain of op-amp, realization of Single- Amplifier Biquad and General Impedance Convertor circuit.

Unit2:Ideal low-pass filter, Buttreworth and Chebyshev magnitude response, pole locations, low-pass filter specifications.

Unit3:Delay equalization: equalization procedures, equalization with first-order and second- order modules, strategies for equalization design. Definition of Bode sensitivity.

Unit4:Properties of Lossless ladders, the general impedance convertor (GIC), optimal design of the GIC, realization of simple ladders, Gorski-Popiel's Embedding Technique, Bruton's FDNR technique, creating negative components.

TEXT BOOKS:

1. R. Schaumann and M.E. Valkenberg," Design of Analog Circuits", Oxford University

INE: 316 – ELECTIVE – 1(C) VIRTUAL INSTRUMENTATION

L	T	PD	TOTAL Pds	Univ Exam Hrs	Marks	Sessnl Marks	Total Marks
3	1	—	4	3	70	30	100

UNIT-I: Introduction to Virtual Instrumentation : History of Instrumentation systems, Evolution of Virtual Instrumentation, premature challenges, programming requirements, Drawbacks of recent approaches, conventional Virtual Instrumentation, Distributed Virtual Instrumentation, Virtual Instrumentation versus Traditional Instruments, Advantages.

UNIT-II: Programming Techniques : Virtual Instrumentation, Front panel, block diagram, LabVIEW environment, data flow programming, G programming.

UNIT-III: Programming Concepts of Virtual Instrumentation : VI & sub VI, loops, shift registers, feedback node, formula node, case and sequence structures, arrays, clusters.

UNIT-IV: Output Verification Tools : Waveform Graphs, Waveform charts, files I/O, local and global variables.

UNIT-V: Data Acquisition Systems : Introduction to data acquisition, data acquisition in LabVIEW, Hardware Installation and configuration, components of DAQ, DAQ Assistant, DAQ hardware.

TEXT BOOKS

1. S. Sumathi, P. Surekha, “ Virtual Instrumentation with LabVIEW,” ACME Learning Pvt. Ltd 2007.

REFERENCE BOOKS

1. Jovitha Jerome, “Virtual Instrumentation Using LabVIEW,” PHI learning Pvt. Ltd 2006.

2. Jeffrey Travis,” LabVIEW for everyone,” Pearson Education 2009.

INE: 317 – CONSTITUTION OF INDIAN/ ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

L	T	PD	TOTAL Pds	Univ Exam Hrs	Marks	Sessnl Marks	Total Marks
3	1	—	4	3	70	30	100

- History of Making of the Indian Constitution:
- History
- Drafting Committee, (Composition & Working)
- Philosophy of the Indian Constitution:
- Preamble
- Salient Features
- Contours of Constitutional Rights & Duties:

- Fundamental Rights
- Right to Equality
- Right to Freedom
- Right against Exploitation
- Right to Freedom of Religion
- Cultural and Educational Rights
- Right to Constitutional Remedies
- Directive Principles of State Policy
- Fundamental Duties.
- Organs of Governance:
- Parliament
- Composition
- Qualifications and Disqualifications
- Powers and Functions
- Executive
- President
- Governor
- Council of Ministers
- Judiciary, Appointment and Transfer of Judges, Qualifications
- Powers and Functions
- Local Administration:
- District’s Administration head: Role and Importance,
- Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.
- Pachayati raj: Introduction, PRI: ZilaPachayat.
- Elected officials and their roles, CEO ZilaPachayat: Position and role.
- Block level: Organizational Hierarchy (Different departments),
- Village level: Role of Elected and Appointed officials,
- Importance of grass root democracy
- Election Commission:
- Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners.
- State Election Commission: Role and Functioning.
- Institute and Bodies for the welfare of SC/ST/OBC and women

Reference Books

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

INE: 321 : DIGITAL SIGNAL PROCESSING

L	T	PD	TOTAL Pds	Univ Exam Hrs	Marks	Sessnl Marks	Total Marks
3	1	—	4	3	70	30	100

UNIT-I: Discrete – Time Signals and Linear Systems: Signals, systems, signal processing, advantages and applications of digital signal processing, Analog to digital conversion, reconstruction of analog signal, types of A/D converters, digital- to- analog converters.

UNIT-II: The Z- Transform: Definition of z-transform, z-transform and ROC of finite duration sequences, z-transform and ROC of infinite duration sequences, ROC of two sided sequences, properties of ROC, properties of z-transform, Inverse z-transform, solution of difference equations using one sided z-transform.

UNIT-III: The Discrete Fourier Transform: Discrete Fourier series, properties of Discrete Fourier series, The discrete Fourier Transform, relationship of the DFT to other transforms, properties of Discrete Fourier Transform, comparison between circular convolution and linear convolution, methods to evaluate circular convolution of two sequences, linear convolution from circular convolution.

UNIT-IV: The Fast Fourier Transforms: Introduction, direct evolution of the DFT, the fast Fourier transforms, Decimation-in-time algorithm, Decimation-in-frequency algorithms, differences and similarities between DIT and DIF algorithms, IDFT using FFT algorithms.

UNIT-V: Infinite Impulse Response Filters: Introduction, Frequency selective filters, design of digital filters from analog filters, analog low pass filter design, analog low pass Butterworth filters, analog low pass Chebyshev filters, frequency transformation in analog domain, realization of digital filters.

TEXT BOOKS

1. Digital Signal Processing : Principals, Algorithms and Applications- John G. Proakis, and Dimitris G. Manolakis, Pearson Edn., PHI, 2007.
2. Digital Signal Processing –Alan V. Oppenheim, Ronald W. Schaffer PHI Ed 2006

REFERENCES

1. Manson H Hayes, " Digital Signal Processing," TMH Publications, 2004.
2. P.RameshBabu, " Digial Signal Processing ," Scitech Publications Pvt. Ltd, Chennai

INE: 322 PROCESS CONTROL & CONTROL COMPONENTS

L	T	PD	TOTAL Pds	Univ Exam Hrs	Marks	Sessnl Marks	Total Marks
3	1	—	4	3	70	30	100

Introduction: control systems- process control principles, servo mechanisms, discrete state control systems; Process control block diagram-identification of elements; Control system evaluation-stability, steady state regulation, transient regulation, evaluation criteria; Process control (P&I) drawings.

Controller Principles: Process characteristics: process equation, process load, process lag, self- regulation; control system parameters; Controller Modes: Discontinuous control modes- two position mode, multi-position mode; Continuous controller modes: Proportional control modes, Integral control mode, Derivative control mode, Composite control modes: PI, PD, PID; Special terminology;

Optimum controller settings: Evaluation criteria-1/4 decay ratio, I.A.E., ISE, ITAE; Tuning of controllers: Continuous oscillation and damped oscillation methods- process reaction curve method.

Multi loop control systems: Feed forward, ratio, cascade and split range controls. Multivariable control –examples from distillation column and boiler systems. Final control elements: Flapper-Nozzle system, I/P, P/I converters, pneumatic, electric and hydraulic actuators. Globe and Butterfly valves, volume booster relays.

Control valve characteristics and sizing: Valve characteristics-quick opening, linear and equal percentage characteristics; Sizing: Flow formulae through control valves. Specific gravity and Viscosity correction, range ability, turn down ; cavitation and flashing in control valves.

References:

1. Curtis.D.Jhonson: Process control instrument Technology, Pearson education.
2. Pollard A, Process control.
3. Eckman, D.P., Automatic Process and Control.
4. Harriot,P., Process control.
5. Patrinas,D, Principles of process control.

INE: 323 ELECTIVE – II (A) – POWER PLANT INSTRUMENTATION

L	T	PD	TOTAL	Univ Exam	Sessnl	Total

			Pds	Hrs	Marks	Marks	Marks
3	1	—	4	3	70	30	100

Energy sources, their availability. Introduction to Power generation- Classification: Renewable and nonrenewable energy generation resources. Renewable-wind power, solar, geothermal and bio-fuels, Nonrenewable-fossil fuels (coal, oil and natural gas) and nuclear power.

Comparison of thermal power plant, hydroelectric power plant, wind, solar, nuclear power plant on the basis of Performance, efficiency, site selection, Economics capital and running, safety standards, pollution, effluent management and handling.

Basic boiler operations, boiler safety standards, Combustion controls; series-parallel operation, optimizing control for air-flow- oxygen trimming control, Drum level control: feed water control, drum level control, steam flow control, two-element control, and three-element control, Furnace pressure control, steam temperature control, super heater control.

Thermal Power Plant- Method of power generation, layout and energy conversion process, major input variables, major control variables.

Turbines and governors: basic operations, turbine speed control methods. Automatic startup systems- safety systems.

TEXT BOOKS:

1. D. Patranabis: Principles of process control., TMH, New Delhi, second edition.
2. Bela.G.Liptak: Instrumentation Engineers Hand book
3. George Stephanopoulos: Chemical process control; Prentice Hall India Pvt Ltd.

INE: 323 ELECTIVE – II (B) – NON-DESTRUCTIVE TESTING

L	T	PD	TOTAL Pds	Univ Exam Hrs	Marks	Sessnl Marks	Total Marks
3	1	—	4	3	70	30	100

Need for inspection- quality of inspection-Benefits of NDT-Liquid penetrant inspection- Principles- Characteristics of a penetrant- Water washable system post emulsifiable system- Solvent removable system- Surface preparation and cleaning- Penetrant application- Sensitivity- Viewing- Recording- Applications. Magnetic methods; Basic principles- Magnetising methods- Characteristics of magnetic particles- Magnetic links- Magnetography- Field sensitive probes- Measurement of metal properties- Ferrography- Applications.

Ultrasonic testing: Basic principles- different kinds of ultrasonic waves- Properties propagation- Mode conversion- Construction of normal and angle probes- Piezo electric materials- attenuation. Different methods of flow detection - Transmission, reflection and immersion methods. Pulse- Echo method- Different types of display- A- Scan, B-Scan, C-Scan methods-

Identification of detects- Sensitivity- calibration and reference standards- Applications.

Radiographic methods: general principles- X-ray and gamma ray sources- Shadow formation- Enlargement and distortion recording of radiation-Radiographic techniques- Single and double image techniques- Sensitivity- Penetrators- Fluoroscopic method- Real time radiography- Application.

Electrical methods: Principle of eddy current testing- Conductivity of material- Magnetic properties- Coil impedance. Lift off factor and edge effect- Skiing effect- Impedance plant diagrams- inspection frequency- Coil arrangements inspection problems- Types of circuit- Reference standards- Phase analysis-Display methods- Typical applications.

Other methods: Optical holographic methods- Electronic / speckle pattern interferometry dynamic inspection-Neutron Radiography-Laser induced ultrasonic-Crack depth gauges- Thermography-Surface texture analysis-Acoustic emission methods.

TEXT BOOKS:

1. Non-destructive testing by Barry Hull and Vennon John ELBS/Momillon,1988,
2. Non-destructive testing by R.Halmshaw Edward Arnold, London.
3. Non destructive testing by Warren J.McgonnagleMcGraw-hill book Co., 1961.

REFERENCE BOOKS:

1. Ultrasonic testing of material by J.Krantkramer and H.Krantkramer Springer Verlag, Newyork.
2. Ultrasonic Engineering by Julien r. Frederick, chapters 1,2,4,7, John Wiley& son Newyork.

INE: 323 ELECTIVE – II (C) – FUNDAMENTALS OF NANO SENSORS

L	T	PD	TOTAL Pds	Univ Exam Hrs	Marks	Sessnl Marks	Total Marks
3	1	—	4	3	70	30	100

NANOSENSORS I Micro and nano-sensors, Fundamentals of sensors, biosensor, micro fluids, Packaging and characterization of sensors, Method of packaging at zero level, dye level and first level. Sensors for aerospace and defense: Accelerometer, Pressure Sensor, Night Vision System, Nano tweezers, nano-cutting tools, Integration of sensor with actuators and electronic circuitry,

NANOSENSORS II Sensor for bio-medical applications: Cardiology, Neurology and as diagnostic tool, For other civil applications: metrology, bridges etc. Biosensors. Clinical Diagnostics, generation of biosensors, immobilization, characteristics, applications, conducting Polymer based

sensor, DNA Biosensors, optical sensors. Biochips. Metal Insulator Semiconductor devices, molecular electronics, information storage, molecular switching, Schottky devices,

NEMS Inertial sensors – accelerometer – gyroscope - micromechanical pressure sensors – piezoresistive – capacitive - microrobotics – micro channel heat sinks – optical MEMS – visual display – precision optical platform – optical data switching – RF MEMS – MEMS variable capacitors – MEMS switches – Resonators.

NANOLITHOGRAPHY Basics of lithography, optical, micro, ion beam lithography, lithographic tools, nanoimprint lithography – polymeric nanofiber templates – focused ion beam doping wet chemical etching – stencil lithography and sacrificial etching – large scale integration – future challenges - applications

REFERENCE BOOKS:

1. K. Goser, P. Glosekotter and J. Dienstuhl, "Nanoelectronics and Nanosystems-From Transistors to Molecular Quantum Devices", Springer, 2004.
2. W.R.Fahrner, "Nanotechnology and Nanoelectronics – Materials, Devices and Measurement Techniques" Springer, 2006.
3. Sensors: Micro & Nanosensors, Sensor Market trends (Part 1&2) by H. Meixner.
4. Nanoscience & Technology: Novel structure and phenomena by Ping Sheng (Editor).
5. Nano Engineering in Science & Technology : An introduction to the world of nano design by Michael Rieth.
6. Tai –Ran Hsu, "MEMS & Microsystems Design and Manufacture", Tata McGraw-Hill publication, 2001.
7. P. Rai-Choudhury, "MEMS and MOEMS technology and applications", PHI learning private Ltd, 2009.
8. Mohamed Gad-el-Hak, "The MEMS Handbook", CRC Press, 2002.

INE: 324 ELECTIVE – III (A) – ADVANCE CONTROL THEORY

L	T	PD	TOTAL Pds	Univ Exam Hrs	Sessnl Marks	Total Marks
3	1	—	4	3	70	100

Unit 1: INTRODUCTION TO DESIGN : The design problem, preliminary considerations of classical design, realization of basic compensators like phase lead compensation, phase lag compensation in time domain using root locus method

Unit 2: DESIGN OF COMPENSATORS : Cascade compensation in time domain and frequency domain, feedback compensation using both root locus and bode plot and Lead-Lag compensation using bode plot.

Unit 3: STATE VARIABLE ANALYSIS : Concept of state variables – State models for linear and time invariant Systems –Solution of state and output equation in controllable canonical form –Concepts of controllability and observability –Effect of state feedback.

Unit 4: PHASE PLANE ANALYSIS : Features of linear and non-linear systems -Common physical non-linearity's –Methods of linearization Concept of phase portraits –Singular points –Limit cycles –Construction of phase portraits –Phase plane analysis of linear and non-linear systems –Isocline method.

UNIT 5: DESCRIBING FUNCTION ANALYSIS : Basic concepts, derivation of describing functions for common non-linearities –Describing function analysis of non-linear systems –limit cycles –Stability of oscillations.

TEXT BOOKS:

1. K. P. Mohandas, "Modern Control Engineering", Sanguine Technical Publishers, 2006.
2. Gopal, M. – "Modern control theory", New Age International publishers, 2002

INE: 324 ELECTIVE – III (B) – ADVANCED SENSING TECHNIQUES

L	T	PD	TOTAL Pds	Univ Exam Hrs	Sessnl Marks	Total Marks
3	1	—	4	3	70	100

Introduction Different Phases of automation. Importance of sensor/smart sensor in automation. Features of Advanced sensing techniques. Sensor classifications according to the energy domains. Introduction of advanced sensing materials. Properties (physical, electrical, chemical, biological) of materials which makes it suitable for sensing in different domain.

Design and modelling, Design and modelling issue in advanced sensing technique, Introduction of different mathematical tools used in sensor design, Study of analytical design from given specification, conformal mapping, Optimization techniques used in sensor design. Numerical design such as FEM, FDM, etc. Study of Tomography and Concept of Feedback in sensing Fabrication and packaging Introduction to MEMS sensor. Comparison between MEMS and Macro sensor. Fabrication and packaging issue in sensor design, Thick film and thin film technique.

Physical sensors, Hall Effect sensors, Eddy current sensors, magneto resistive and magneto strictive detectors, Accelerometers: Capacitive, Piezoelectric, Piezoresistive, Thermal, Humidity and moisture sensor, Proximity detectors using polarized light, Semiconductor gas sensor, Fluidic and Micro-fluidic sensors.

Chemical sensor, Chemical sensor characteristics, specific difficulties related to chemical sensor, Classification of Chemical sensing mechanism, Study of chemical sensor based on the principle of direct sensing techniques such as Metal oxide chemical sensor, electro chemical sensors, potentiometric sensors, conductive sensors, amperometric sensors, enhanced catalytic gas sensors, enzyme sensors, Study of chemical sensors in indirect mode such as thermal sensor, optical chemical sensor, biochemical sensor, enzyme sensor, Sensor array.

Introduction to the concept of Lab on chip/sensor platform technology, The role of PCA, LDA, Neural network in designing sensor array, Study of temperature cycle, mode of sensing to obtain virtual sensor array, Case study of a gas sensing platform, liquid sensing.

REFERENCE BOOKS

1. Sensors- A Comprehensive study-W.Gopal, J Hesse, J N Zemel – VHC Press, 1989.
2. Sensors Handbook-SabreeSoloman—McGraw Hill Publishers-1998
3. Electro Optical Instrumentation- SilvanoDonati, Pearson Education 2005.
4. Introduction to Medical Equipment Technology: Carr and Brown- Addison Weseley- 2001.

INE: 324 ELECTIVE – III (C) – DESIGN OF INSTRUMENT SYSTEMS

L	T	PD	TOTAL Pds	Univ Exam Hrs	Marks	Sessnl Marks	Total Marks
3	1	—	4	3	70	30	100

Design of Pressure and vacuum gauges with bourdon tubes, bellows and diaphragms. Design of manometers-single, two liquid U-Tube manometers, inclined tube, well and ring types. Design of flow meters-orifice, venturi and Rota meters. Design of liquid level measuring instruments- displacer and bubble types. Design of control system components-flapper nozzle with ball valve, pneumatic globule valve, butterfly valve and Saunders patent valve. Design of temp measuring systems with RTD, thermocouples and thermistors. Design of displacement measuring circuits with LVDT, and differential capacitors. Design of strain gauges and measuring circuits. Design of piezoelectric transducers and measuring circuits.

REFERENCE BOOK:

1. DP Eckman-Industrial Instrumentation

INE: 325OPEN ELECTIVE- 1 HUMANITIES AND MANAGEMENT COURSE

L	T	PD	TOTAL Pds	Univ Exam Hrs	Marks	Sessnl Marks	Total Marks

3	1	—	4	3	70	30	100

INE: 411ELECTIVE – IV (A) – INSTRUMENT DATA NETWORKS

L	T	PD	TOTAL Pds	Univ Exam Hrs	Marks	Sessnl Marks	Total Marks
3	1	—	4	3	70	30	100

Introduction: uses of computer networks-networks for companies-networks for people.Network hardware: local area networks-network topologies-Metropolitan area networks-Wide area networks-Wireless networks

Network software: Reference models-The OSI reference model-TCP/IP reference model- comparison of models- Critiques of OSI and TCP/IP models regarding implementation and success.

Transmission media: magnetic media- twisted pair-base band coaxial cable-broadband coaxial cable-Fiber optic networks: multi mode and single mode fibers-Transmission of light through fiber-fiber cables. Fiber optic networks-comparison of fiber optics and copper wire.

Example networks and services: introduction to novellnetworkare, ARPANET, NSFNET, The internet-Broadband ISDN and ATM, comparison of services.

Field bus standardization, Smart transmitters- smart overview- smart mode of operation— command classes-transmission modes, Field bus-benefits of field bus-architecture- Profibus - architecture, international field bus standards

Intelligent controllers, introduction , model based controllers, adaptive controllers- optimal control-predictive control, Artificial intelligent based systems, expert systems- Expert controllers.

Fuzzy and neural controllers- Fuzzy logic system-Fuzzy logic tools, membership functions- defuzzification - fuzzy controller. Artificial neural networks-biological neuron-mathematical model-classification of ANNS- Perceptron-multilayer ANN- neural controllers, neuro-fuzzy control system.

Textbooks :

1. Computer Networks -ANDREW S. Tanandaum 3rd edition., PHI
2. Krishna kant-Computuer based industrial control, PHI
3. Instrument engineers handbook B.G. Liptak 3rd edition.

INE: 411ELECTIVE – IV (B) – DIGITAL IMAGE PROCESSING

L	T	PD	TOTAL Pds	Univ Exam Hrs	Marks	Sessnl Marks	Total Marks
3	1	—	4	3	70	30	100

Digital image fundamentals:

Light and Electromagnetic spectrum, Components of Image processing system, Image formation and digitization concepts, Neighbours of pixel

adjacency connectivity, regions and boundaries, Distance measures, Applications.

Image Enhancements:

Image Enhancements: In spatial domain: Basic gray level transformations, Histogram processing, Using arithmetic/Logic operations, smoothing spatial filters, Sharpening spatial filters.

In Frequency domain: Introduction to the Fourier transform and frequency domain concepts, smoothing frequency-domain filters, Sharpening frequency domain filters.

Image Restoration: Various noise models, image restoration using spatial domain filtering, image restoration using frequency domain filtering, Estimating the degradation function, Inverse filtering.

Colour Image processing: Colour fundamentals, Colour models, Colour transformation, Smoothing and Sharpening, Colour segmentation

Image compression: Introduction, Image compression model, Error-free compression, Lossy compression.

Image segmentation: Detection of discontinuities, Edge linking and boundary detection, thresholding

TEXT BOOKS

1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, 3rd edition, Prentice Hall, 2008.
2. R. C. Gonzalez, R. E. Woods and Steven L. Eddins, Digital Image Processing Using MATLAB, 2nd edition, Prentice Hall, 2009.
3. Anil K. Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India, 9th Edition,
4. Jayaraman, S. Esakkirajan, and T. Veerakumar, Digital Image Processing, Tata McGraw- Hill Education, 2011.

INE: 411ELECTIVE – IV (C) – MICRO AND NANO SENSORS

L	T	PD	TOTAL Pds	Univ Exam Hrs	Univ Exam Marks	Sessnl Marks	Total Marks
3	1	—	4	3	70	30	100

Unit 1: Introduction sensors, Micro technology, Nano technology, Micro and nano biosensors: Introduction to Micro/Nano biosensor, Biosensor history and current status, Classical Sensors. Applications of micro electronics and nano electronics.

Unit 2: Carbon-Nanotube-Based Sensors: Introduction, Synthesis of Carbon Nanotubes, Relevant Physical Characteristics of Carbon Nanotubes, Chemical Sensors and MEMS-Based Nanotube Sensors. Carbon-Nanotube-Based Fluidic Shear-Stress Sensors: Overview of Carbon Nanotube Sensors, Types of Shear-Stress Sensors.

Unit 3: Nanomechanical Cantilever Sensors: Theory and Applications: Introduction, Operation Principles, Preparation of Microcantilever Sensors. Protein in Films: Sensing Elements for Sensors: Protein-Containing LB Films for Biosensor Applications, Antibody-Containing LB Films, Enzyme-Containing LB Films. DNA Sensors: DNA Hybridizations, DNA sequencing, DNA-Containing Monolayers and LB Films

Unit 4: Biomolecules, Protein, DNA structures and their immobilizations on sensor surface, Thermodynamic and Kinetics at biosensor surface. Microfluidics: Advances in microfluidics, Sensor integrations. Immunosensors: antibody- antigen, Single molecule detections.

Unit 5: Optical Capillary Sensors for Intelligent Classification of Micro fluidic Samples: Introduction, Operating Principles and Construction Aspects of the Optical Capillary Head, General Description of the Sensor System, Measurement Cycle of the Capillary Sensor. Optical biosensors: Optical Imaging, Optical Sensing, Opto-genetics.

Reference Books:

1. Nanosensors: Theory and Applications in Industry, Healthcare and Defense Edited By Teik-Cheng Lim (<https://www.taylorfrancis.com/books/e/9780429130793>).
2. Introduction to Biosensors, Jeong-Yeol Yoon et al. Springer.
3. Handbook of Biosensors and Biosensor Kinetics, Ajit Sadana, Elsevier.
4. Nanofabrication Towards Biomedical Applications, Challa Kumar, Wiley-VCH.
5. Optical Biosensors: Present & Future, Frances Ligler, Elsevier

INE: 412ELECTIVE – V (A) – TELEMETRY

L	T	PD	TOTAL Pds	Univ Exam Hrs	Univ Exam Marks	Sessnl Marks	Total Marks
3	1	—	4	3	70	30	100

Classification of Telemetry Systems: voltage, current position, frequency, pulse, land-line and radio telemetry.

Land-Line Telemetry: voltage telemetering system, current telemetering system, motion balance current telemetering system, position telemetering system using bridge configuration, position telemetering system using synchro's.

Amplitude Modulation and Demodulation of a Carrier Wave: Expression for an AM-wave, frequency spectrum of an AM-wave, bandwidth, AM-detector, illustration of AM for measuring system, full-wave phase sensitive demodulator, block diagram of carrier amplifier system.

Frequency Modulation and Demodulation of a Carrier Wave: Expression for an FM-wave, frequency spectrum of an FM-wave, bandwidth, diode FM modulator, phase shift discriminator, ratio detector.

Amplitude Modulation and Demodulation Circuits for Measurement Systems: Basic configuration for a modular electromechanical chopper, semiconductor modulator, balanced modulator, basic configuration of a demodulator chopper, demodulator semiconductor, demodulators, balanced demodulator. Block diagrams of DC and AC signal conditioning systems.

Multiplexing In Telemetry Systems: Block diagram of multiplexer and its mechanical switch, equivalent block diagram of a demultiplexer and its mechanical switch, equivalent frequency division multiplexing, time division multiplexing, sample-and-hold circuit, an outline of pulse modulation techniques used in telemetry.

Radio Telemetry Systems: Analog TDM system, FM-FM telemetry system, standard telemetry channel, frequencies for FDM, block diagrams of PAM, PCM, and FDM telemetry systems.

Transmission Channels: Wire line channels, radio channels, microwave channels, power line carrier channels and fiber optic transmission.

TEXT BOOKS:

1. Electrical and electronics measurements and instrumentation, by A.K. Sawhney, Dhanpat Rai & Sons.
2. Introduction to Telemetry by Alan Andrews, Foulsham-Sams technical books, published by W-Foulsham & Co Ltd., England.
3. Understanding telemetry circuits, by John D. Lenk, Foulsham – Sams technical books, Published by W-Foulsham & Co., England

INE: 412ELECTIVE – V (B) –ARTIFICIAL INTELLIGENCE

L	T	PD	TOTAL Pds	Univ Exam Hrs	Sessnl Marks	Total Marks
3	1	—	4	3	70	100

Basic Problem-Solving Methods: Production systems – state space search – control strategies – heuristic search – forward and backward reasoning – hill climbing techniques – breadth first search – depth first search – best search – staged search.

Knowledge Representation: Predicate logic – resolution question answering – nonmonotonic reasoning – statistical and probabilistic reasoning semantic nets – conceptual dependency – frames- scripts.

AI Languages: important characteristics of AI languages- PROLOG, introduction to expert systems, structure of an expert system-interaction with an expert design of an expert system.

Neural Networks: basic structure of a neuron, perception feed forward, back propagation, Hopfield network.

Fuzzy Logic: fuzzy sets, membership function, rules and algorithms, de-fuzzification and implementation.

Textbooks:

1. Rich E and Knight K- Artificial intelligence. Tata McGraw Hill, New Delhi 1991.
2. Nilsson NJ – Principals of artificial intelligence, Springer Verlag Berlin 1980.
3. Barr A. Fergenza E A & Cohen P R- Artificial intelligence, edition- Wesley reading (mass 0, 1989).
4. Waterman D A- A guide to expert systems, edition- Wesley reading (mass), 1986.
5. Artificial intelligence Hand book VOL 1-2, ISA, Research triangle park, 1989.
6. Kosko B- neural networks and fuzzy systems, PHI.

INE: 412ELECTIVE – V (C) –Fiber Optics and Sensors

L	T	PD	TOTAL Pds	Univ Exam Hrs	Sessnl Marks	Total Marks
3	1	—	4	3	70	100

Principles of light propagation through fiber- Different types of fibers and their properties– transmission characteristics of optical fibers - absorption losses-scattering losses-dispersion.

Fiber optic sensors – Fiber optic communication and instrument system – Advantages of optical communications – Different types of Modulators – Detectors – Fiber optic communication setup – Applications in instrumentation.

Characteristics and fundamentals of lasers – Laser emission and light amplification – Optical Resonators – Modes of resonators – Q-Factors, Q-Switching, Mode locking in lasers – Properties of Laser Beams - Types of lasers – Gas lasers – Solid lasers – liquid lasers – semiconductor lasers.

Lasers for Analysis – Laser application in holographic microscopy, holographic interferometer and applications - Medical applications of lasers. Laser and tissue interaction – Laser instruments for surgery, removal of tumors of vocal cords, Brain Surgery, Plastic surgery, gynecology & oncology.

Industrial application of Lasers – Measurement of distance and length, velocity, acceleration, atmospheric effects, pollutants, Material processing, laser heating, melting, scribing, material removal.

REFERENCE BOOKS

1. H.C. Allen, An Introduction to Optical Fibers, McGraw-Hill International Book Co., 1983.
2. John and Harry, Industrial lasers and their applications, McGraw Hill publications, 1974

3. Gerd Kaiser, Optical fiber communications, McGraw Hill International Edition, 2000

4. D.C. Oshea and W. Russel Callen, Introduction to lasers and their Applications, Addison Wesley, 1978.

5. BS. Wherrelt, Laser Advances and Applications, John Wiley, 1979.

6. W.O.N. Guimarass and A. Mooradian, Lasers and Application Springer Verlag, 1981.

INE: 413 OPEN ELECTIVE – 2 - IoT Sensors and Devices

L	T	PD	TOTAL Pds	Univ Exam Hrs	Sessnl Marks	Total Marks
3	1	—	4	3	70	100

IoT Platform overview

Overview of IoT supported Hardware platforms such as: Raspberry pi, ARM Cortex Processors, Arduino and Intel Galileo boards.

IoT Architecture:

History of IoT, M2M – Machine to Machine, Web of Things, IoT protocols

Applications: Remote Monitoring & Sensing, Remote Controlling, Performance Analysis

The Architecture: The Layering concepts, IoT Communication Pattern, IoT protocol Architecture, The 6LoWPAN

Security aspects in IoT

Case Study & advanced IoT Applications:

IoT applications in home, infrastructures, buildings, security, Industries, Home appliances, other IoT electronic equipment. Use of Big Data and Visualization in IoT,

Industry 4.0 concepts. Sensors and sensor Node and interfacing using any Embedded target boards (Raspberry Pi / Intel Galileo/ARM Cortex/ Arduino)

Text Books:

1. Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, Dr. Ovidiu Vermesan, Dr. Peter Friess, River Publishers.

2. Interconnecting Smart Objects with IP: The Next Internet, Jean-Philippe Vasseur, Adam Dunkels, Morgan Kuffmann.

3. 6LoWPAN: The Wireless Embedded Internet, Zach Shelby, Carsten Bormann, Wiley.

INE: 414 BIOMEDICAL INSTRUMENTATION

L	T	PD	TOTAL	Univ Exam	Sessnl	Total

			Pds	Hrs	Marks	Marks	Marks
3	1	—	4	3	70	30	100

Introduction to the Man-Instrument system – components of the system – Problems encountered in measuring a living system — sources of bioelectric potentials – Structure of a cell- resting and action potentials.

The cardiovascular system – The heart anatomy – Generation of Electrocardiogram – Recording ECG - Blood pressure measurement- Direct and Indirect methods - Sphygmomanometer – Blood flow measurement – heart sounds – Phono Cardiograph – measurement of blood flow and cardiac output - plethysmography– pacemakers – defibrillators.

Physiology of the respiratory system – tests and instrumentation for the mechanics of the breathing – Spirometers- respiratory therapy inhalators – ventilators-humidifiers nebulizers and aspirators.

The nervous system and its anatomy – neuronal communication – the organization of brain – neuronal receptors – the somatic nervous system – the autonomic nervous system – measurements from the nervous system – electrode placement-neuronal firing measurements EEG and EMG.

Noninvasive diagnostic instrumentation - temperature measurement – principles of ultra sound measurement and diagnosis – echo cardiogram – echo encephalogram – ultra sonogram. X-ray machine- CT Scan- MRI Scan- Computer in biomedical instrumentation. Physiological effects of electric current – shock hazards from electric equipment – methods of accident prevention.

TEXT BOOKS:

1. Biomedical Instrumentation and Measurements – C. Cromwell, F.J. Weibell, E.A. Pfeiffer – Pearson education.

2. Handbook of biomedical instrumentation R. S. Khandpur, Tata McGraw hill company Ltd, New Delhi.

INE: 421 ELECTIVE – IV (A) – STEEL PLANT INSTRUMENTATION

L	T	PD	TOTAL Pds	Univ Exam Hrs	Sessnl Marks	Total Marks
3	1	—	4	3	70	100

Basics of steel production; mill zones: iron zone, steel zone, mill zone, utility zone Automation strategy: different levels, input, output data. Iron zone: supervisory control, direct digital control; instrumentation for-raw material handling, coke oven, sinter plant, Blast furnace; input/output data, control architecture. Steel zone: Automation for- LD converters, continuous casting, soaking pit control, blooming mill controls.

Utility zone: instrumentation for-Gas distribution, liquid fuel distribution, power generation, steam generation, compressed air generation.

Instrumentation for water management system.

Pollution control and monitoring for steel plant environment.

TEXT BOOKS:

1. D. Patranabis: Principles of process control., TMH, New Delhi, second edition.
2. Krishna Kant: Computer based industrial control, Prentice Hall India Pvt Ltd.
3. George Stephanopoulos: Chemical process control; Prentice Hall India Pvt Ltd.

REFERENCE BOOKS:

1. Bela.G.Liptak: Instrumentation Engineers Hand book

INE: 421 ELECTIVE – IV (B) – INDUSTRIAL SAFETY INSTRUMENTS

L	T	PD	TOTAL Pds	Univ Exam Hrs	Marks	Sessnl Marks	Total Marks
3	1	—	4	3	70	30	100

Safety In Metal Working Machinery And Wood Working Machines
General safety rules, principles, maintenance, Inspections of turning machines, boring machines, milling machine, planning machine and grinding machines, CNC machines, Wood working machinery, types, safety principles, electrical guards, work area, material handling, inspection, standards and codes- saws, types, hazards.

Principles Of Machine GuardingGuarding during maintenance, Zero Mechanical State (ZMS), Definition, Policy for ZMS – guarding of hazards - point of operation protective devices, machine guarding, types, fixed guard, interlock guard, automatic guard, trip guard, electron eye, positional control guard, fixed guard fencing- guard construction- guard opening. Selection and suitability: lathe-drilling-boring-milling-grinding-shaping-sawingshearingpresses- forge hammer-flywheels-shafts-couplings-gears-sprockets wheels and chains-pulleys and belts- authorized entry to hazardous installations-benefits of good guarding systems.

Safety In Welding And Gas Cutting Gas welding and oxygen cutting, resistances welding, arc welding and cutting, common hazards, personal protective equipment, training, safety precautions in brazing, soldering and metalizing – explosive welding, selection, care and maintenance of the associated equipment and instruments – safety in generation, distribution and handling of industrial gases-colour coding – flashback arrestor – leak detection-pipe line safety- storage and handling of gas cylinders.

Safety In Cold Forming And Hot Working Of Metals Cold working, power presses, point of operation safe guarding, auxiliary mechanisms, feeding and cutting mechanism, hand or foot- operated presses, power press electric controls, power press set up and die removal, inspection and maintenance-metal sheers-press brakes. Hot working safety in forging, hot rolling mill operation, safe guards in hot rolling mills – hot bending of pipes, hazards and control measures. Safety in gas furnace operation, cupola, crucibles, ovens, foundry health hazards, work environment, material handling in foundries, foundry production cleaning and finishing foundry processes.

Safety In Finishing, Inspection And Testing Heat treatment operations, electro plating, paint shops, sand and shot blasting, safety in inspection and testing, dynamic balancing, hydro testing, valves, boiler drums and headers, pressure vessels, air leak test, steam testing, safety in radiography, personal monitoring devices, radiation hazards, engineering and administrative controls, Indian Boilers Regulation.

REFERENCE BOOKS:

1. "Accident Prevention Manual" – NSC, Chicago, 1982.
2. "Occupational safety Manual" BHEL, Trichy, 1988.
3. "Safety Management by John V. Grimaldi and Rollin H. Simonds, All India Travelers Book seller, New Delhi, 1989.
4. "Safety in Industry" N.V. Krishnan JaicoPublishery House, 1996.
5. Indian Boiler acts and Regulations, Government of India.
6. Safety in the use of wood working machines, HMSO, UK 1992.
7. Health and Safety in welding and Allied processes, welding Institute, UK, High Tech. Publishing Ltd., London, 1989.

INE: 421 ELECTIVE – IV (C) – ROBOTS & COMPUTER CONTROL OF MACHINE PARTS

L	T	PD	TOTAL Pds	Univ Exam Hrs	Marks	Sessnl Marks	Total Marks
3	1	—	4	3	70	30	100

Unit I Robot anatomy: Definition, law of robotics, History and Terminology of Robotics Accuracy and repeatability of Robotics Simple problems Specifications of Robot Speed of Robot Robot joints and links Robot Classifications Architecture of robotic systems

Unit II Introduction to automation: Components and subsystems, basic building block of automation, manipulator arms, wrists and end effectors. Transmission elements: Hydraulic, pneumatic and electric drives. Gears, sensors, materials, user interface, implications for robot design, controllers.

Unit III Machine Vision: Introduction, Low level & High-level vision, Sensing & Digitizing, Image processing & analysis, Segmentation, Edge detection, Object description & recognition, Interpretation, Applications

Unit IV Kinematics, dynamics and control: Object location, three-dimensional transformation matrices, inverse transformation, kinematics and path planning, Jacobian work envelope, manipulator dynamics, dynamic stabilization, position control and force control, present industrial robot control schemes.

Unit V Robot programming: Robot programming languages and systems, levels of programming robots, problems peculiar to robot programming, control of industrial robots using PLCs.

Unit VI Automation and **robots**: Case studies, multiple robots, machine interface, robots in manufacturing and non manufacturing applications, robot cell design, selection of a robot.

REFERENCE BOOKS:

1. S.R. Deb, Robotics Technology and flexible automation, Tata McGraw Hill Education., 2009
2. Mikell P Groover & Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, Industrial Robotics, Technology programming and Applications, McGraw Hill, 2012.
3. Richard D. Klafter, Thomas .A, ChriElewski, Michael Negin, Robotics Engineering an Integrated Approach, Phi Learning., 2009.
4. Francis N. Nagy, Andras Siegler, Engineering foundation of Robotics, Prentice Hall Inc., 1987.
5. P.A. Janaki Raman, Robotics and Image Processing an Introduction, Tata McGraw Hill Publishing company Ltd., 1995.
6. Carl D. Crane and Joseph Duffy, Kinematic Analysis of Robot manipulators, Cambridge University press, 2008.
7. Fu. K. S., Gonzalez. R. C. & Lee C.S.G., "Robotics control, sensing, vision and intelligence", McGraw Hill Book co, 1987
8. Craig. J. J. "Introduction to Robotics mechanics and control", Addison Wesley, 1999. 9. Ray Asfahl. C., "Robots and Manufacturing Automation", John Wiley & Sons Inc., 1985.

INE: 422 OPEN ELECTIVE – III – PROGRAMMABLE CONTROL SYSTEMS

L	T	PD	TOTAL Pds	Univ Exam Hrs	Exam Marks	Sessnl Marks	Total Marks
3	1	—	4	3	70	30	100

Unit I Control Systems and Automation Strategy : Evolution of instrumentation and control, Role of automation in industries, Benefits of

automation, Introduction to Descriptive automation tools PLC, DCS, SCADA, Hybrid DCS/PLC, Automation strategy evolution, Control system audit, and performance criteria.

Unit II Instrumentation Standard Protocols: Definition of protocol, Introduction to Open System Interconnection (OSI) model, Communication standard (RS232, RS485), Modbus (ASCII/RTU), Introduction to third party interface, concept of OPC (Object linking and embedding for Process Control), HART Protocol: Introduction, frame structure, programming, implementation examples, benefits, advantages and limitation.

Foundation Fieldbus H1: Introduction, frame structure, programming, implementation examples, benefits, advantages and limitation. Comparison of HART, Foundation Fieldbus, Devicenet, Profibus, Controlnet, Industrial Ethernet.

Unit III Programmable logic controllers (PLC) : Introduction, architecture, definition of discrete state process control, PLC Vs PC, PLC Vs DCS, relay diagram, ladder diagram, ladder diagram examples, relay sequencers, timers/counters, high speed counter, PTO, PWM and PID blocks in PLC, PLC design, study of at least one industrial PLC.

Unit IV Advance Applications of PLC and SCADA : PLC programming methods as per IEC 61131, PLC applications for batch process using SFC, Analog Control using PLC, PLC interface to SCADA/DCS using communication links (RS232, RS485) and protocols (Modbus ASCII/RTU)

Unit V Distributed Control Systems : DCS introduction, functions, advantages and limitations, DCS as an automation tool to support Enterprise Resources Planning, DCS Architecture of different makes, specifications, configuration and programming, functions including database management, reporting, alarm management, communication, third party interface, control, display etc. Enhanced functions viz. Advance Process Control, Batch application, Historical Data Management, OPC supports, Security and Access Control etc.

Reference:

1. Distributed Computer Control for Industrial Automation, PoppovikBhatkar, Dekkar Publications
2. Programmable Logic Controllers: Principles and Applications, Webb and Reis, PHI.
3. Computer Aided Process Control, S. K. Singh, PHI.
4. Introduction to Programmable Logic Controllers, Garry Dunning, Thomson Learning.
5. Computer Based Process Control, Krishna Kant, PHI.
6. The Management of Control System: Justification and Technical Auditing, N. E. Battikha, ISA.

INE: 423 OPEN ELECTIVE – IV – VLSI

L	T	PD	TOTAL Pds	Univ Exam Hrs	Univ Exam Marks	Sessnl Marks	Total Marks
3	1	—	4	3	70	30	100

INTRODUCTION TO MOS TECHNOLOGY: Various types of technologies – Bi-polar, MOS, CMOS, NMOS, PMOS. Comparison, fabrication of NMOS, PMOS, CMOS, BiCMOS devices. Basic Electrical Properties: Drain-to- source current versus Voltage relationship, Threshold voltage, MOS transistor transconductance and output conductance, figure of merit, Pass transistor, determination of Pull-up to Pull-down ratio of NMOS Inverter driven by another Inverter, determination of Pull-up to Pull-down ratio of NMOS Inverter driven through one or more Pass transistors.

CIRCUIT DESIGN PROCESSES: NMOS circuits: Inverter, NAND and NOR gates, CMOS circuits: Inverter, NAND and NOR gates. Stick Diagrams: NMOS Design style and CMOS Design Style. Design rules: Lambda based design rules, contact cuts, CMOS Lambda based design rules, Layout diagrams: NMOS Inverter, NAND and NOR gates, CMOS Inverter, NAND and NOR gates. Inverter delays, propagation delays.

INTEGRATED CIRCUIT DESIGN: Types of ASICs: full custom and semi-custom devices, Major activities in ASIC Design, ASIC Design and Development flow, Standard Cell based ASICs, Gate arrays based ASICs including channeled, sea-of gates, structured gate arrays. PLDs: Block diagram of PLA, PLA design, Bipolar PLA, NMOS PLA, PLA organization, folded PLA, CPLD, PAL design, FPGA block diagram, CLB, interconnect, I/O blocks

VLSI DESIGN TOOLS: VHDL synthesis, VHDL synthesizer, Circuit design flow, Circuit Synthesis, Simulation, types of Simulations, Simulation versus Synthesis, Design verification tools, Test vector generation, Scan based techniques, Boundary scan test, BIST.

PACKAGING: Types of packages, VLSI design rules, Constraints: Electrical, Mechanical, Thermal design considerations of IC packages.

REFERENCE BOOKS:

- 1) Basic VLSI Design by Douglass 3rd Edition, A Pucknell and Kamran Eshraghian, PHI, 1994.
- 2) Applications specific integrated Circuits by Michel John Sebastian Smith, Addison Wesley, 1997.
- 3) Introduction of VLSI by Mead and Conway.

III/IV B.Tech ECE (Four Year Course) &**III/VI B.Tech ECE (Six Year Double Degree Course)**

(With effect from 2019-2020 admitted batches onwards)

B.Tech. (ECE) 2nd Year I-semester Scheme of Instruction and Examination

Code Number	Course	Hours Per Week			Maximum Marks			Credits
		Theory	Tutorial	Lab	Exam	Sessionals	Total	
ECE 2101	Mathematics IV	3	0	0	70	30	100	3
ECE 2102	Network Theory Analysis	3	0	0	70	30	100	3
ECE 2103	Electrical Machines	3	0	0	70	30	100	3
ECE 2104	Electronic Devices and Circuits	3	0	0	70	30	100	3
ECE 2105	Switching Theory and Logic Design	3	0	0	70	30	100	3
ECE 2106	Data Structures	3	0	0	70	30	100	3
ECE 2107	Network and Machines Lab	0	0	3	50	50	100	1.5
ECE 2108	Electronic Devices & Circuits Lab	0	0	3	50	50	100	1.5
Total		18	0	6	520	280	800	21

B.Tech. (ECE) 2nd Year I-semester Scheme of Instruction and Examination

Code Number	Course	Hours Per Week			Maximum Marks			Credits
		Theory	Tutorial	Lab	Exam	Sessionals	Total	
ECE 2201	Mathematics V	3	0	0	70	30	100	3
ECE 2202	Electromagnetic Field Theory & Transmission Lines	3	0	0	70	30	100	3
ECE 2203	Analog Electronics Circuits	3	0	0	70	30	100	3
ECE 2204	Probability Theory & Random Process	3	0	0	70	30	100	3
ECE 2205	Signals & Systems	3	0	0	70	30	100	3
ECE 2206	Environmental Studies	2	0	0	70	30	100	0
ECE 2207	Digital ICs and HDL Lab	0	0	3	50	50	100	1.5
ECE 2208	Analog Electronics & Circuits Lab with Simulation	0	0	3	50	50	100	1.5
Total		17	0	6	520	280	800	18

III/IV B.Tech ECE (Four Year Course) &**III/VI B.Tech ECE (Six Year Double Degree Course)**

(With effect from 2019-2020 admitted batches onwards)

B.Tech. (ECE) 3rd Year I-semester Scheme of Instruction and Examination

Code Number	Course	Hours Per Week			Maximum Marks			Credits
		Theory	Tutorial	Lab	Exam	Sessionals	Total	

ECE 3101	Linear ICs & Applications	3	0	0	70	30	100	3
ECE 3102	Analog Communications	3	0	0	70	30	100	3
ECE 3103	Core Elective I	3	0	0	70	30	100	3
ECE 3104	Antenna & Wave Propagation	3	0	0	70	30	100	3
ECE 3105	Pulse and Digital Circuits	3	0	0	70	30	100	3
ECE 3106	Digital Signal Processing	3	0	0	70	30	100	3
ECE 3107	Soft Skills	2	0	0	-	100	100	0
ECE 3108	Linear ICs and Pulse Circuits Lab	0	0	3	50	50	100	1.5
ECE 3109	Analog Communications Lab	0	0	3	50	50	100	1.5
Total		20	0	6	520	380	900	21

B.TECH. (ECE) 3RD YEAR II-SEMESTER SCHEME OF INSTRUCTION AND EXAMINATION

Code Number	Course	Hours Per Week			Maximum Marks		Credits	
		Theory	Tutorial	Lab	Exam	Sessionals	Total	
ECE 3201	Computer Network Engineering	3	0	0	70	30	100	3
ECE 3202	Microprocessors & Microcontrollers	3	0	0	70	30	100	3
ECE 3203	Digital Communications	3	0	0	70	30	100	3
ECE 3204	Core Elective II	3	0	0	70	30	100	3
ECE 3205	Digital Image Processing	3	0	0	70	30	100	3
ECE 3206	Control Systems	3	0	0	70	30	100	3
ECE 3207	Cellular Mobile Communication	3	0	0	70	30	100	3
ECE 3208	DSP Lab	0	0	3	50	50	100	1.5
ECE 3209	Microprocessors & Microcontrollers Lab	0	0	3	50	50	100	1.5
Total		21	0	6	590	310	900	24

IV/IV B.TECH ECE (FOUR YEAR COURSE) &

IV/VI B.TECH ECE (SIX YEAR DOUBLE DEGREE COURSE)

(With effect from 2019-2020 admitted batches onwards)

B.TECH. (ECE) 4th YEAR I-SEMESTER SCHEME OF INSTRUCTION AND EXAMINATION

Code Number	Course	Hours Per Week			Maximum Marks		Credits	
		Theory	Tutorial	Lab	Exam	Sessionals	Total	
ECE 4101	Principles of Economics & Management	3	0	0	70	30	100	3
ECE 4102	Information Theory & Coding	3	0	0	70	30	100	3
ECE 4103	VLSI Design	3	0	0	70	30	100	3

ECE 4104	Microwave Engineering	3	0	0	70	30	100	3
ECE 4105	Radar Engineering	3	0	0	70	30	100	3
ECE 4106	Core Elective III	3	0	0	70	30	100	3
ECE 4107	Core Elective IV	3	0	0	70	30	100	3
ECE 4108	Digital Communications Lab	0	0	3	50	50	100	1.5
ECE 4109	Microwave Engineering Lab	0	0	3	50	50	100	1.5
Total		21	0	6	590	310	900	24

B.TECH. (ECE) 4th YEAR II-SEMESTER SCHEME OF INSTRUCTION AND EXAMINATION

Code Number	Course	Hours Per Week			Maximum Marks		Credits	
		Theory	Tutorial	Lab	Exam	Sessionals	Total	
ECE 4201	Project	0	0	28	50	50	100	14
Total		0	0	28	50	50	100	14

Core Elective –I	Core Elective-II
1. Computer Architecture & Organization	1. Wireless Sensor Networks
2. Networks & Protocols	2. Micro Electronics
3. Internet & Web Technology	3. EMI/EMC
4. Software Engineering	4. DSP Processors & Architectures
5. OOPS Instrumentation	5. Electronic Measurements and
Core Elective –III	Core Elective-IV
1. Fiber Optic Communications	1. Global Positioning System
2. Data Communications	2. Tele Communication Switching Systems
3. Bio Medical Signal Processing	3. Smart Antenna Systems
4. Embedded Systems	4. Radar Signal Processing
5. TV and Satellite Communication	5. Artificial Neural Networks

III/IV B.TECH ECE (FOUR YEAR COURSE) &

III/VI B.TECH ECE (SIX YEAR DOUBLE DEGREE COURSE)

(With effect from 2019-2020 admitted batches onwards)

B.TECH. (ECE) 2ND YEAR I-SEMESTER SCHEME OF INSTRUCTION AND EXAMINATION

Code Number	Course	Hours Per Week			Maximum Marks		Credits	
		Theory	Tutorial	Lab	Exam	Sessionals	Total	
ECE 2101	Mathematics IV	3	0	0	70	30	100	3
ECE 2102	Network Theory Analysis	3	0	0	70	30	100	3
ECE 2103	Electrical Machines	3	0	0	70	30	100	3
ECE 2104	Electronic Devices and Circuits	3	0	0	70	30	100	3

ECE 2105	Switching Theory and Logic Design	3	0	0	70	30	100	3
ECE 2106	Data Structures	3	0	0	70	30	100	3
ECE 2107	Network and Machines Lab	0	0	3	50	50	100	1.5
ECE 2108	Electronic Devices & Circuits Lab	0	0	3	50	50	100	1.5
Total		18	0	6	520	280	800	21

B.TECH. (ECE) 2ND YEAR II-SEMESTER SCHEME OF INSTRUCTION AND EXAMINATION

Code Number	Course	Hours Per Week			Maximum Marks		Credits	
		Theory	Tutorial	Lab	Exam	Sessionals	Total	
ECE 2201	Mathematics V	3	0	0	70	30	100	3
ECE 2202	Electromagnetic Field Theory & Transmission Lines	3	0	0	70	30	100	3
ECE 2203	Analog Electronics Circuits	3	0	0	70	30	100	3
ECE 2204	Probability Theory & Random Process	3	0	0	70	30	100	3
ECE 2205	Signals & Systems	3	0	0	70	30	100	3
ECE 2206	Environmental Studies	2	0	0	70	30	100	0
ECE 2207	Digital ICs and HDL Lab	0	0	3	50	50	100	1.5
ECE 2208	Analog Electronics & Circuits Lab with Simulation	0	0	3	50	50	100	1.5
Total		17	0	6	520	280	800	18

III/IV B.TECH ECE (FOUR YEAR COURSE) &

III/VI B.TECH ECE (SIX YEAR DOUBLE DEGREE COURSE)

(With effect from 2019-2020 admitted batches onwards)

B.TECH. (ECE) 3RD YEAR I-SEMESTER SCHEME OF INSTRUCTION AND EXAMINATION

Code Number	Course	Hours Per Week			Maximum Marks		Credits	
		Theory	Tutorial	Lab	Exam	Sessionals	Total	
ECE 3101	Linear ICs & Applications	3	0	0	70	30	100	3
ECE 3102	Analog Communications	3	0	0	70	30	100	3
ECE 3103	Core Elective I	3	0	0	70	30	100	3
ECE 3104	Antenna & Wave Propagation	3	0	0	70	30	100	3
ECE 3105	Pulse and Digital Circuits	3	0	0	70	30	100	3
ECE 3106	Digital Signal Processing	3	0	0	70	30	100	3
ECE 3107	Soft Skills	2	0	0	-	100	100	0

ECE 3108	Linear ICs and Pulse Circuits Lab	0	0	3	50	50	100	1.5
ECE 3109	Analog Communications Lab	0	0	3	50	50	100	1.5
Total		20	0	6	520	380	900	21

B.TECH. (ECE) 3RD YEAR II-SEMESTER SCHEME OF INSTRUCTION AND EXAMINATION

Code Number	Course	Hours Per Week			Maximum Marks		Credits	
		Theory	Tutorial	Lab	Exam	Sessionals	Total	
ECE 3201	Computer Network Engineering	3	0	0	70	30	100	3
ECE 3202	Microprocessors & Microcontrollers	3	0	0	70	30	100	3
ECE 3203	Digital Communications	3	0	0	70	30	100	3
ECE 3204	Core Elective II	3	0	0	70	30	100	3
ECE 3205	Digital Image Processing	3	0	0	70	30	100	3
ECE 3206	Control Systems	3	0	0	70	30	100	3
ECE 3207	Cellular Mobile Communication	3	0	0	70	30	100	3
ECE 3208	DSP Lab	0	0	3	50	50	100	1.5
ECE 3209	Microprocessors & Microcontrollers Lab	0	0	3	50	50	100	1.5
Total		21	0	6	590	310	900	24

IV/IV B.TECH ECE (FOUR YEAR COURSE) &

IV/VI B.TECH ECE (SIX YEAR DOUBLE DEGREE COURSE)

(With effect from 2019-2020 admitted batches onwards)

B.TECH. (ECE) 4TH YEAR I-SEMESTER SCHEME OF INSTRUCTION AND EXAMINATION

Code Number	Course	Hours Per Week			Maximum Marks		Credits	
		Theory	Tutorial	Lab	Exam	Sessionals	Total	
ECE 4101	Principles of Economics & Management	3	0	0	70	30	100	3
ECE 4102	Information Theory & Coding	3	0	0	70	30	100	3
ECE 4103	VLSI Design	3	0	0	70	30	100	3
ECE 4104	Microwave Engineering	3	0	0	70	30	100	3
ECE 4105	Radar Engineering	3	0	0	70	30	100	3
ECE 4106	Core Elective III	3	0	0	70	30	100	3
ECE 4107	Core Elective IV	3	0	0	70	30	100	3
ECE 4108	Digital Communications Lab	0	0	3	50	50	100	1.5
ECE 4109	Microwave Engineering Lab	0	0	3	50	50	100	1.5
Total		21	0	6	590	310	900	24

B.TECH. (ECE) 4th YEAR II-SEMESTER SCHEME OF INSTRUCTION AND EXAMINATION

Code Number	Course	Hours Per Week			Maximum Marks		Credits
		Theory	Tutorial	Lab	Exam	Sessionals Total	
ECE 4201	Project	0	0	28	50	50	14
	Total	0	0	28	50	50	14

Core Elective –I	Core Elective-II
1. Computer Architecture & Organization	1. Wireless Sensor Networks
2. Networks & Protocols	2. Micro Electronics
3. Internet & Web Technology	3. EMI/EMC
4. Software Engineering	4. DSP Processors & Architectures
5. OOPS Instrumentation	5. Electronic Measurements and
Core Elective –III	Core Elective-IV
1. Fiber Optic Communications	1. Global Positioning System
2. Data Communications	2. Tele Communication Switching Systems
3. Bio Medical Signal Processing	3. Smart Antenna Systems
4. Embedded Systems	4. Radar Signal Processing
5. TV and Satellite Communication	5. Artificial Neural Networks

ECE: 2101 MATHEMATICS-IV

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	0	0	3	30	70	100

UNIT I : VECTOR CALCULUS-1 Differentiation of vectors, curves in space, velocity and acceleration, relative velocity and relative acceleration, scalar and vector point functions, vector operator ∇ applied to scalar point functions- gradient, ∇ applied to vector point functions- divergence and curl. Physical interpretation of $\nabla \cdot \mathbf{F}$, $\nabla \times \mathbf{F}$, $\nabla \cdot (\nabla \times \mathbf{F})$, $\nabla \times (\nabla \phi)$ applied twice to point functions, ∇ applied to products of two functions; Irrotational and Solenoidal fields.

UNIT II: VECTOR CALCULUS-2 : Integration of vectors, line integral, circulation, work done, surface integral-flux, Green's theorem in the plane, Stoke's theorem, volume integral, Gauss Divergence theorem. Introduction of orthogonal curvilinear coordinates, cylindrical and spherical polar coordinates

UNIT III : INTRODUCTION OF PARTIAL DIFFERENTIAL EQUATIONS : Formation of partial differential equations, solutions of partial differential equations- equations solvable by direct integration, linear equations of first order: Lagrange's Linear equation, non-linear equations of first order,

Charpit's method. Homogeneous linear equations with constant coefficients-rules for finding the complementary function, rules for finding the particular integral (working procedure), non-homogeneous linear equations.

UNIT IV: APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS : Method of separation of variables, One dimensional wave equation-vibrations of a stretched string, one dimensional Heat equation, Two dimensional heat flow in steady state - solution of Laplace's equation in Cartesian and polar coordinates (two dimensional).

UNIT V: INTEGRAL TRANSFORMS : Introduction, definition, Fourier integral, Sine and cosine transforms, Complex form of Fourier integral, Fourier transform, Fourier Sine and Cosine transforms, Finite Fourier Sine and Cosine transforms, properties of Fourier transforms, Convolution theorem for Fourier transforms, Parseval's identity for Fourier transforms, Fourier transforms of the derivatives of a function, simple applications to Boundary value problems.

TEXT BOOKS:

1. Scope and treatment as in "Higher Engineering Mathematics", by Dr.B.S.Grewal, 43rd Edition, Khanna Publishers.

REFERENCE BOOKS:

1. A text book of Engineering Mathematics by N.P. Bali and Dr. Manish Goyal, Lakshmi Publications.

2. Mathematical Methods of Science & Engineering aided with MATLAB by Kanti B. Dutta, Cengage Learning India Pvt. Ltd.

3. Advanced Engineering Mathematics by Erwin Kreyszig.

4. Higher Engineering Mathematics by B.V. Ramana, Tata McGraw Hill Company.

5. Advanced Engineering Mathematics by H.K. Dass, S.Chand Company.

6. Higher Engineering Mathematics by Dr. M.K. Venkataraman.

ECE: 2102 NETWORK THEORY ANALYSIS

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	0	0	3	30	70	100

UNIT I . Analysis of DC Circuits: Active elements, Passive elements, Reference directions for current and voltage, Kirchhoff's Laws, Voltage and Current Division Nodal Analysis, Mesh analysis, Linearity and superposition, Thevenin's theorem and Norton's theorem, Reciprocity theorem, Z,Y,H,S-parameters.

UNIT II . DC transients: Inductor, Capacitor, source free RL, RC and RLC response, Evaluation of Initial conditions, Application of unit-step

function to RL, RC and RLC circuits, concepts of Natural, Forced and Complete response.

UNIT III . SINUSOIDAL STEADY STATE ANALYSIS: The sinusoidal forcing function, Phasor Concept, Average and Effective value of Voltage and Current, instantaneous and Average Power, Complex Power, Steady State Analysis using mesh and node analysis, application of network theorems to AC circuits, resonance, Concept of Duality.

UNIT IV . NETWORK FUNCTIONS: Network functions for single port and two port, Calculation of Network functions for Ladder and General Networks, Poles and Zeroes, Restriction of Poles and Zeroes for Driving point and Transfer functions, Time Domain Behavior from Pole Zero plot, Transfer Functions in terms of Y and Z functions, Scaling Network Functions.

UNIT V . POSITIVE REAL FUNCTIONS: Positive real function and other properties, Herwitz polynomials, Computation of residues, even and Odd functions, Test for Positive Real Functions.

Textbooks:

1. Engineering Circuit Analysis, William H. Hayt Jr. and Jack E. Kemmerley, 5th Edition, McGraw Hill International Edition.
2. Network Analysis, M. E. Van Valkenburg, 3rd Edition, PHI.
3. Modern Network Synthesis, M. E. Van Valkenburg, Wiley Eastern.

ECE: 2103 ELECTRICAL MACHINES

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	0	0	3	30	70	100

UNIT I DC MACHINES : Constructional Features, Function of Commutator, Induced EMF and Torque Expressions, Relationship Between Terminal Voltage and Induced EMF for Generator and Motoring Action, Different Types of Excitation and Performance Characteristics of Different Types of DC Machines, Starting and Speed Control of DC Motors, Losses and Efficiency, Efficiency by Direct Loading, Swinburne's Test and Hopkin's Test, Applications of DC Machines.

UNIT II TRANSFORMERS : Constructional Details, EMF Equation, Equivalent Circuit, Voltage Regulation, Losses and Efficiency, Auto – Transformers, Instrument Transformers, Open/Short – Circuit Tests and Determination of Efficiency and Regulation.

UNIT III THREE – PHASE INDUCTION MACHINES : Construction, Rotating Magnetic Field and 3ph Induction Motor, Power Flow Diagram, Torque and Torque-slip Characteristics, Condition for Max. Torque and its Value, Starting and Speed Control, Losses and Efficiency, Equivalent Circuit

and Circle Diagram of Induction Motor, No – Load and Rotor – Blocked Tests and Efficiency and Torque – Speed Characteristics.

UNIT IV THREE – PHASE SYNCHRONOUS MACHINES : Generation of EMF, Constructional Details, Induced EMF, Synchronous Generator on No – Load and Load, Synchronous Impedance and Voltage Regulation.

UNIT V : V – Curves and Inverted V – Curves, Synchronous Condenser, Starting of Synchronous Motors, Applications of Synchronous Machines.

UNIT VI SINGLE – PHASE MOTORS : Double Revolving Field Theory, Methods of Starting Single Phase Induction Motors, Universal Motor, Stepper Motor.

Text Books:

1. Electrical Machines, S. K. Bhattacharya, TMH Publications N. Delhi.
2. A First Course In Electrical Engineering, S. M. Tiwari, A. S. Binsaroor, Wheeler Publications.

ECE: 2104 ELECTRONIC DEVICES AND CIRCUITS

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	0	0	3	30	70	100

UNIT I Energy Band Theory of Solids : Intrinsic and Extrinsic Semiconductors Doping, Doping Materials, Carrier Mobility, Conductivity, Diffusion and continuity equation, Hall – Effect and its Application.

UNIT II Semiconductor Diodes : Band structure of PN Junction, Quantitative Theory of PN Diode, Volt – Amp. Characteristics, Temperature Dependence, Transition and Diffusion Capacitance of PN Junction, Zener and Avalanche Breakdowns, Tunnel Diode, LED, Schottky Barrier Diode, Varactor Diode, Photo Diode, PIN Diode, Point Contact Diode.

UNIT III Diode Rectifiers : Half-wave, Full-wave and Bridge Rectifiers with and without Filters, Ripple Factor and Regulation Characteristics.

UNIT IV Bipolar Junction Transistor : NPN and PNP junction Transistor, Characteristics of Current Flow across the Base Regions, Minority and Majority Carrier Profiles, CB, CE and CC Configurations and their Input and Output Characteristics. Comparison of CE, CB and CC Configurations. Junction Biasing for Saturation, Cutoff and Active Region, α and β Parameters and the relation between them, Photo Transistor, various Biasing circuits, stabilizations, thermal runaway, thermal stability, Transistor series and shunt voltage regulators.

UNIT V 5 JFET : JFET and its characteristics, Pinch off Voltage, Drain Saturation Current, JFET biasing, MOSFET – Enhancement and Depletion Modes, Small signal models of FET.

UNIT VI Small Signal – Low Frequency Transistor Amplifier Circuits : Transistor as an Amplifier, h – parameter model, Analysis of Transistor Amplifier Circuits using h –parameters. CB, CE and CC Amplifier configurations and performance factors. Analysis of Single Stage Amplifier, RC Coupled Amplifiers. Effects of Bypass and Coupling Capacitors. Frequency Response of CE Amplifier, Emitter – Follower, Cascaded Amplifier.

Text Books:

1. Integrated Electronics, Analog Digital Circuits and systems, Jacob Millman and D. Halkias, McGraw Hill.
2. Electronic Devices and Circuits, G.S.N. Raju, I.K. International Publications, New Delhi, 2006.

References:

1. Electronic Devices and Circuits 2nd Edition, B. V. Rao and K. Raja Rajeswari, Pearson Education
2. Electronic Devices and Circuits, K. VenkatRao, K. Rama Sudha, McGraw Hill education, Edition-2015.
3. Electronic Devices and Circuits Theory, Boylsted and Nashelsky, Prentice Hall Publications.

ECE: 2105 SWITCHING THEORY AND LOGIC DESIGN

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	0	0	3	30	70	100

Unit-1 Number system and codes: Number systems, Base conversion methods, Complement of numbers, Codes: Binary, Non binary, Decimal, Alphanumeric, Gray, Error detecting and error correcting codes. Logic Gates: AND, OR, NOT, NAND, NOR, XOR, EX-NOR and Universal Gates

Unit-2 Minimization of Boolean Functions: Fundamental postulates of Boolean algebra, Basic theorems, Simplification of Boolean equations, Min terms, Max terms, Standard form of Boolean functions. Simplification of functions: Karnaugh map method and Quine-McClusky methods (up to six variables), Multiple Output functions, incomplete specified functions.

Unit-3 Combinational Logic-Circuit Design-1: Logic design of combinational circuits: Adders and Subtractors: Binary, BCD, Excess -3 and Look –ahead-carry adder, Code converters, Multiplexers, De multiplexers, Encoders, Decoders and priority encoders, Realization of Boolean functions using multiplexers, De multiplexers and Decoders

Unit-4 Combinational Logic-Circuit Design-II Design of 4-bit comparator, Parity checker/Generator, Seven segment decoders, Hazards in combinational circuits, Hazard free realizations. Basics of PLDs: Basic

structure of PROM, PAL, PLA, CPLD, FPGAs, Realization of Boolean functions with PLDs and their merits and demerits.

Unit-5 Sequential circuits: Classification of sequential circuits, SR-latch, Gated latches, Flip flops: RS, JK, D, T and Master slave flip flops, Excitation tables, flip flop conversion from one type to another. Design of counters: Ripple counters, Synchronous counters, asynchronous counters, up-down counters, Johnson counter, ring counter. Design of registers: Buffer registers, Shift registers, Bi directional shift registers, Universal shift register

Unit-6 : Analysis and design of finite state machines, State assignment, State tables, Equivalent states, Elimination of Redundant states, Determination of state equivalence, Reduction using implication table, reducing incompletely specified state tables.

Text Books:

1. Switching and finite Automatic theory, ZuiKohari, TMH
2. Switching theory and logic design by Frederick.J.Hill and Gerald.R.Peterson
3. Switching theory and logic design, Anandakumar, PHI.

References:

1. Fundamentals of Logic Design, Charles.R.Roth, Thomson Publications.
2. Digital Design by Morris Mono, PHI.

ECE: 2106 DATA STRUCTURES

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	0	0	3	30	70	100

1. Revision of C Language Overview only

(no questions to be set on this).

2. Arrays and Functions: Organization and use of One Dimensional, Two Dimensional and Multi Dimensional Arrays, Handling of Character Strings, String Operation, Concept of Function, Parameter Passing, Recursion.

3. Structures, Pointers and Files: Definition of Structure and Union, Programming examples; Pointers, Pointer Expressions, Programming examples; File Operations, Preprocessor.

4. Linear Data Structures: Stack Representation, Operation, Queue Representation, Operations, Circular Queue, List, Representation, Operations, Double Linked and Circular Lists.

5. Non-Linear Data Structures: Trees, Binary Tree Representation, Tree Transversals, Conversion of a General Tree to Binary Tree, Representation of Graphs.

6. Searching Techniques: Basic Search Techniques, Tree Searching Graphics, Linked Representation of Graphics, Graph Transversal and Spanning Trees.

Text Books:

1. Programming In ANSI C, by E. Balaguruswamy.
2. Data Structures Using C, by A. M. Tanenbaum and others.

Reference Books:

1. An Introduction To Data Structures With Applications, Trembly and Sorenson.
2. The C – Programming Language, Kerningham and others.

ECE: 2107 NETWORKS AND MACHINES LAB

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
1.5	0	0	3	3	50	50	100

LIST OF EXPERIMENTS

I. NETWORK LAB EXPERIMENTS

1. Verification of Superposition Theorem
2. Verification of Reciprocity Theorem
3. Verification of Thevenin's Theorem
4. Calibration of UPF Wattmeter
5. Verification of Ohm's law
6. Verification of Kirchhoff's law

II. ELECTRICAL MACHINES LAB EXPERIMENTS

7. No load and blocked rotor tests on 3-phase squirrel cage Induction motor
8. Regulation of alternator by synchronous Impedance method
9. Open circuit test and short circuit test on 1-phase transformer
10. Swin burner's test
11. No load and load characteristics of self-excited Shunt generator

ECE: 2108 ELECTRONIC DEVICES AND CIRCUITS LAB

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
1.5	0	0	3	3	50	50	100

LIST OF EXPERIMENTS

1. Study of CRO and Applications
2. V-I Characteristics of PN Junction Diode

3. V-I Characteristics of Zener Diode and Zener regulator characteristics.

4. V-I Characteristics of LED

5. V-I characteristics of Photo diode

6. Half-wave and full-wave rectifiers

7. Half-wave and full-wave rectifiers with capacitor filter

8. CE characteristics of BJT, h-parameters

9. CB characteristics of BJT, h-parameters

10. Voltage gain, input impedance and output impedance of emitter follower

11. Drain and transfer characteristics of JFET

12. Frequency response of CE amplifier

ECE: 2201 MATHEMATICS- V

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	0	0	3	30	70	100

UNIT I: FUNCTIONS OF A COMPLEX VARIABLE- I : Introduction-Limit and continuity of $f(z)$ - Derivative of $f(z)$, Cauchy-Reimann Equations, Harmonic functions, Orthogonal systems, Applications to flow problems, Geometrical representation of $f(z)$, Conformal mappings, some standard transformations: (i) $w = z+c$, (ii) $w = cz$, (iii) $w = 1/z$, (iv) Bilinear transformation $w=az+b/cz+d$.

UNIT II: FUNCTIONS OF A COMPLEX VARIABLE- II : Integration of complex functions, Cauchy's theorem, Cauchy's integral formula, Series complex terms –Taylor's and Laurent's series (without proofs).Zero's and Singularities of analytic functions. Residues and calculations of Residues, Cauchy's Residue theorem, Evaluation of real definite integrals: Integration around unit circle, semi circle, rectangular contour and contours having poles on the real axes

UNIT III: DIFFERENCE EQUATIONS : Finite difference equations-order and solution of difference equations, formation of difference equations, linear difference equations, rules for finding the complementary function and articular integral.

UNIT IV: Z-TRANSFORMS: Introduction to Z-transforms, standard Z-transforms, linear property, damping rule, some standard results, shifting rules, initial and final value theorems, Convergence of Z-transforms, evaluation of inverse Z-transforms, applications of Z-transforms to solve difference equations.

UNIT V: SAMPLING THEORY : Sampling distribution, standard error, testing of hypothesis, level of significance, confidence limits, sampling of variable-large samples and small samples, students t-distribution, xz-distribution and F-distribution.

TEXT BOOKS:

1. Scope and treatment as in “higher engineering Mathematics”, by Dr.B.S.Grewal, **43rd Edition**, Khanna Publishers.

REFERENCE BOOKS:

1. Advanced Engineering Mathematics by Erwin Kreyszig.
2. A text book of Engineering Mathematics by N.P. Bali and Dr. Manish Goyal, Lakshmi Publications.
3. Mathematical Methods of science & Engineering aided with MATLAB by KantiB.Dutta, Cengage Learning India Pvt. Ltd.
4. Higher Engineering Mathematics by B. V. Ramana, Tata McGraw Hill Company.
5. Advanced Engineering Mathematics by H.K.Dass. S.Chand Company.
6. Higher Engineering Mathematics by Dr. M.K. Venkataraman.
7. Engineering Mathematics series by Chandrica Prasad.

ECE: 2202 ELECTROMAGNETIC FIELD THEORY & TRANSMISSION LINES

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	0	0	3	30	70	100

Unit -1 Electrostatics : Coulomb's Law, Electric Field Intensity – Fields due to Different Charge Distributions, Electric Flux Density, Gauss Law and Applications, Electric Potential, Maxwell's Two Equations for Electrostatic Fields, Energy density, Convection and Conduction Currents, Continuity Equation, Relaxation Time, Poisson's and Laplace's Equations; Capacitance.

Unit -2 Magneto statics : Biot-Savart Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Maxwell's Two Equations for Magneto static Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Inductances and Magnetic Energy.

Unit -3 Maxwell's Equations : Faraday's Law and Transformer emf, Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's Equations in Different Final Forms and Word Statements. Conditions at a Boundary Surface: Dielectric-Dielectric and Dielectric-Conductor Interfaces. Related Problems.

Unit -4 Electromagnetic Waves : Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves, Wave Propagation in Lossless and Conducting Media, Conductors & Dielectrics – Characterization, Polarization, Reflection and Refraction of Plane Waves – Normal and Oblique Incidences for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection, Surface Impedance. Poynting Vector and Poynting Theorem

Unit -5 Transmission Lines : Introduction to Transmission line equations, Primary & Secondary constants Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Losslessness /Low Loss Characterization, Distortion , Loading, SC and OC Lines, Reflection Coefficient, VSWR, $\Gamma/8$, $\Gamma/4$, $\Gamma/2$ line impedance Transformations, Smith Chart – Configuration and Applications.

Unit -6 Waveguides : Introduction, Rectangular Waveguides, electric and magnetic field patterns in TE₁₀ and TE₁₁ mode configuration, modes of TE wave in rectangular waveguide, field equations, impossibility of TEM wave propagation in waveguides, cutoff frequency of rectangular waveguide, propagation constant, wave impedance, phase velocity, group velocity, dominant mode and degenerate modes, related problems.

Textbooks

1. Electromagnetic Field Theory and Transmission Lines, GottapuSasibhushanaRao, Wiley India Pvt. Ltd. , New Delhi, 1st Ed.,2012.
2. Electromagnetics with Applications, Kraus and Fleisch, McGraw Hill, 1999.
3. Electromagnetic Field Theory and Transmission Lines, G.S.N. Raju, Pearson Education (Pvt., Ltd., New Delhi, 2005.

References:

1. Elements of Electromagnetic – Matthew N.O. Sadiku, Oxford Univ. Press, 3rd ed., 2001.
2. Engineering Electromagnetics, W. H. Hayt Jr., McGraw Hill – New York.
3. EM Waves and Radiating Systems, E. C. Jordan, PHI, 1997.

ECE: 2203 ANALOG ELECTRONICS CIRCUITS

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	0	0	3	30	70	100

Unit:1 Small Signal High Frequency Transistor Amplifier models:

BJT: Transistor at high frequencies, Hybrid- π common emitter transistor model, Hybrid- π conductance's, Hybrid- π capacitances, validity of Hybrid- π model, determination of high frequency parameters in terms of low frequency parameters, CE short circuit current gain, current gain with

resistive load, cut-off frequencies, frequency response and gain bandwidth product.

FET: Analysis of common source and common drain amplifier circuits at high frequencies.

Unit:2 Multistage Amplifiers : BJT and FET RC Coupled Amplifiers – Frequency Response. Cascaded Amplifiers. Calculation of Band Width of Single and Multistage Amplifiers. Concept of Gain Bandwidth Product.

Unit:3 Feedback Amplifiers : Concept of Feedback Amplifiers – Effect of Negative feedback on the amplifier Characteristics. Four Feedback Amplifier Topologies. Method of Analysis of Voltage Series, Current Series, Voltage Shunt and Current Shunt feedback Amplifiers.

Unit:4 Sinusoidal Oscillators : Condition for oscillations –LC Oscillators – Hartley, Colpitts, Clapp and Tuned Collector Oscillators – Frequency and amplitude Stability of Oscillators – Crystal Oscillators – RC Oscillators — RC Phase Shift and Weinbridge Oscillators.

Unit:5 Power Amplifiers : Classification of Power Amplifiers – Class A, Class B and Class AB power Amplifiers. Series Fed, Single Ended Transformer Coupled and Push Pull Class A and Class B Power Amplifiers. Cross-over Distortion in Pure Class B Power Amplifier, Class AB Power Amplifier – Complementary Push Pull Amplifier, Derating Factor – Heat Sinks.

Unit:6 Tuned Voltage Amplifiers : Single Tuned and Stagger Tuned Amplifiers – Analysis – Double Tuned Amplifier – Bandwidth Calculation.

Text Books :

1. Integrated Electronics, Analog Digital Circuits and systems, Jacob Millman and D. Halkias, McGraw Hill, 1972
2. Electronic Devices and Circuits by Salivahanan, N.Suresh Kumar and A.Vallava Raj TMH, 2nd Edition, 1998.
3. Electronic Circuit Analysis, B.V.Rao, K.RajaRajeswari et.al, Pearson Publishers

References:

1. Electronic Devices and Circuits, G.S.N. Raju, IK International Publications, New Delhi, 2006.
2. Electronic Devices and Circuits – G.K.Mithal, Khanna Publishers, 23rd Edition, 2004.

ECE: 2204 PROBABILITY THEORY & RANDOM PROCESS

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	0	0	3	30	70	100

Unit-I : Probability Theory : Sample spaces, Events, Probability definition and Axioms, Mathematical model of experiments, Probability as relative frequency, Joint and conditional probability, Properties of joint probability and conditional probability, Total probability, Bayes' theorem, Independent events: Two events and multiple events, properties of independent events.

Unit-II: Random Variables and Operations on one random variable : Random variable concept, Distribution function, Density function, Gaussian random variable, Conditional distribution and density function, Expectation, Moments, Functions that give moment, Transformations of a random variable.

Unit-III: Multiple random variables : Vector random variables, Joint distribution and its properties, Joint density and its properties, Conditional distribution and density, statistical independence, Distribution and density of a sum of random variables, Central limit theorem.

Unit-IV: Operations on multiple random variables : Expected values of a function of random variables: Joint moments about the Origin, joint central moments, Joint characteristic functions, Jointly Gaussian random variables: Two random variables, n-random variables, properties of Gaussian random variables, Transformations of multiple random variables: One function, Multiple functions, Inequalities of Chebyshev and Schwartz.

Unit-V : Random Processes : The Random Process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, concept of Stationarity and Statistical Independence, First-Order Stationary Processes, Second- Order and Wide-Sense Stationarity, (N-Order) and Strict-Sense Stationarity, Time Averages and Ergodicity, Mean-Ergodic Processes, Autocorrelation Function and Its Properties, Cross-Correlation Function and Its Properties, Covariance Function and their properties, Weiner-Kinchine Theorem ,Gaussian Random Processes, Poisson Random Process.

Unit-VI: Linear Systems with Random Inputs : System Response – Convolution, Mean and Mean-squared Value of System Response, autocorrelation Function of Response, Cross-Correlation Functions of Input and Output, Power Density Spectrum of Response, Cross-Power Density Spectrums of Input and Output, Band pass, Band-Limited and Narrowband Processes.

Textbook:

1. Probability Theory and Random Signal Principles, Peyton Z. Peebles,Jr, 4th edition Tata McGraw Hill Publishers,2002.

2. Probability Theory and Random Processes, S. P. Eugene Xavier, S. Chand and Co. New Delhi, 1998 (2nd Edition).

References:

1. Fundamentals of Applied Probability and Radom processes, Oliver C.Ibe, Elsevier Publications, 2007.
2. Probability, Random Variables and Stochastic Processes – Athanasios Papoulis and S. Unnikrishna Pillai, PHI, 4th Edition, 2002.
3. Probability theory and Stochastic Processes, B.Prabhakara Rao, T.S.R.Murthy, BS Publications, Hyderabad, 2012.

ECE: 2205 SIGNALS & SYSTEMS

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	0	0	3	30	70	100

Unit 1 Introduction to signals and linear time Invariant systems : Continuous –Time and Discrete –Time signals, Signal Energy and Power, Periodic Signals, Even and odd Signals, continuous- Time complex Exponential and Sinusoidal Signals, Discrete –Time complex Exponential and Sinusoidal Signals, Periodicity Properties of Discrete –Time Complex Exponentials, The Unit Impulse and Unit step Functions, The Discrete- Time Unit Step and Unit Impulse Functions, The Continuous-Time Unit impulse and Unit step Sequence, Continuous –Time and Discrete –Time Systems, Interconnections of Systems, Basic System Properties, Discrete –Time LTI Systems: The Convolution Sum, The Representation of Continuous –Time Signals in terms of Impulses, The Commutative property, Casual LTI Systems Described by Differential and Difference Equations, Singularity Functions.

Unit-2 Fourier Series Representation of Periodic Signals : Introduction, Fourier Series Representation of continuous time Periodic Signals, convergence of the Fourier Series, Properties of continuous time Fourier Series, Fourier Series representation of discrete time periodic signals, Properties of discrete time Fourier Series.

Unit-3 Continuous and Discrete time Fourier Transform : Introduction, Representation of Aperiodic signals, The continuous time Fourier Transform, The Fourier Transform for periodic signals, Properties of the continuous time Fourier Transform, The convolution Property, Multiplication property, Systems characterized by linear constant-coefficient differential equations. Discrete time Fourier Transform, Representation of Aperiodic signals discrete time Fourier Transform, Fourier Transform for periodic signals, Properties of the Discrete time Fourier Transform, The convolution property, The multiplication property, Duality, Systems characterized by linear constant co-efficient differential equations.

Unit-4 Convolution and correlation of signals : System analysis by Convolution, Convolution as a superposition of impulse response, some Convolution relationships, Graphical interpretation of Convolution, Convolution of a function with a unit impulse, Signal comparison, Correlation and Convolution, Some properties of correlation functions, Correlation functions for nonfinite energy signals, Detection of periodic signals in the presence of Noise by correlation, Determination of the waveform of a periodic signal masked by Noise, Extraction of a signal from Noise by filtering.

Unit-5 Laplace Transform : Introduction, The Laplace Transform, the region of convergence for Laplace Transforms, The Inverse Laplace Transform, Geometrical evaluation of the Fourier transform from the Pole-Zero plot, Properties of Laplace Transforms, The initial and Final value theorems, Analysis and characterization of LTI systems using the Laplace Transforms.

Unit-6 Sampling Theorem and Z-transform : Introduction, reconstruction of a signal from its samples using interpolation, The effect of Undersampling: aliasing, Discrete time processing of continuous time signals, sampling of Discrete time signals. The ZTransform, The Inverse Z-Transform, Geometrical evaluation of the Z-Transform from the Pole-Zero plot, Properties of Z-Transform, The initial theorems, some common Z-transform pairs, Analysis and characterization of LTI systems using the Z-Transforms, System function algebra and block diagram representation, The unilateral Z-Transform.

Textbooks:

1. Signals and Systems, Alan V. Oppenheim, Alan S. Willsky and Ian T. Young, PHI, 2ndEdn.
2. Signals Systems and Communication, B. P. Lathi, BS Publication
3. Signals and Systems, K. Raja Rajeswari and B. V. Rao, Prentice Hall of India.

References:

1. Signals and Systems- Simon Haykin and Van Veen, Wiley 2ndEdn.
2. Signals and Systems – P.Ramesh Babu and R.Ananda Natarajan 3rdEdn.

ECE: 2206 ENVIRONMENTAL STUDIES

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	0	0	3	30	70	100

Module 1 : Introduction : Definition, Score and importance, Measuring and defining environmental development : Indicators

Module 2 : Ecosystems : Introduction, Types, Characteristic features, Structure and functions of ecosystems, Forest, Grassland, Desert, Aquatic (lakes, rivers and estuaries).

Module 3 : Environment and Natural Resources Management : Land Resources : Land as a resource, Common property resources, land degradation, Solerision and desertification, Effects of modern agriculture, fertilizer-pesticide problems, Forest Resources : Use and over-exploitation, Mining and dams – their effects on forest and tribal people, Water resources : Use and over-utilization of surface and ground water, Floods, roughts, Water logging and salinity, Dams – benefits and costs, Conflicts over water, Energy Resources : Energy needs, Renewable and non-renewable energy sources, Use of alternate energy resources, Impact of energy use on environment.

Module 4 : Bio-Diversity and its Conservation : Value of bio-diversity – Consumptive and productive use, Social, Ethical, Aesthetic and option values, Bio-geographical classification of India – India as a mega diversity habitat, Threats to biodiversity – Hot-sports, habitat loss, poaching of wildlife, loss of species, seeds etc., Conservation of biodiversity – in – situ and ex-situ conservation.

Module 5 : Environmental Pollution – Local and Global Issues : Causes, Effects and control measures of : Air pollution, Indoor air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Solid waste management, Compositing, Vermiculture, Urban and industrial wastes, Recycling and re-use, Nature of thermal pollution and nuclear hazards, Global warming, Acid rain, Ozone depletion.

Module 6 : Environmental Problems in India : Drinking water, Sanitation and public health, Effect of activities of the quality of environment : Urbanization, ransportation, Industrialization, Green revolution, Water scarcity and ground water depletion, Controversies on major dams – esettlement and rehabilitation of people problems and concerns, Rain water harvesting, Cloud seeding and watershed management.

Module 7 : Economy and Environment : The economy and environment interaction, Economics of development, Preservation and conservation, Sustainability : Theory and practice, Limits to growth, Equitable use of resources for sustainable lifestyles, Environmental impact assessment.

Module 8 : Social Issues and the Environment : Population growth and environment, Environmental education, Environmental movements, Environment Vs development.

Module 9 : Institutions and Governance : Regulation by Government, Monitoring and enforcement of environmental regulation, Environmental acts : Water (Prevention and control of pollution) act, air (Prevention and control of pollution) act, Environmental Protection Act, Wild life protection act, Forest

conservation act, Costal zone regulations, Institutions and policies relating to India, Environmental Governance.

Module 10 : International Conventions : Stockholm Conference 1972, Earth Summit 1992, World Commission for Environmental Development (WCED).

Module 11 : Case Studies : Chipko movement, Narmada bachaoandolan, Silent valley project, Madhura refinery and TajMajal, Industrialization of pattancheru, Nuclear reactor at Nagarjuna Sager, Tehri Dam, Ralegaon Siddhi (Anna Hazare), Kolleru lake – Acquaculture, Florosis in Andhra Pradesh.

Module 12 : Field Work : Visit to a local area to document and mapping environmental assets – River / forest / grassland / hill /mountain, Study of local environment – Common plants, Insects, Birds, Study of simple ecosystems –Pond, river, hill, slopes etc. Visits to industries, Water treatment plants, Affluent treatment plants.

Textbooks :Kaushik – Kaushik, Anubha

Reference : Deswal&Deswal, Raja Gopal, Dharmaraj Publishers.

ECE: 2207 DIGITAL ICS AND HDL LAB

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
1.5	0	0	3	3	50	50	100

LIST OF EXPERIMENTS

HARDWARE EXPERIMENTS

1. Logic Gates
2. Realization of Gates by using universal building blocks
3. Realization of SOP and POS
4. Verification of Demorgan's Laws
5. Half Adder & Full adder
6. Function generation by using Decoders & Multiplexers.
7. Realization of Flip - flops
8. 4-bit Ripple counter
9. Mod-8 Synchronous counter.
10. 4 - bit Shift-register
11. Seven segment display

SIMULATION EXPERIMENTS

1. Simulation of Logic gates
2. Simulation of Full adder

3. Simulation of Multiplexer & De-Multiplexer
4. Simulation of Decoder & Encoder
5. Simulation of Flip flops (SR & D)
6. Simulation of Up-down counter & Shift register

ECE: 2208 ANALOG ELECTRONICS & CIRCUITS LAB WITH SIMULATION

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
1.5	0	0	3	3	50	50	100

LIST OF EXPERIMENTS

1. Current series feedback Amplifier
2. Colpitts oscillator
3. RC-Phase shift oscillator
4. Two stage RC-Coupled Amplifier
5. Wein bridge oscillator
6. Hartley Oscillator
7. Class-B Push pull Amplifier
8. Voltage series feedback Amplifier
9. Common source FET Amplifier
10. Tuned Voltage Amplifier
11. Applications of Operational Amplifier
12. Frequency response of Op-amp (Software Simulation)
13. Common emitter and common source Amplifier
14. Two stage RC coupled Amplifier
15. RC Phase shift oscillator using transistors
16. Class-A Power Amplifier (transformer less)
17. Class-B complementary symmetry Amplifier
18. High frequency common base (BJT) and common gate (JFET) Amplifier

ECE 3101 LINEAR ICS AND APPLICATIONS

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	0	0	3	30	70	100

1. Operational Amplifiers: Design Aspects of Monolithic Op-Amps, Ideal Characteristics, AC and DC Characteristics, Data sheet Specifications, Offset Voltages and Currents, Frequency Compensation Techniques, Measurement of Op-Amp Parameters.

2. Applications of Op-Amps: Inverting and Non-inverting Amplifiers, Integrator, Differentiator, Comparator, Logarithmic Amplifiers, Instrumentation Amplifiers, Op-Amp Phase Shift, Wein-bridge and Quadrature Oscillator, Voltage Controlled Oscillators, Voltage to Current and Current to Voltage Converters., Analog Multiplexers.

3. Signal Conditioning Circuits: Rectifiers, Peak Detection and, Wave form Generators, Sample and Hold Circuits, Multivibrators, Square Wave Generators, Schmitttrigger.

4. Active Filters: LPF, HPF, BPF, BEF, All-pass Filters, Higher Order Filters and their Comparison, Switched Capacitance Filters.

5. Special ICs: 555 Timers, 556 Function Generator ICs and their Applications, Three Terminal IC Regulators, IC 1496 (Balanced Modulator), IC 565 PLL and its Applications, Function Generators, Voltage to Frequency and Frequency to Voltage Converters.

6. Digital to Analog and Analog to Digital Converters: DAC techniques, Weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, Different types of ADCs-parallel Comparator type ADC, Counter type ADC, Successive approximation ADC and dual type ADC, DAC and ADC specifications, Integrated ADC and DACs.

Text Books:

1. Op-Amps and Linear ICs- RamakanthGayakwad, PHI, 1987.
2. Linear Integrated Circuits- D.RoyChowdhury, New Age International(p) Ltd,2nd Edition ,2003.

Reference Books:

1. Integrated Circuits- Botkar, Khanna Publications.
2. Applications of Linear ICs- Clayton.
3. Microelectronics-JacobMillman.

ECE 3102 ANALOG COMMUNICATION

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	0	0	3	30	70	100

1. Linear Modulation Systems: Need for Modulation, Frequency Translation, Method of Frequency Translation, Amplitude Modulation, Modulation Index, Spectrum of AM Signal, Modulators and Demodulators (Diode detector), DSB-SC Signal and its Spectrum, Balanced Modulator, Synchronous Detectors, SSB Signal, SSB Generation Methods, Power Calculations in AM Systems, Application of AM Systems.

2. Angle Modulation Systems: Angle Modulation, Phase and Frequency Modulation and their Relationship, Phase and Frequency Deviation, Spectrum of an FM Signal, Bandwidth of Sinusoidally Modulated FM Signal, Effect of the Modulation Index on Bandwidth, Spectrum of

Constant Bandwidth FM, Phasor Diagram for FM Signals, FM Generation: Parameter variation method, Indirect method of Frequency Modulation (Armstrong Method), Frequency Multiplication, PLL FM Demodulator, Pre – emphasis and De –emphasis, Comparison of FM and AM.

3. Noise in AM and FM Systems: Sources of Noise, Resistor Noise, Shot Noise, Calculation of Noise in a Linear System, Frequency Domain representation of Noise, The effect of Filtering on the Probability density of Gaussian Noise, Effect of filter on the power spectral Density of Noise, Narrow Bandwidth, Quadrature components of Noise, Power spectral density of Noise, Probability Density of Noise and their time derivatives, representation of Noise using Orthonormal coordinates, Noise in AM Systems, Noise in Angle Modulation Systems, Comparison between AM and FM with respect to Noise, Threshold Improvement in Discriminators, Comparisons between AM and FM.

4. Radio Transmitters: Classification of Radio Transmitters, Principle of a Radio Transmitters, AM and FM Transmitters, Radio Telegraph and Radio Telephone Transmitters, SSB Transmitters.

5. Radio Receivers: Radio receiver Types, AM Receivers – RF Section, Frequency Changing and Tracking, Intermediate Frequency and IF Amplifiers, Automatic Gain Control (AGC); FM Receivers – Amplitude Limiting, FM Demodulators, Ratio Detectors, ISB Receiver, Comparison with AM Receivers, Extensions of the Super-heterodyne Principles, Additional Circuits.

6. Pulse Analog Modulation methods: Pulse Modulation techniques, Sampling, Types of Sampling and its analysis, Time division Multiplexing, Pulse Amplitude Modulation, Pulse Width Modulation, Pulse position modulation, Pulse Code Modulation.

Text Books:

1. Principles of Communication Systems, H. Taub , D. L. Schilling and GouthamSahe, TMH 3rd edition, 2007.
2. Principle of Communication Systems, Simon Haykins (2nd Edition).
3. Electronic Communication Systems, G. Kennedy, McGraw Hill, 1977 (2nd Edition).

References:

1. Modern Digital and Analog Communication Systems, . P. Lathi (2nd Edition).
2. Communication systems, R.P.Singh and S.D.Sapre 2nd edition TMH 2008
3. Electronic Communications Modulation and Transmission, Robert J. Schoenbeck, PHI N. Delhi, 1999.

ECE 3103-(1) COMPUTER ARCHITECTURE & ORGANIZATION

(Core Elective-I)

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	0	0	3	30	70	100

1. Register Transfer and Micro operations: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Micro operations, Logic Micro operations, Shift Micro operations, Arithmetic Logic Shift Unit.

2. Basic Computer Organization: Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction cycle, Memory Reference Instructions, Input-Output and Interrupt, Complete Computer Description.

3. CPU Organization: Introduction, General Register Organization, Instruction formats, Addressing modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer (RISC), Stack Organization.

4. Micro Programmed Control: Control memory, Address sequencing, Microinstruction Formats, Microprogram Example, Design of Control Unit.

5. Memory Organization: Memory Hierarchy, Main memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory.

6. Input-Output Organization: Peripheral Devices, Input-output Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, Direct Memory Access (DMA).

7. Introduction to Multiprocessor System : Introduction, Interconnection Structures, Interprocessor Arbitration, Interprocess Communication and Synchronization.

Text Book:

1. Computer System Architecture, M.Morris Mano, PHI Publications, 3rd Edition May 1996.

References:

1. Computer Organization, V.CarlHamacher, ZvonkoG.Vranesic and SafwatG.Zaky, McGraw Hill International, 4th Edition.
2. Digital Computer Fundamentals, Thomas C.Bartee.

ECE 3103-(2) NETWORK PROTOCOLS

(Core Elective-I)

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	0	0	3	30	70	100

FUNDAMENTALS OF NETWORKING STANDARDS AND PROTOCOLS : Network Communication Architecture and Protocols - OSI Network Architecture seven Layers Model - Definition and Overview of TCP/IP Protocols -TCP/IP Four Layers Architecture Model - Other Network Architecture Models: IBM SNA.

ROUTED AND ROUTING PROTOCOLS : Application Layer Protocols- Presentation Layer Protocols- Session Layer Protocols - Transport Layer Protocols - Network Layer Protocols - Data Link Layer Protocols - Routing Protocols - Multicasting Protocols - MPLS.

ISDN AND NETWORK MANAGEMENT PROTOCOLS : Overview of ISDN “ Channels “ User access – Protocols Network management requirements – Network monitoring “ Network control “ SNMP V1, V2 and V3 “ Concepts, MIBs “ Implementation issues-RMON. 58

SECURITY AND TELEPHONY PROTOCOLS : Network Security Technologies and Protocols - AAA Protocols - Tunneling Protocols - Security Protocols- Private key encryption “ Data encryption system, public key encryption “ RSA “ Elliptic curve cryptography “ Authentication mechanisms” Web security -Secured Routing Protocols - IP telephony -Voice over IP and VOIP Protocols –Signaling Protocols- Media/CODEC.

NETWORK ENVIRONMENTS AND PROTOCOLS : Wide Area Network and WAN Protocols - Frame relay - ATM - Broadband Access Protocols -PPP Protocols - Local Area Network and LAN Protocols - Ethernet Protocols - Virtual LAN Protocols - Wireless LAN Protocols - Metropolitan Area Network and MAN Protocol - Storage Area Network and SAN Protocols.

REFERENCES:

1. Javvin, “Network Protocols” , Javvin Technologies Inc , second edition, 2005
2. William Stallings, “Cryptography and Network Security”, PHI, 2000.
3. Mani Subramanian, “Network Management”Principles and Practices”, Addison Wesley, 2000.
4. William Stallings, “SNMP, SNMPV2, SNMPV3 and RMON1 and 2”, 3rd Edition, Addison Wesley, 1999.
5. William Stallings, “Data and Computer Communications” 5th Edition, PHI, 1997

ECE 3103-(3) INTERNET & WEB TECHNOLOGY

(Core Elective-I)

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	0	0	3	30	70	100

HTML Common tags- List, Tables, images, forms, Frames; Cascading Style sheets; Java Script: - Introduction to Java Scripts, Objects in Java Script, Dynamic HTML with Java Script

XML: Document type definition, XML Schemas, Document Object model, Presenting XML, Using XML Processors: DOM and SAX.

Java Beans: Introduction to Java Beans, Advantages of Java Beans, BDk, Introspection, Using Bound properties, Bean Info Interface, Constrained properties Persistence, Customizes, Java Beans API, Introduction to EJB's

Web Servers and Servlets: Tomcat web server, Introduction to Servlets: Lifecycle of a Servlet, The Servlet API, The javax.servelet Package, Reading Servlet parameters, and Reading Initialization parameters. The javax.servelet HTTP package, Handling Http Request & Responses, Using Cookies-Session Tracking, Security Issues

JSP Application Development: Generating Dynamic Content, Using Scripting Elements Implicit JSP Objects, Conditional Processing – Displaying Values Using an Expression to Set an Attribute, Declaring Variables and Methods Error Handling and Debugging Sharing Data between JSP pages, Requests, and Users Passing Control and Date between Pages – Sharing Session and Application Data – Memory Usage Considerations

Database Access: Database Programming using JDBC, Studying Javax.sql.* package, Accessing a Database from Servlets & JSP Page , Application – Specific Database Actions, Deploying JAVA Beans in a JSP Page, Introduction to struts framework.

TEXT BOOKS:

1. Internet and World Wide Web – How to program by Dietel and Nieto
PHI/Pearson Education Asia.
2. Advanced Java™ 2 Platform How to Program, Deitel/Deitel/Santry
3. Java Server Pages –Hans Bergsten, SPD O'Reilly

REFERENCE BOOKS:

1. HTML Black Book: The Programmer's Complete HTML Reference Book-by Steven Holzner
2. Core Servlets and Java Server Pages Volume2: Core Technologies by Marty Hall and Larry Brown, Pearson Education

ECE 3103-(4) INTERNET & WEB TECHNOLOGY

(Core Elective-I)

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				

3	3	0	0	3	30	70	100

1. Software Engineering: Software related problems, software engineering, concepts, and development activities
2. Modelling: Concepts, Modelling with UML
3. Project Organization & Communication: Project Organization & communication concepts and their activities
4. Requirements: Requirements elicitation & its activities and managing requirements elicitation
5. Analysis: Analysis overview, concepts, activities and managing analysis
6. System Design: Design overview, concepts, and activities, addressing design goals and managing system design
7. Object Design: Object reuse, its activities & managing reuse, Interface specification concepts & its activities and Managing object design
8. Testing; Testing concepts, activities and managing testing
9. Software Configuration Management: Configuration Management overview, concepts, activities and managing configuration management

Text Book:

1. Object-Oriented Software Engineering: Using UML, Patterns and Java, Bernd Bruegge and Allen H. Dutoit, 2nd Edition, Pearson Education Asia

Reference Books:

1. Object-Oriented Software Engineering: Practical software development using UML and Java Timothy C. Lethbridge and Robert Laganieri , McGraw-Hill Higher education
2. An Introduction to Object Oriented Systems Analysis and Design with UML and the Unified Process, Stephen R Schach, Tata McGraw-Hill

ECE 3103-(5) OBJECT ORIENTED PROGRAMMING

(Core Elective-I)

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	0	-	3	30	70	100

1. Procedural Paradigms, Object Oriented Paradigm, Concept of Data Abstraction Encapsulation, Inheritance and Polymorphism, Introduction to U.M.L, Description of various U.M.L. Diagrams with examples.
2. Basics of Object Oriented Programming : benefits of OOP, data types, declarations, expressions and operator precedence, functions, scope of variables
3. Introduction to OOP: Classes and objects, Constructors & Destructors, Operator Overloading & type conversions.

4. Inheritance: Derived classes, syntax of derived classes, making private members inheritable, single, multilevel, multiple, hierarchical, hybrid inheritance

5. Polymorphism: Pointers, virtual functions and polymorphism-pointers to objects, this pointer, pointers to derived classes, virtual and pure virtual functions.

6. Templates, Exception handling, console I/O and File I/O: class templates, Function templates, member function templates, exception handling, managing console I/O operations, and working with files.

7. Introduction to JAVA: Introduction, Classes and Objects, Arrays, strings and Vectors, Exception Handling, Managing I/O files in Java.

8. Packages and Interface, and Multi-threading: Packages, Interfaces, creating, extending, stopping, blocking threads, thread states, thread methods, exceptions, priority in threads, synchronization, Runnable interface.

Text Books:

1. JAVA 2.0- Complete Reference: Herbert Schildt& F. Naughton.
2. Introduction to JAVA PROGRAMMING by Y.Daniel Liang (PHI)
3. Object oriented Programming using C++: E. Balagurusamy, PHI.
4. Programming with JAVA- A primer: E. Balagurusamy, PHI
5. The Unified Modeling Languages user Guide by Grady BoochEtal.(Pearson Education)

References:

1. Object Oriented Programming in C++: N. Barkakati, PHI
2. Object Oriented Programming through C++ by RobatLaphore.
3. Object Oriented Analysis and Design by Andrew Haigh – (Tata McgrahHjill.)

ECE 3104 ANTENNAS AND WAVE PROPAGATION

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	0	-	3	30	70	100

1. Radiation and Antennas : Antenna definition and Functions, Network theorems, Properties of antennas, Antenna parameters , Polarization, Basic antenna elements , Radiation mechanism, Radiation fields of alternating current element, Radiated power and radiation resistance of current element, Radiation, induction and electrostatic fields, Hertzian dipole, Different current distributions in linear antennas, Radiation from half-wave dipole, Radiation from quarter wave monopole , Radiation characteristics of dipoles.

2. Analysis of Linear Arrays : Directional characteristics of dipole antennas, Radiation pattern of alternating current element, Radiation pattern expressions of centre-fed vertical dipoles of finite length, Radiation patterns of centre-fed vertical dipoles, Radiation patterns of centre-fed horizontal dipoles, Radiation patterns of vertical dipoles, Two-element uniform array, Uniform linear arrays, Field strength of a uniform linear array, First sidelobe ratio (SLR), Broadside and End-fire arrays, Patterns of array of non-isotropic radiators, Multiplication of patterns, Generalized expression for principle of pattern multiplication, Radiation pattern characteristics, Binomial arrays, Effect of earth on vertical patterns, Effect of earth on radiation resistance, Methods of excitation, Impedance matching techniques, Transmission loss between transmitting and receiving antennas - Friis formula, Antenna temperature and signal-to-noise ratio.

3. Array Synthesis : Introduction, Synthesis methods, Fourier transform method, Linear array design by Woodward-lawson method, Dolph-chebyshev method (Tschebyscheff distribution), Taylor method, Laplace transform method, Standard amplitude distributions.

4. HF, VHF and UHF Antennas : Introduction, Isotropic radiators, Directional antennas, Omni-directional antennas, Resonant antennas, Nonresonant antennas, LF antennas, Antennas for HF, VHF and UHF, Dipole arrays, Folded dipole, V-Antennas, Inverted V-antennas, Rhombic antenna, Yagi-Uda antenna, Log-periodic antennas, Loop antenna, Helical antenna, Whip antenna, Ferrite rod antenna, Turnstile antennas, Discone antennas, Notch antenna.

5. Microwave Antennas and Antenna Measurements : Introduction, Rod reflector, Plane reflector, Corner reflector, Parabolic reflector, Types of parabolic reflectors, Feed systems for parabolic reflectors, Shaped beam antennas, Horn antennas, Corrugated horns, Slot antennas, Impedance of a few typical dipoles, Slots in the walls of rectangular waveguides, Babinet's principle, Lens antennas, Microstrip antennas, Measurement ranges, Indoor and outdoor ranges, Antenna impedance measurements, Measurement of radiation resistance, Gain measurements, Measurement of antenna bandwidth, Directivity measurement, Measurement of sidelobe ratio, Measurement of radiation efficiency, Measurement of antenna aperture efficiency, Measurement of polarization of antenna, Phase measurement.

6. Wave Propagation : Propagation characteristics of EM Waves, Factors involved in the propagation of radio waves, Ground wave propagation, Ground wave field strength by Maxwell's equations, Reflection of radio waves by the surface of the earth, Roughness of earth, Reflection factors of earth, Wave tilt of the ground wave, Tropospheric wave propagation, Atmospheric effects in space wave propagation, Duct propagation, Radio horizon, Troposcatter, Fading of EM waves in Troposphere, Line of sight (LOS), Ionospheric propagation, Characteristics of ionosphere, Refractive index of ionosphere, Phase and group velocities,

Mechanism of Ionospheric propagation, reflection and refraction, Characteristic parameters of Ionospheric propagation, Sky wave field strength, Fading and diversity techniques, Faraday's rotation, Effect of earth's magnetic field.

Text Book:

1. Antennas and Wave Propagation, G.S.N. Raju, Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2007.

References:

1. EM Waves and Radiation Systems, E. C. Jordan and K. G. Balmain, PHI – N. Delhi, 1997.

2. Antennas, J.D. Kraus, McGraw Hill, NY.

3. Antenna theory, C.A. Balanis, John Wiley & Sons, NY, 1982.

ECE 3105 PULSE AND DIGITAL CIRCUITS

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	0	-	3	30	70	100

UNIT- I: LINEAR WAVE SHAPING: High pass and Low pass RC circuits, Response of High pass and Low pass RC circuits to sinusoidal, step, pulse, square, exponential and Ramp inputs, High pass RC circuit as a differentiator, Low pass RC circuit as an integrator. Attenuators and its application as CRO probe, RL and RLC Circuits and their response for step input, Ringing Circuit.

UNIT- II: NONLINEAR WAVE SHAPING: Diode clippers, Transistor Clippers, Clipping at two independent levels, Comparator, Applications of voltage Comparators, Diode Comparator, Clamping Operation, Clamping Circuits using Diode with Different Inputs, Clamping Circuit Theorem, Practical Clamping circuits, Effect of diode Characteristics on Clamping Voltage.

UNIT- III: BISTABLE MULTIVIBRATORS: Transistor as a switch, Switching times of a transistor, Design and Analysis of Fixed-bias and self-bias transistor binary, Commutating capacitors, Triggering schemes of Binary, Transistor Schmitt trigger and its applications.

UNIT- IV: MONOSTABLE AND ASTABLE MULTIVIBRATORS: Design and analysis of Collector coupled Monostable Multivibrator, Expression for the gate width and its waveforms. Design and analysis of Collector coupled Astable Multivibrator, expression for the Time period and its waveforms, The Astable Multivibrator as a voltage to frequency convertor.

UNIT- V: TIME BASE GENERATORS: General features of a time-base signal, Methods of Generating time base waveform, Exponential voltage

sweep circuit, Basic principles of Miller and Bootstrap time base generators, transistor Miller sweep generator, transistor Bootstrap sweep generator, Current Sweep circuit, Linearity correction through adjustment of driving Waveform.

UNIT VI: SYNCHRONIZATION AND FREQUENCY DIVISION: Principles of Synchronization, Frequency division in sweep circuit, Synchronization of Astable Multivibrators, Synchronization of a sweep circuit with symmetrical signals, Sine wave frequency division with a sweep circuit.

LOGIC GATES: Realization of gates using diodes and Transistors, RTL, DTL.

Text Books:

1. Pulse Digital and Switching Waveforms, J. Millman and H. Taub, McGraw-Hill, 2nd Edition 1991.

2. Pulse switching and digital circuits – David A.Bell, PHI, 5th Edn., Oxford University Press.

References:

1. Pulse and Digital Circuits, K.VenkatRao, Pearson Education India, 2nd Edition, 2010.

2. Pulse and Digital Circuits, A. Anand Kumar, PHI, second edition, 2005.

ECE 3106 DIGITAL SIGNAL PROCESSING

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	0	-	3	30	70	100

1. Discrete - Time Signals and Systems: Discrete - Time Signals – Sequences, Linear Shift – Invariant Systems, Stability and Casuality, Linear Constants – Coefficient Difference Equations, Frequency Domain Representation of Discrete – Time Signals and Systems.

2. Applications of Z – Transforms: System Functions H(z) of Digital Systems, Stability Analysis, Structure and Realization of Digital Filters, Finite Word Length Effects.

3. Discrete Fourier Transform (DFT): Properties of the DFS, DFS Representation of Periodic Sequences, Properties of DFT, Convolution of Sequences.

4. Fast – Fourier Transforms (FFT): Radix – 2 Decimation – In – Time (DIT) and Decimation – In – Frequency (DIF), FFT Algorithms, Inverse FFT.

5. IIR Digital Filter Design Techniques: Design of IIR Filters from Analog Filters, Analog Filters Approximations (Butterworth and Chebyshev Approximations), Frequency Transformations, General Considerations in

Digital Filter Design, Bilinear Transformation Method, Step and Impulse Invariance Technique.

6. Design of FIR Filters: Fourier series Method, Window Function Techniques, Comparison of IIR and FIR Filters.

7. Applications: Applications of FFT in Spectrum Analysis and Filtering, Application of DSP in Speech Processing.

Text Book:

1. Alan V. Oppenheim and Ronald W. Schaffer: Digital Signal Processing, PHI.

References:

1. Sanjit K. Mitra, Digital Signal Processing “A – Computer Based Approach”, Tata Mc Graw Hill.

2. Raddar and Rabiner, Application of Digital Signal Processing.

3. S. P. Eugene Xavier, Signals, Systems and Signal Processing, S. Chand and Co. Ltd.

4. Antonio, Analysis and Design of Digital Filters, Tata Mc Graw Hill.

ECE 3107 SOFT SKILLS

ECE 3108 LINEAR IC'S AND PULSE CIRCUIT LABORATORY

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
1.5	-	-	3	3	50	50	100

LIST OF EXPERIMENTS

1. Linear wave shaping
2. Non-linear wave shaping
3. UJT as a Relaxation oscillator
4. Measurement of parameters of Op-amp
5. Schmitt trigger
6. Frequency response of Active filters
7. Op-amp as Wave form generator
8. IC-555 as an Astable Multi vibrator
9. Study of Instrumentation Amplifier
10. Voltage regulator using IC-723
11. Monostable Multi vibrator using IC-555.

ECE 3109 ANALOG COMMUNICATION LABORATORY

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				

1.5	-	-	3	3	50	50	100

LIST OF EXPERIMENTS

1. AM M Modulation and Demodulation
2. Low Pass Filter using passive components
3. High Pass Filter using passive components
4. Active Notch Filter
5. Frequency Modulation and Demodulation
6. Pre-emphasis and De-emphasis
7. T – Type attenuator
8. Band pass filter using passive components
9. Mixer characteristics
10. SSB-SC modulation and demodulation.

ECE 3201 COMPUTER NETWORKS ENGINEERING

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	0	-	3	30	70	100

1. Introduction: Uses of Computer Networks, Network Structure, Architectures, Services, Standardization, Functions of Various Network Layers, Network examples.

2. Physical layer: Theoretical Basis for Data Communication, Transmission Media, Analog and Digital Transmission, Transmission and Switching ISDN.

3. Medium Access Sub-layer: LAN, MAN, Protocol, ALOHA, IEEE Standard for 802 for LANs, Fiber Optic Networks, Satellite Networks.

4. Data Link layer: Design Issues, Error Detection and Correction, Protocols and their Performance, Specifications and Examples.

5. Network layers: Design Considerations, Difference between Gateway, Ethernet Switch, Router, Hub, Repeater, Functions of Router, Congestion Control Internetworking and Examples, Details of IP addressing schemes, TCP/IP Protocol details.

6. The Transport Layer: The Transport Service, Elements of Transport Protocols, The Internet Transport Protocols; UDP, The Internet Transport Protocols; TCP.

The Application Layer: The Domain Name System, Electronic Mail, The World Wide Web.

Books:

1. Data Communications and Networking by Behrouz A. Forouzan, 2nd Edition, Tata McGraw Hill.

References:

1. Computer Networks, A. S. Tannenbaum, PHI – New Delhi.
2. Computer Networking Terminology Products and Standards, R. P. Suri and J. K. Jain, Tata McGraw Hill.

ECE 3202 MICROPROCESSORS AND MICROCONTROLLERS

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	0	-	3	30	70	100

UNIT-I: 8086/8088 MICROPROCESSORS : Register organization of 8086, Architecture, signal description of 8086, physical memory organization, general bus operation, I/O addressing capability, special purpose activities, Minimum mode, maximum mode of 8086 system and timings, the processor 8088, machine language instruction formats, addressing mode of 8086, instruction set off 8086, assembler directives and operators.

UNIT-II: PROGRAMMING WITH 8086 MICROPROCESSOR : Machine level programs, programming with an assembler, Assembly language programs, introduction to stack, stack structure of 8086/8088, interrupts and interrupt service routines, interrupt cycle of 8086, non-mask able interrupt and mask able interrupts, interrupt programming.

UNIT-III: BASIC AND SPECIAL PURPOSE PROGRAMMABLE PERIPHERALS AND THEIR INTERFACING WITH 8086/88 : Semiconductor memory interfacing, dynamic RAM interfacing, interfacing i/o ports, PIO 8255 modes of operation of 8255, interfacing to D/A and A/D converters, stepper motor interfacing, control of high power devices using 8255. Programmable interrupt controller 8259A, the keyboard /display controller 8279, programmable communication interface 8251 USART, DMA Controller 8257.

UNIT-IV: ADVANCED MICRO PROCESSORS : Salient features of 80386DX, architecture and signal description of 80386, register organization of 80386 and addressing modes, data types of 80386, real address mode of 80386, protected mode of 80386, segmentation and Paging, virtual 8086 mode and enhanced mode. Instruction set of 80386. The coprocessor 80387.

UNIT-V: 8051 MICROCONTROLLER : Introduction to microcontrollers, 8051 Microcontrollers, 8051 pin description, connections, I/O ports and memory organization, MCS51 addressing modes and instructions, assembly language programming tools.

UNIT-VI: PIC MICROCONTROLLERS AND ARM 32-BIT MICROCONTROLLER : Overview and features, PIC16Cx/7X instructions, interrupts in PIC 16C61/71, PIC 16F8XX Flash controllers, I/O ports and timers. Introduction to 16/32 Bit processors, ARM architecture and organization, ARM / Thumb programming model, ARM / Thumb instruction set.

TEXT BOOKS:

1. A.K.Ray, K.M.Bhurchandi, "Advanced Microprocessors and Peripherals", Tata McGraw Hill Publications, 2000.
2. N.Sentil Kumar, M.Saravanan, S.Jeevananthan, "Microprocessors and Microcontrollers", Oxford University Press, 2010.

REFERENCES:

1. Ajay V Deshmukh, "Microcontrollers", TATA McGraw Hill publications, 2012.
2. Krishna Kant, "Microprocessors and Microcontrollers", PHI Publications, 2010.

ECE 3203 DIGITAL COMMUNICATIONS

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	0	-	3	30	70	100

1. Analog-to-Digital Conversion: Pulse modulation techniques, Sampling, Time Division Multiplexing, Pulse Amplitude Modulation, Pulse Width Modulation, Pulse Position Modulation, Digital Modulation Techniques: Pulse Code Modulation, Differential Pulse Code Modulation, Delta Modulation, Adaptive Delta Modulation, Continuously Variable Slope Delta Modulation, Companding, Noise in Pulse-Code and Delta-Modulation Systems.

2. Binary Phase-Shift Keying, Differential Phase-Shift Keying, Differentially-Encoded PSK (DEPSK), Quadrature Phase-Shift Keying (QPSK), M-ary PSK, Quadrature Amplitude Shift Keying (QASK), Binary Frequency Shift-Keying, Similarity of BFSK and BPSK, M-ary FSK, Minimum Shift Keying (MSK), Duo-binary Encoding.

3. Mathematical Representation of Noise: Some Sources of Noise, Frequency-Domain Representation of Noise, The Effect of Filtering on the Probability Density of Gaussian Noise, Spectral Components of Noise Response of a Narrowband Filter to Noise, Effect of a Filter on the Power Spectral Density of Noise, Superposition of Noises, Mixing Involving Noise, Linear Filtering, Noise Bandwidth, Quadrature Components of Noise, Power Spectral Density of $n(t)$ and $n(t)$, Probability Density of $n(t)$, $n(t)$, and their Time Derivatives, Representation of Noise Using Orthonormal Coordinates, Irrelevant Noise Components

4. Data Transmission: A Base-band Signal Receiver, Probability of Error, The Optimum Filter, White Noise: The Matched Filter, Probability of Error of the Matched Filter, Coherent Reception: Correlation, Phase-Shift Keying, Frequency-Shift Keying, Non-coherent Detection of FSK, Differential PSK, Four Phase PSK (QPSK), Error Probability for QPSK, Probability of Error of Minimum Shift Keying (MSK), Comparison of Modulation Systems.

5. Spread Spectrum Modulation: Direct Sequence (DS) Spread Spectrum, Use of Spread Spectrum with Code Division, Multiple Access (CDMA), Ranging using DS Spread Spectrum, Frequency Hopping (FH) Spread Spectrum, Generation and Characteristics of PN Sequences, Acquisition (Coarse Synchronization) of a FH Signal, Tracking (Fine Synchronization) of a FH Signal, Acquisition (Coarse Synchronization) of a DS Signal, Tracking of a DS Signal.

Text Books:

1. Analog and Digital Communication Systems by Martin S. Roden, 3rd edition, Prentice Hall, 1994;
2. Principles of Communications By Taub and Schilling.

ECE 3204-(1) WIRELESS SENSORS & NETWORKS

(Core Elective-II)

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	0	-	3	30	70	100

UNIT I : OVERVIEW OF WIRELESS SENSOR NETWORKS: Key definitions of sensor networks, Advantages of sensor Networks, Unique constraints and challenges, Driving Applications, Enabling Technologies for Wireless Sensor Networks.

ARCHITECTURES: Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments, Network Architecture -Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts.

UNIT II : NETWORKING Technologies: Physical Layer and Transceiver Design Considerations, Personal area networks (PANs), hidden node and exposed node problem, Topologies of PANs, MANETs, WANETs.

UNIT-III : MAC Protocols for Wireless Sensor Networks: Issues in Designing a MAC protocol for Ad Hoc Wireless Networks, Design goals of a MAC Protocol for Ad-Hoc Wireless Networks, Classifications of MAC Protocols, Contention - Based Protocols, Contention – Based Protocols with reservation Mechanisms, Contention – Based MAC Protocols with Scheduling Mechanisms,

MAC Protocols that use Directional Antennas, Other MAC Protocols.

UNIT-IV : ROUTING PROTOCOLS: Introduction, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classification of Routing Protocols, Table –Driven Routing Protocols, On – Demand Routing Protocols, Hybrid Routing Protocols, Routing Protocols with Efficient Flooding Mechanisms, Hierarchical Routing Protocols, Power – Aware Routing Protocols, Proactive Routing.

UNIT-V : TRANSPORT LAYER AND SECURITY PROTOCOLS:
Introduction, Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks, Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer Solutions, TCP Over Ad Hoc Wireless Networks, Other Transport Layer Protocol for Ad Hoc Wireless Networks.

UNIT- VI : SECURITY IN WSNs: Security in Ad Hoc Wireless Networks, Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management, Secure Routing in Ad Hoc Wireless Networks.

SENSOR NETWORK PLATFORMS AND TOOLS: Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node level Simulators, State-centric programming.

APPLICATIONS of WSN: Ultra-wide band radio communication, Wireless fidelity systems. Future directions, Home automation, smart metering Applications.

TEXT BOOKS:

1. Ad Hoc Wireless Networks: Architectures and Protocols - C. Siva Ram Murthy and B.S.Manoj, 2004, PHI
2. Wireless Ad- hoc and Sensor Networks: Protocols, Performance and Control – JagannathanSarangapani, CRC Press
3. Holger Karl & Andreas Willig, “Protocols And Architectures for Wireless Sensor Networks”, John Wiley, 2005.

REFERENCES:

1. KazemSohraby, Daniel Minoli, &TaiebZnati, “Wireless Sensor Networks- Technology, Protocols, and Applications”, John Wiley, 2007.
2. Feng Zhao & Leonidas J. Guibas, “Wireless Sensor Networks- An Information Processing Approach”, Elsevier, 2007.
3. Ad- Hoc Mobile Wireless Networks: Protocols & Systems, C.K. Toh ,1 ed. Pearson Education.
4. Wireless Sensor Networks - C. S. Raghavendra, Krishna M. Sivalingam, 2004, Springer.
5. Wireless Sensor Networks – S Anandamurugan , Lakshmi Publications

ECE 3204-(2) MICROELECTRONICS

(Core Elective-II)

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	0	-	3	30	70	100

Integrated- Circuit Fabrication: Monolithic Integrated - Circuit (microelectronics) technology- The planar processes - Bipolar Transistor Fabrication - Fabrication of FETs - CMOS Technology - Monolithic Diodes - The Metal – Semiconductor Contact - IC Resistor - IC Capacitors - IC Packaging - Characteristics of IC Components – Microelectronic circuit layout.

Basic Digital circuits: MOS Technology - NMOS, CMOS, Inverters, Logic gates - ECL circuits. **Combinational Circuits:** Arithmetic functions - Comparators - Multiplexers - Demultiplexers - Memory - Memory applications – PAL - PLAs.

Sequential Circuits: A1 - Bit memory - The circuits properties of biastable latch - The clocked SR Flip-Flop - J-K, T, and D-type Flip-flops. Shift-registers - Ripple Counters - synchronous counters - Applications of counters.

Text Book:

1. Microelectronic by JacobMilliman, ArbinGrabel second edition, TMH.

References:

1. Part 2 of Integrated Circuits, Design Principles and Fabrications by editors, Warner and Fordemwalt, 1965, Motorola Series, McGraw Hill.
2. MOS LSI Design and Applications by Dr. William N. Carr and Dr. Jack P. Mize, McGraw Hill, 1972.
3. Microelectronic circuits and devices second edition Horenstien, PHI.

ECE 3204-(3) EMI/EMC

(Core Elective-II)

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	0	-	3	30	70	100

1. Introduction to EMI/EMC: EMI Sources, EMI Coupling, Noise Path, Models of Noise Coupling, EMC Regulations, Designing for EMC, Compliance Tests, Elimination of EMI, EMI Testing, Compliance Test and Engineering Tests.

2. Grounding Techniques, Shielding Techniques, Cabling Techniques.

3. Conducted EMI/EMC: Origin of Conducted EMI, Common and Normal mode Noise, Noise from Power Electronic Systems, Spectra of Pulse Noise Sources, Modeling of EMI Noise Sources, Transient Disturbance Simulation Signals, EMI Filters for Mains Noise.

4. Choice of Passive Components: EMC Design Components

5. EMI Measurement Technology: EMI Measuring Instruments, Pitfalls of EMI Measurements, Test Instrumentation Accessories and their Characteristics, Measurement of Pulsed EMF, EMI Patterns from Different List Objects, EMI Immunity Test System, Software in EMI/EMC Measurements, Recent Trends in Susceptibility Measurement, Cost Effective EMI/EMC Measurements, Setup and its Maintenance.

Text Books:

1. IMPACT Learning Material Series Modules 1 – 9, IIT New Delhi, Published by RSTE.
2. Electromagnetic Compatibility, R. C. Paul.

ECE 3204-(4) DSP PROCESSORS & ARCHITECTURES

(Core Elective-II)

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	0	-	3	30	70	100

1. INTRODUCTION TO DIGITAL SIGNAL PROCESING : Introduction, A Digital signal-processing system, The sampling process, Discrete time sequences Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear time-invariant systems, Digital filters, Decimation and interpolation, Analysis and Design tool for DSP Systems MATLAB, DSP using MATLAB.

2. COMPUTATIONAL ACCURACY IN DSP IMPLEMENTATIONS : Number formats for signals and coefficients in DSP systems, Dynamic Range and Precision, Sources of error in DSP implementations, A/D Conversion errors, DSP Computational errors, D/A Conversion Errors, Compensating filter.

3. ARCHITECTURES FOR PROGRAMMABLE DSP DEVICES AND EXECUTION : Basic Architectural features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities. Address Generation Unit, Programmability and Program Execution, Speed Issues, Features for External interfacing, Hardware looping, Interrupts, Stacks, Relative Branch support, Pipelining and Performance, Pipeline Depth, Interlocking, Branching effects, Interrupt effects, Pipeline Programming models

4. PROGRAMMABLE DIGITAL SIGNAL PROCESSORS : Commercial Digital signal-processing Devices, Data Addressing modes of TMS320C54XX DSPs, Data Addressing modes of TMS320C54XX Processors, Memory space of TMS320C54XX Processors, Program Control, TMS320C54XX instructions and Programming, On-Chip Peripherals,

Interrupts of TMS320C54XX processors, Pipeline Operation of TMS320C54XX Processors.

5. IMPLEMENTATIONS OF BASIC DSP ALGORITHMS : The Q-notation, FIR Filters, IIR Filters, Interpolation Filters, Decimation Filters, PID Controller, Adaptive Filters, 2-D Signal Processing, An FFT Algorithm for DFT Computation, A Butterfly Computation, Overflow and scaling, Bit-Reversed index generation, An 8-Point FFT implementation on the TMS320C54XX, Computation of the signal spectrum

6. INTERFACING MEMORY AND I/O PERIPHERALS TO PROGRAMMABLE DSP DEVICES : Memory space organization, External bus interfacing signals, Memory interface, Parallel I/O interface, Programmed I/O, Interrupts and I/O, Direct memory access (DMA). A Multichannel buffered serial port (McBSP), McBSP Programming, a CODEC interface circuit, CODEC programming, A CODEC-DSP interface example.

TEXT BOOKS:

1. Digital Signal Processing – Avtar Singh and S. Srinivasan, Thomson Publications, 2004.
2. DSP Processor Fundamentals, Architectures & Features – Lapsley et al. S. Chand & Co, 2000.

REFERENCES:

1. Digital Signal Processors, Architecture, Programming and Applications – B. VenkataRamani and M.Bhaskar, TMH, 2004.
2. Digital Signal Processing – Jonatham Stein, John Wiley, 2005.

ECE 3204-(5) ELECTRONIC MEASUREMENTS & INSTRUMENTATION

(Core Elective-II)

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	0	-	3	30	70	100

BASIC MEASUREMENT CONCEPTS : Measurement systems – Static and dynamic characteristics – error analysis – moving coil meters – DC ammeters, DC voltmeters, Series type ohmmeter, Shunt type ohmmeter, multimeter - moving iron meters – Bridge measurements – Wheatstone, Kelvin, Guarded Wheatstone, Maxwell, Hay, Schering, Anderson and Wein bridge.

BASIC ELECTRONIC MEASUREMENTS : AC voltmeters using rectifiers, True RMS responding voltmeter, Electronic multimeter – Comparison of analog and digital techniques – digital voltmeter - Ramp,

Stair case ramp, Integrating, Continuous balance, Successive approximation.

DIGITAL INSTRUMENTS : Frequency counters – measurement of frequency and time interval – extension of frequency range – measurement errors - Cathode ray oscilloscopes – block schematic – applications – special oscilloscopes – Storage and sampling oscilloscopes – wave analyzer - distortion analyzer - spectrum analyzer – Q meters.

TRANSDUCERS : Introduction, Classification of transducers, Analog transducers, Resistive transducers, Potentiometers, Strain gauges, Types of strain gauges, Resistance strain gauges, Semiconductor strain gauges, Resistance thermometers, Thermometers, Application of Thermistors, Thermo-couple construction, Measurement of thermocouple output, Compensating circuits, Advantages and disadvantages of thermocouples, Variable inductance type transducer, Variation of self-inductance, Variation of mutual inductance, Linear variable differential transformer, Rotary variable differential transformer, Capacitive transducers, Piezo-electric transducers, Digital transducers, Shaft Encoder.

TEXT BOOK

1. Albert D. Helfrick and William D .Cooper – Modern Electronic Instrumentation and Measurement Techniques, Prentice Hall of India, 2003.
2. A K Sawahney, Electrical And Electronics Measurement and Instrumentation, Dhanpat Rai, 2000

REFERENCES

1. H S Kalsi, Electronic instrumentation, TMH, 1995.
2. Ernest O. Doebelin, Measurement Systems- Application and Design- Tata McGraw-Hill-2004.
3. Oliver B.M. & Cage – Electronic Measurements & Instrumentation - Tata McGraw Hill
4. K Padma Raju, Y J Reddy, Instrumentation and Control Systems, McGraw Hill Education, 2016

ECE 3205 DIGITAL IMAGE PROCESSING

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	0	-	3	30	70	100

UNIT-1 : Introduction: Origins of digital image processing, uses digital image processing, fundamental steps in digital image processing, components of an image processing system, digital image fundamentals, Elements of visual perception, light and electromagnetic spectrum, imaging sensing and acquisition, image sampling and quantization. Some basic relationships between pixels, and introduction to the mathematical tools used in digital image processing.

Image Transforms: Need for image transforms, Spatial Frequencies in image processing, introduction to Fourier transform, discrete Fourier transform, fast Fourier transform and its algorithm, properties of Fourier transform. Discrete sine transforms. Walsh Transform. Hadamard transform, Haar Transform. Slant transforms, SVD and KL Transforms or Hotelling Transform

UNIT-2 : Intensity Transformations and Spatial Filtering: Background, Some basic intensity transformation functions, histogram processing, fundamentals of spatial filtering, smoothing spatial filters, sharpening spatial filters, combining spatial enhancement methods, using fuzzy techniques for intensity transformations and spatial filtering.

Filtering in the frequency domain: Preliminary concepts, Sampling and the Fourier transform of sampled functions, the discrete Fourier transform (DFT) of one variable, Extension to functions of two variables, some properties of the 2-D Discrete Fourier transform. The Basic of filtering in the frequency domain, image smoothing using frequency domain filters, Selective filtering, Implementation.

UNIT-3 : Image restoration and Reconstruction: A model of the image degradation /Restoration process, Noise models, restoration in the presence of noise only-Spatial Filtering, Periodic Noise Reduction by frequency domain filtering, Linear, Position –Invariant Degradations, Estimation the degradation function, Inverse filtering, Minimum mean square error (Wiener) filtering, constrained least squares filtering, geometric mean filtering, image reconstruction from projections.

UNIT-4 : Color image processing: color fundamentals, color models, pseudo color image processing, basic of full color image processing, color transformations, smoothing and sharpening. Image segmentation based on color, noise in color images, color image compression.

UNIT-5 : Wavelets and Multi-resolution Processing: image pyramids, sub band coding & Haar transforms multi resolution expressions, wavelet transforms in one dimensions. The fast wavelets transform, wavelet transforms in two dimensions, wavelet packets.

Image compression: Fundamentals, various compression methods-coding techniques, digital image water marking.

UNIT-6 : Morphological image processing: preliminaries Erosion and dilation, opening and closing, the Hit-or-miss transformation, some Basic Morphological algorithms, grey –scale morphology

Image segmentation: Fundamentals, point, line, edge detection thresholding, region –based segmentation, segmentation using Morphological watersheds, the use of motion in segmentation.

TEXT BOOKS:

1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, 3rd edition, Prentice Hall, 2008.
2. R. C. Gonzalez, R. E. Woods and Steven L. Eddins, Digital Image Processing Using MATLAB, 2nd edition, Prentice Hall, 2009.
3. Anil K.Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India, 9th Edition, Indian Reprint, 2002.
4. Jayaraman, S. Esakkirajan, and T. Veerakumar, Digital Image Processing, Tata McGraw-Hill Education.

ECE 3206 CONTROL SYSTEMS

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	0	-	3	30	70	100

1. Transfer Functions of Linear Systems – Impulse Response of Linear Systems – Block Diagrams of Control Systems – Signal Flow Graphs (Simple Problems) – Reduction Techniques for Complex Block Diagrams and Signal Flow Graphs (Simple Examples).
2. Basic Structure of a Feedback Control Systems-Introduction to Mathematical Modelling of Physical Systems – Equations of Electrical Networks – Modelling of Mechanical Systems – Equations of Mechanical Systems, Analogous Systems- Feedback Control System Characteristics.
3. Time Domain Analysis of Control Systems – Time Response of First and Second Order Systems with Standard Input Signals – Steady State Error Constants – Effect of Derivative and Integral Control on Transient and Steady State Performance of Feedback Control Systems.
4. Concept of Stability and Necessary Conditions for Stability – Routh-Hurwitz Criterion, Relative Stability Analysis, the Concept and Construction of Root Loci, Analysis of Control Systems with Root Locus (Simple Problems to understand theory).
5. Correlation between Time and Frequency Responses – Polar Plots – Bode Plots – Log Magnitude versus Phase Plots – All Pass and Minimum Phase Systems – Nyquist Stability Criterion – Assessment of Relative Stability – Constant M and N Circles.

Text Books:

1. Automatic Control Systems, Benjamin C. Kuo, PHI Publication (5th Edition).
2. Control Systems Engineering, I. J. Nagrath and M. Gopal, Wiley Eastern Ltd.

Reference Books:

1. Modern Control Engineering, Ogata, PHI.
2. Control Systems Principles and Design, M.Gopal, McGrawHill.

ECE 3207 CELLULAR MOBILE COMMUNICATION

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

INTRODUCTION: Evolution of Mobile Communications, Mobile Radio Systems around the world, First, Second, Third Generation Wireless Networks, Wireless Local Loop(WLL), Wireless LANs, Bluetooth, Personal Area Networks(PANs), Examples of Wireless Communication Systems, A Simplified Reference Model, Applications.

WIRELESS TRANSMISSION TECHNIQUES: Frequencies for radio transmission, Signals, Antennas, Signal Propagation, Multiplexing, Modulation Techniques: ASK, PSK, FSK, Advanced ASK, Advanced PSK, Multicarrier, Spread Spectrum: Direct sequence and Frequency hopping, Medium Access control- SDMA, FDMA, TDMA, CDMA, Comparison of S/F/T/CDMA.

THE CELLULAR CONCEPT: Introduction, Frequency reuse, Handoff strategies, Interference and System Capacity: Co- Channel Interference, Channel Planning, Adjacent Channel Interference, Power control for reducing interference, Trunking and Grade of Service, Cell Splitting, Sectoring, Repeaters for Range extension, A microcell zone concept.

MOBILE RADIO PROPAGATION: Introduction, Free space propagation model, The three basic propagation models-Reflection, Diffraction and Scattering, Two-ray model, Outdoor propagation models, Indoor propagation models, Signal Penetration into building, Small scale multipath Propagation, Parameters of Mobile multipath channels, Types of small scale fading.

TELECOMMUNICATION SYSTEMS: GSM: Mobile Services, System Architecture, Radio interface, Protocols, Localization and Calling, Handover, Security, New data services, UMTS and IMT-2000: Releases and Standardization, System Architecture, Radio interface, UTRAN, Handover.

Textbooks:

1. Mobile Cellular Communication by Gottapu Sasibhushana Rao, PEARSON International, 2012.

References:

1. Mobile Communications-Jochen Schiller, Pearson education, 2nd Edn, 2004.
2. Wireless Communications: Principles and Practice-Theodore. S. Rapoport, Pearson education, 2nd Edn, 2002.
3. Mobile Cellular Telecommunications-W.C.Y.Lee, Tata McGraw Hill, 2nd Edn, 2006.
4. Wireless and Mobile Communications-Lee, McGraw Hill, 3rd Edition, 2006.

5. Wireless Communications and Networks-William Stallings, Pearson Education, 2004.

ECE 3208 DIGITAL SIGNAL PROCESSING LABORATORY

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
1.5	-	-	3	3	50	50	100

LIST OF EXPERIMENTS

MAT LAB EXPERIMENTS:

1. Generation of discrete –time sequences
2. Implementation of Discrete time systems
 - a) Linear Convolution of two sequences
 - b) Circular Convolution of two sequences
3. Frequency analysis of discrete time sequences
4. Frequency analysis of discrete time systems
5. Design of IIR digital filter
 - a) Butterworth
 - b) Chebyshev
6. Design of FIR digital filter
 - a) Hamming window
 - b) Rectangular window

HARDWARE EXPERMENTS:

1. Verification of Linear Convolution using DSP Processor kit
2. Verification of Circular Convolution using DSP Processor kit
3. Implementation of IIR Filters on DSP Processor
4. Implementation of FIR Filters using Window Techniques on DSP Processor

ECE 3209 MICROPROCESSORS & MICROCONTROLLERS LAB LABORATORY

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
1.5	-	-	3	3	50	50	100

LIST OF PROGRAMS 8086 ESA-86/88 KIT PROGRAMMING

1. Write a Program to add two 16 bit numbers stored in two memory locations 2000h and 2002h and store the result in another memory location 2004h.

2. Write a Program to divide two 16 bit numbers stored in two memory locations 2000h and 2002h and store the result in another memory location 2004h.

3. Write a Program to multiply two 16 bit numbers stored in two memory locations 2000h and 2002h and store the result in another memory location 2004h.

4. Write a Program to add two 32 bit numbers stored in two memory locations 2000h and 2004h and store the result in another memory location 2008h.

5. Write a program to find factorial of a given number.

8086 PROGRAMMING USING MASM32 ASSEMBLER

6. Write a program to perform addition operation on two multibyte numbers.

7. Write a program to perform subtraction operation on two multibyte numbers.

8. Write a program to sort a given set of hexadecimal numbers.

9. Write a program to find whether the given string is a palindrome or not.

10. Write a program for inserting an element at a specified location in a given string.

11. Write a program to convert BCD numbers into equivalent binary value. Write a subroutine for the conversion.

12. Write a program to read a keyboard and display the characters on the PC screen using DOS/BIOS commands.

8051 PROGRAMMING USING KEIL SIMULATOR

13. Write a program to generate a square wave of 50% duty cycle at pin P2.1 using timer 0 in mode1. Assume XTAL=11.0592MHz.

14. Write a program to send a message "WELCOME" serially at 9600 baud rate continuously through serial port of 8051.

8086 INTERFACING

15. Write a program to interface stepper motor.

16. Write a program to interface keyboard with 8279 display controller.

ECE 4101 PRINCIPLES OF ECONOMICS AND MANAGEMENT

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

1. Introduction to Managerial Economics – Wealth, Welfare and scarce definition of Economics – Micro and Macro Economics; Demand – Law of Demand – Elasticity of Demand, Types of Elasticity and Factors determining price elasticity of Demand : Utility-Law of diminishing Marginal Utility and its limitations.

2. Conditions of Different Market Structures: - Perfect competition, Monopolistic competition, Monopoly, oligopoly and Duopoly.

3. Forms of business organizations: - Sole Proprietorship, Partnership, Joint Stock Company – Private Limited and public limited companies, Public enterprises and their types.

4. Introduction to Management: - Functions of Management – Taylors Scientific Management. Henry Falol's Principals of Management: Human resource management – basic functions of HR manager: manpower planning, recruitment, selection, training; development, placement, compensation, and performance appraisal (in Brief)

5. Production management – Production planning and control, plant location, break-even analysis, assumptions and applications.

6. Financial management – types of capital, fixed and working capital and methods of raising finance; depreciation: straight line and diminishing balance methods. Market management – functions of marketing and distribution channels.

7. Entrepreneurship – Entrepreneurial functions, entrepreneurial development objectives, training, benefits; phases of installing a project.

Text Books:

1. K.K.DEWETT, Modern Economic Theory, S.Chand and Co., New Delhi 55

2. S.C. SHARMA and BANGA T.R., Industrial Organisation & Engineering Economics, Khanna Publications, Delhi 6

Reference Books:

1. A.R.Aryasri, Management Science, Tata McGrah-Hill, New Delhi 2012

ECE 4102 INFORMATION THEORY AND CODING

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

1. Information measure and source coding, Information measure, Entropy and Information rate, Coding for a discrete memory less source, Predictive coding for sources with memory, Information transmission on discrete channels, Mutual information. Discrete channel capacity, coding for the binary symmetric channel, Continuous channels and system comparisons, continuous information, continuous channel capacity, Ideal communication system, system comparisons.

2. Rationale for coding, and types of codes, Discrete memory less channels, linear block codes, cyclic codes, convolution codes, Maximum likelihood Decoding of Convolution codes, Distance properties of convolution codes. Sequential Decoding of Convolution codes, Trellis codes,

Applications, Algebraic codes, Burst error correcting, Parity check bit coding for error detection, comparison of error rates in coded and uncoded transmission, Automatic repeat request.

Text Books:

1) Communication Systems, 3/e, by A.B. Carlson, Mc. Graw Hill Publishers (for topic 1)

2) Digital Communications by Simon Haykin, John Wiley & Sons (for topic 2)

References:

1) Principles of Digital Communications, Signal representation, Detection, Estimation & Information

2) Coding by J Das, S.K. Mullick, P.K. Chatterjee, New Age Int. Ltd.

3) Principles of Communication Systems, Taub & Schilling, 2/e, TMH Publishers

ECE 4103 VLSI DESIGN

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

1. Review of microelectronics and an introduction to MOS technology: Introduction to IC technology, MOS and related VLSI technology, NMOS, CMOS, BiCMOS Technologies, Thermal aspects of processing, Production of E beam masks.

2. MOS and BiCMOS circuit design processes: MOS layers, Stick diagrams, Design rules, and layout, 2 & 1.2 micro meter CMOS rules, Layout diagrams, Symbolic diagram.

3. Basic Circuit concepts: Sheet resistance, Area capacitances of layers, Delay unit, Wiring Capacitances, Choice of layers.

4. Scaling of MOS Circuits: Scaling models, Scaling function for device parameters, Limitations of scaling.

5. Sub system design and Layout: Architectural issues, Switch logic, Examples of Structural design (Combinational logic).

6. Sub system design process: Design of ALU subsystem, Some commonly used storage elements, Aspects of design tools, Design for testability, Practical design for test guidelines, Built in self test, CMOS project-an incrementor / decrementer, a comparator for two n-bit numbers. Ultra fast systems, Technology development, MOSFET based design.

7. Introduction to Embedded Systems: Embedded Systems, Processor Embedded into a System, Embedded Hardware Units and Devices in a System, Embedded Software in a System, Examples of Embedded Systems, Embedded Systems on Chip, Complex Systems

Design and Processors, Design Process in Embedded System, Formalization of System Design, Design Process and Design Examples, Classification of Embedded Systems, Skills required for an Embedded System Designer.

8. Embedded Software Development Process and Tools : Introduction to Embedded Software Development Process and Tools, Host and Target Machines, Linking and Locating Software, Getting Embedded Software into the Target System, Issues in Hardware-Software Design and Co-design

Text books:

1. Basic VLSI Design by Douglas A, Pucknell, Kamran Eshraghian, Prentice-Hall, 1996, 3rd Edition.

2. Embedded Systems Architecture, Programming and Design, second edition by Raj Kamal, Tata McGraw Hill Publication (Chapter 1, Chapter 13)

References:

1. Mead, C.A and Conway, LA, "Introduction to VLSI Systems", Addison-Wesley, Reading, Massachusetts, 1980.

ECE 4104 MICROWAVE ENGINEERING

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

1. Microwave Components:

Introduction to Microwaves and their applications, Coaxial Line Components, Wave-guide Components, Directional Couplers, Hybrid Tee Junction, Magic Tee, Attenuators, Ferrite Devices, Isolators, Circulators, Cavity Resonators, Re-entrant Cavities, Wave-meters, Microwave Filters, Detectors, Mixers.

2. Microwave Signal Generators and Amplifiers: Vacuum Tube Triodes, Resonant Cavity Devices, Reflex Klystron, Two – Cavity Klystron, Multi – Cavity Klystron, Slow – Wave Devices, TWT, Crossed Field Devices, Magnetrons, Semiconductor Devices, Microwave BJTs, FETs, Tunnel Diodes, Gunn Diode, IMPATT, TRAPATT Diodes.

3. Microwave Circuits: Scattering Matrix and its Properties, Scattering Matrix of directional coupler, circulator, E Plane Tee, H plane Tee and Magic Tee.

4. Microwave Integrated Circuits: Materials, Substrate, Conductor, Dielectric and Resistive Materials, MMIC Growth, Fabrication Techniques, MOSFET Fabrication, NMOS Growth and CMOS Development, Thin Film Formation.

5. Microwave Measurements: VSWR, Frequency, Guide Wavelength, Coupling and Directivity measurements.

Text Books:

1. Microwave Engineering, G.S.N. Raju, IK International Publishers,
2. Microwave Communications – Components and Circuits, E. Hund, McGraw Hill.
3. Microwave Devices and Circuits, S. Y. Liao, PHI.
4. Microwave Engineering, R. Chatarjee, East – West Press Pvt. Ltd.

References:

1. Foundations For Microwave Engineering, R. R. Collin, McGraw Hill.

ECE 4105 RADAR ENGINEERING

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

1. Radar Equation, Radar Block Diagram and Operation, Prediction of Range, Minimum Detectable Signal, Receiver Noise, Probability Density Functions, S/N, Integration of Radar Pulses, Radar Cross-section, Transmitter Power, PRF and Range Ambiguities, Radar Antenna Parameters, System Losses and Propagation Effects.

2. MTI and Pulse Doppler Radar: Introduction, Delay line Cancellers, Moving target Detector, Limitation to MTI performance, MTI from moving platform, Pulse Doppler Radar

3. Tracking Radar, Sequential Lobing, Conical Scan, Monopulse tracking Radar, Low angle tracking, Pulse compression,

Block Diagrams of Synthetic Aperture Radar (SAR), Phased array Radars,. MST Radar, ECM, ECCM

4. Radar Receiver, Mixers, Radar Displays, Receiver Protectors.

5. Principles of Direction Finders, Aircraft Homing and ILS, Radio Altimeter, LORAN, DECCA, OMEGA, Inland Shipping Aids.

Text Book:

Radar Engineering and Fundamentals of Navigational Aids, G S N Raju, IK International Publishers, 2008

References

Introduction to Radar Systems, Skolnik, McGraw Hill, 2007.

ECE 4106Core Elective III FIBER-OPTIC COMMUNICATIONS

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

1. Propagation: in Fibers: Elementary discussion of propagation in fibers Attenuation in Optical Fibers

E M wave propagation in step-Index Fibers

E M wave propagation in graded-Index Fibers.

2. Optical Fibers and Associated Components: Fiber Properties Splices, connectors, Couplers, and Gratings.

3. Transmitting and Receiving Devices: Injection laser Characteristics LED structures, Characteristics and modulation

4. Optical Transmitters, Receivers and Fiber-optic Link Design:

5. Concepts of Fiber-Optic Networks and wavelength – Division Multiplexing:

Books:

For syllabus items 2,4 and 5 An Introduction to Fiber Optic Systems by John Powers, 2nd Edition, Irwin, 1997.

For syllabus item 1 Optical Communication Systems by John Gowar, PHI 1994

For syllabus item 3 Optical Fiber Communications, Principles and Practice by John M. Senior, Second Edition, PHI 1996.

ECE 4106 Core Elective III DATA COMMUNICATIONS

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

Data Communication Concepts and Terminology: Data Representation, Data Transmission, Modes of Data Transmission, Signal Encoding, Frequency Spectrum, Transmission Channel, Data Communication

Transmission Media: Transmission Line Characteristics, Transmission Line Characteristics in Time Domain, Cross talk, Metallic Transmission Media, Optical Fiber Base-band Transmission of Data Signals, Telephone Network, Long Distance Network

Modems and Data Multiplexers: Digital Modulation Methods, Multilevel Modulation, Differential PSK, Standard Modems, Limited Distance Modems and Line Drivers, Group Band Modems, Data Multiplexers, Statistical Time Division Multiplexers

Error Control: Transmission Errors, Coding for Error Detection and Correction, Error Detection Methods, Forward Error Correction Methods, Reverse Error Correction

The Physical Layer, The Data Link Layer: Need for Data Link Control, The Data Link Layer 196, Frame Design Considerations, Flow Control, Data

Link Error Control, Data Link Management, HDLC-HIGH-LEVEL DATA LINK CONTROL

The Network Layer: The Sub network Connections, Circuit Switched Sub networks, Store and Forward Data Sub networks, Routing of Data Packets, Internetworking, Purpose of the Network Layer, Title of X.25 Interface, Location of X.25 Interface, Addressing in X.25, Packet Assembler and Disassembler (PAD), Asynchronous Character Mode Terminal PAD

Local Area Networks: LAN Topologies, Media Access Control and Routing, MEDIA ACCESS CONTROL IN LOCAL AREA NETWORKS, INTERNETWORKING, THE TRANSPORT AND UPPER OSI Layer, The Session Layer, The Presentation Layer, The Application Layer.

Text Book:

Praksh C. Gupta 'DATA COMMUNICATIONS' Prentice Hall of India 1996.

ECE 4106 BIO MEDICAL SIGNAL PROCESSING

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

Introduction: Biomedical signal Processing : Basics of Bioelectrical signals, signal Acquisition and analysis, Performance Evaluation.

Examples of Biomedical signals: The Electroencephalogram, The Electromyogram, The Electrocardiogram, The Electroneurogram, The Electrogastrogram, Event-related potentials (ERPs). Objectives of Biomedical signal analysis, Difficulties in Biomedical signal analysis, Computer-aided Diagnosis.

The Electroencephalogram (EEG): The Electroencephalogram (EEG) – A brief background, The Nervous system, The EEG-electrical Activity measured on the scalp, Recording techniques, EEG applications.

EEG Signal Processing: Modeling the EEG signal, Artifacts in the EEG, Nonparametric Spectral Analysis, Model-based Spectral Analysis, EEG Segmentation, Joint Time-Frequency analysis.

The Electromyogram: The Electrical Activity of Muscles, Amplitude Estimation in the surface EMG, Spectral analysis of the Surface EMG, Conduction Velocity Estimation, Modeling the Intramuscular EMG, Intramuscular EMG Signal Decomposition.

The Electrocardiogram: The Electrocardiogram – A Brief Background : Electrical Activity of the Heart, Generation and Recording of an ECG, Heart Rhythms, Heartbeat Morphologies, Noise and Artifacts, Clinical Applications.

ECG Signal Processing: Baseline Wander, Power line interference (50/60 Hz), Muscle Noise Filtering, QRS detection, Wave delineation, Data Compression

ECG Signal Processing: Heart Rate Variability: Acquisition and RR interval condition, Time domain measures, Heart Rhythm representations, Spectral Analysis of Heart rate variability, Clustering of Beat Morphologies, Dealing with Ectopic Beats, Interaction with other Physiological signals.

TEXT BOOKS:

1. Leif Sornmo and Pablo Laguna, "Bioelectrical Signal Processing in Cardiac and Neurological Applications" Elsevier Academic Press, 2005.
2. Rangaraj M. Rangayan, "Biomedical Signal Analysis- A case study approach" IEEE Press series on Biomedical Engineering, 2002.

REFERENCE BOOKS:

1. Bruce, "Biomedical Signal Processing & Signal Modeling," Wiley, 2001
2. D.C.Reddy, "Biomedical Signal Processing: Principles and Techniques", 2nd edition, Tata McGraw-Hill, New Delhi, 2005.

ECE 4106 EMBEDDED SYSTEMS

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

SYLLABUS

1. Introduction to Embedded Systems: Examples, Typical Hardware, Memory, Microprocessors, Busses; Introduction to 8051 Microcontroller, Architecture, Instruction set, Programming. Interrupts: Interrupt Basics, Shared-Data problem, Interrupt Latency.
2. Software Architectures: Round-Robin Architecture, Round-Robin with Interrupts Architecture, Function-Queue Scheduling Architecture, Real-Time Operating Systems Architecture, Selection of Architecture.
3. Real Time Operating System: Tasks and Task States, Tasks and Data, Semaphores and Shared Data, Semaphore Problems, Semaphore variants. Inter Task Communication: Message Queues, Mailboxes, Pipes, Timer Functions, Events, Memory Management, Interrupt Routines in RTOS Environment.
4. Design issues of RTOS: Principles, Encapsulation Semaphores and Queues, Hard Real-Time Scheduling Considerations, Saving Memory Space, Saving Power.
5. Embedded Software development Tools: Host and Target Machines, Linker/Locator for Embedded Software, Getting Embedded Software into the Target System. Embedded Software Debugging Techniques: Testing on your

Host Machine, Instruction Set Simulators, Laboratory Tools used for Debugging.

6. Introduction to the Internet of Things: History of IoT, IoT Architecture, M2M – Machine to Machine, Web of Things, IoT protocols, The Layering concepts, IoT Communication Pattern, IoT protocol Architecture.

Text Books: 1. The 8051 Microcontroller Architecture, Programming & Applications, Kenneth J. Ayala, Penram International.

2. An Embedded Software Primer, David E. Simon, Pearson Education, 2005. 3. Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, Marina Ruggieri & Homayoun Nikookar, River Publishers Series in Communications.

Reference Book: 1. Embedded Systems: Architecture, Programming and Design, Raj Kamal, Tata McGraw-Hill Education, 2008

ECE 4106 Core Elective III TV AND SATELLITE COMMUNICATION

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

Television

Basic Television System: Sound and Picture Transmission, the Scanning Process, Interlaced Scanning, Number of Scanning Lines, Vertical and Horizontal Resolution, Bandwidth of the Baseband Picture Signal.

Television Cameras: Principle of working and constructional details of Image Orthicon, Vidicon, Plumbicon and Silicon diode array Vidicon and Solidstate Image Scanners.

Composite - Video Signal: Video signal levels, Need for Synchronization, Details of Horizontal and Vertical Sync Pulses, Equalizing Pulses.

Signal Transmission and Channel Bandwidth: AM and FM Channel Bandwidth, VSB Transmission, Complete Channel Bandwidth, Reception of Vestigial Sideband Transmission, Television Standards, Block Schematic study of a typical TV Transmitter.

The TV Picture Tube: Monochrome Picture Tube, Picture Tube Characteristics and Picture Tube Control Circuits, Gamma Correction.

Television Receiver: Block Schematic and Functional Requirements, VSB Correction, Vertical and Horizontal Deflection Circuits, E.H.T. Generation, Study of Video IF Amplifier Video Detector, Sound Channel Separation, Sync Separation Circuits.

Colour Television: Principles of Additive and Subtractive Colour Mixing, Chromaticity Diagram, Compatibility and Reverse Compatibility of Colour

and Monochrome TV Requirements, Colour Signal Transmission, Bandwidth for Colour Signal Transmission, Sub-carrier Modulation of Chroma Signals, NTSC Encoding (Y, I, Q signals), PAL Encoding (Y, U, V signals), NTSC and PAL Decoders, Types of Colour TV Picture Tubes (Delta-gun, PIL and Trinitron Picture Tubes), Convergence Techniques.

Satellite Communication: Orbital Aspects, Tracking and Control of Communication Satellites, Launch Vehicles, Propagation Characteristics: Attenuation and Noise, Frequency Bands, Satellite Transponders, Earth Station: Configuration, High Power Amplifiers, Antennas, LNA, Link Design, Multiple Access: FDMA, TDMA, CDMA, SPADE, INTELSATs, INSAT.

Text Books:

1. Global Navigation Satellite Systems with Essentials of Satellite Communications authored by G S Rao, Mc-Graw Hill Publication, New Delhi 2010

2. Monochrome and Colour Television, R. R. Gulati, Wiley Eastern.

References:

1. Television Engineering, A. M. Dhake, Tata - McGraw Hill.

2. Satellite Communication, D. C. Agarwal, Khanna Publishers.

3. Satellite Communication, T. Pratt and S. W. Bostian, John Wiley and Sons.

ECE 4107 Core Elective- IV (1)GLOBAL POSITIONING SYSTEM

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

Introduction to Global Position System, the History of GPS, the Evolution of GPS, Development of NAVSTAR GPS, Block I, Block II satellites, Block IIA, Block IIR and Block II R-M satellites.

GPS working principle, Trilateration, Determination of where the satellites are, Determination of how far the satellites are, Determining the receiver position in 2D or X-Y Plane, Determining the receiver position in 3D or X-Y-Z Plane, basic equations for finding user position, user position determination with least squares estimator.

Other Global Satellite Constellations, GLONASS, GALILEO, Comparison of 3GNSS (GPS, GALILEO, GLONASS) interms of constellation and services provided.

GPS Satellite constellation and Signals, GPS system segments, Space segment, Control segment, User segment, GPS Signals, Pseudorandom noise (PRN) code, C/A code, P code Navigation data, Signal structure of GPS.

Coordinate Systems: Geoid, Ellipsoid, Coordinate Systems, Geodetic and Geo centric coordinate systems, ECEF coordinates, world geodetic 1984 system, Conversion between Cartesian and geodetic coordinate frame.

Textbook:

1. G S RAO, Global Navigation Satellite Systems, McGraw-Hill Publications, New Delhi, 2010

2. Pratap Mishra, Global positioning system: signals, measurements, and performance, Ganga-Jamuna Press, 2006

References:

1. Scott Gleason and DemozGebre-Egziabher, GNSS Applications and Methods, Artech House, 685 Canton Street, Norwood, MA 02062, 2009.

2. James Ba – Yen Tsui, 'Fundamentals of GPS receivers – A software approach', John Wiley & Sons (2001).

3. B. Hoffmann-Wellenhof, GPS theory and practice, 5th Edition, Springer 2001.

ECE 4107 TELECOMMUNICATION SWITCHING SYSTEMS

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

1. Telecommunication Switching Systems : Basics of Switching Systems, Manual Switching Systems, Principles of Cross Bar Switching. Electronic Space Division Switching: Stored Program Control, Centralized SPC, Distributed SPC, Two Stage Networks, Three Stage Networks, N Stage Networks

2 Time Division Switching: Basic Time Division Space Switching, Basic Time Division Time Switching, Time Multiplexed Space Switching, Time Multiplexed Time Switching, Combination Switching, Three Stage Combination Switching, N-Stage Combination Switching

3 Telephone Networks : Subscriber Loop Systems, Switching Hierarchy and Routing, Transmission Plan, Numbering Plan, Charging Plans. Signaling Techniques : In Channel Signaling, Common Channel Signaling.

4 Traffic Engineering : Network Traffic Load And Parameters, Grade Of Service, Blocking Probability, Modeling Switching Systems, Incoming Traffic and Service Time Characterization, Blocking Models and Loss Estimates, Delay Systems

5 Integrated Services Digital Network (ISDN) : Motivation For ISDN, Network & Protocol Architecture, Transmission Channels, User Network Interfaces, Signaling, Numbering, Addressing, ISDN Standards, Broadband ISDN.

6 Data Networks : Data transmission in PSTNs, Switching techniques for data transmission, Data communication architecture, Link-to-link layers, End-to-End layers, Local Area Networks, Metropolitan Area Networks, Data Network Standards, Protocol Stacks, Internetworking.

Text Book:

1. Thyagarajan Viswanath, "Telecommunication Switching Systems and Networks" PHI, 2000. (UNIT I, II, III & IV).

Reference Books :

1. J. Bellamy, "Digital telephony", 2nd edition, 2001, John Wiley.

2. B.A. Forouzan, "Data Communication & Networking", 3rd Edition, 2004, TMH.

3. J E Flood, "Telecommunication switching, Traffic and Networks", 2002, Pearson Education.

ECE 4107 SMART ANTENNA SYSTEMS

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

Unit I: Introduction To Smart Antennas : Need for Smart Antennas, Smart Antenna Configurations, Switched-Beam Antennas, Adaptive Antenna Approach, Space Division Multiple Accesses (SDMA), Architecture of a Smart Antenna System, Receiver, Transmitter, Benefits and Drawbacks, Mutual Coupling Effects

Unit II: DOA Estimation Fundamentals : Introduction The Array Response Vector, Received Signal Model, The Subspace-Based Data Model, Signal Auto covariance Matrices, Conventional DOA Estimation Methods, Conventional Beamforming Method, Capon's Minimum Variance Method, Subspace Approach to DOA Estimation, The MUSIC Algorithm, The ESPRIT Algorithm, Uniqueness of DOA Estimates

Unit III: Beam forming Fundamentals : The Classical Beam former- Statistically Optimum Beam forming Weight Vectors, The Maximum SNR Beam former, The Multiple Side lobe Canceller and the Maximum, SINR Beam former- Minimum Mean Square Error (MMSE), Direct Matrix Inversion (DMI), Linearly Constrained Minimum Variance (LCMV), Adaptive Algorithms for Beam forming, The Least Mean-Square (LMS) Algorithm, The Recursive Least-Squares (RLS) Algorithm

Unit IV: Space-Time Processing : Introduction, Discrete Space-Time Channel and Signal Models, Space-Time Beamforming, Inter symbol and Co-Channel Suppression, ISI Suppression, CCI Suppression, Joint ISI and CCI Suppression, Space-Time Processing for DS-CDMA, Capacity and Data Rates in MIMO Systems, Single-User Data Rate Limits, Multiple-Users

Data Rate Limits, Data Rate Limits Within a Cellular System, MIMO in Wireless Local Area Networks

Unit V: Mobile Stations' Smart Antennas- Introduction - Multiple-Antenna MS Design, Combining Techniques, Selection (Switched) Diversity, Maximal Ratio Combining, Adaptive Beamforming or Optimum Combining, RAKE Receiver Size, Mutual Coupling Effects, Dual-Antenna Performance Improvements, Downlink Capacity Gains

Text Books:

1. Constantine A. Balanis, Panayiotis I. Ioannides, Introduction to Smart Antennas Morgan & Claypool Publishers

2. Ahmed El Zooghby, Smart Antenna Engineering, Artech House

Reference Book:

1. M.J. Bronzel, Smart Antennas, John Wiley, 2004

2. T.S. Rappaport & J.C. Liberti, Smart Antennas for Wireless Communication, Prentice Hall (PTR), 1999.

3. R. Janaswamy, Radio Wave Propagation and Smart Antennas for Wireless Communication, Kluwer, 2001

ECE 4107 RADAR SIGNAL PROCESSING

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

Introduction : Basic radar functions, elements of pulsed radar, review of selected signal processing concepts, preview of basic radar signal processing.

Signal Models : Components of a radar signal, amplitude models, simple point target radar range equation, distributed target forms of range equation, radar cross section (RCS), radar cross section for meteorological targets, statistical descriptions of RCS, Clutter, behavior of σ_0 , signal to clutter ratio, temporal and spatial correlation of clutter, compound models of RCS, noise model and Signal to Noise Ratio, jamming, frequency models: the Doppler shift, simplified approach to Doppler shift, the stop and hop assumption and spatial Doppler.

Sampling and Quantization of Pulsed Radar Signals : Domains and Criteria for sampling radar signals, time and frequency samples, spatial samples sampling criteria, Sampling in the fast time dimension sampling in slow time, Sampling the Doppler spectrum, the Nyquist rate in Doppler, Straddle Loss, sampling in the spatial and angle domains, Phased array element spacing, Antenna beam spacing, Quantization.

Radar Waveforms : Introduction, the waveform matched filter, the matched filter, matched filter for the simple pulse, all range matched filtering, range resolution of the matched filter, matched filtering of moving targets,

the ambiguity function, definition and properties of the ambiguity function, ambiguity function of the simple pulse, the pulse burst waveform, matched filter for the pulse burst waveform, pulse by pulse processing, range ambiguity, Doppler response of the pulse burst waveform, ambiguity function for the pulse burst waveform, relation of the slow time spectrum to the ambiguity function, Frequency modulated (FM) pulse compression waveform, linear frequency modulation (LFM), the principle of stationary phase, ambiguity function of the LFM waveform, range-Doppler coupling.

Doppler Processing : Moving platform effects on the Doppler spectrum, moving target indication (MTI), pulse cancellers, vector formulation of the matched filter, matched filter for clutter suppression, blind speeds and staggered pulse repetition frequencies (PRFs), MTI figures of merit, limitations of MTI, pulse Doppler processing, the discrete time Fourier transform of a moving target, sampling the DTFT: the discrete Fourier transform, matched filter and filter-bank interpretations of pulsed Doppler processing with the DFT, fine Doppler estimation, modern spectral estimation in pulse Doppler processing.

TEXT BOOK

1. Mark Richards, Fundamentals of radar signal processing, McGraw-Hill education, 2005, 539pp.

REFERENCE BOOK

1. Bassem R. Mahafza, Radar signal analysis and processing using Matlab, Chapman and Hall/CRC, 2008, 504pp.

ECE 4107: ARTIFICIAL NEURAL NETWORKS

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

1. Artificial Intelligence as Representation and Search : Introduction to AI, Roots and Scope of AI, Definition, Turing Test, Application Areas of AI, Predicate Calculus, Structures and Strategies for State Space Search , Heuristic Search , Control and Implementation of State Space Search

2 Representation and Inference : Knowledge Representation , Strong Methods for Problem Solving , Reasoning in Uncertain

3 Situations, Machine Learning : Symbol-Based: Framework for Symbol – Based Learning, Version Space Search, ID3 Algorithm, Un-supervised learning, Reinforcement Learning , Connectionist: Perceptron Learning, Backpropagation Learning, Competitive Learning, Hebbian Coincidence Learning, Attractor Networks

4 Neural Networks and Fuzzy Systems : Neural and Fuzzy machine intelligence, fuzziness as multivalence, the dynamical-systems approach to

machine intelligence, intelligent behaviour as adaptive model-free estimation.

5 Neural Dynamics : I. Activations and signals : Neurous as functions, signal monotonicity, biological activations and signals, neuron fields, neuronal dynamical systems, common signal functions, pulse-coded signal functions

Neuronal dynamics II : Activation Models : neuronal dynamical systems, additive neuronal dynamics, additive neuronal feedback, additive bivalent models, BAM Connection matrices, additive dynamic and the noise-saturation dilemma, general neuronal activations : Cohen-grossberg and multiplicative models

6 Synaptic Dynamics : I. Unsupervised Learning : Learning as encoding, change, and quantization, four unsupervised learning laws, probability spaces and random processes, stochastic unsupervised learning and stochastic equilibrium, signal hebbian learning, competitive learning, differential hebbian learning, differential competitive learning. Synaptic Dynamics II : Supervised learning : Supervised function estimation, supervised learning as operant conditioning, supervised learning as stochastic pattern learning with known class memberships, supervised learning as stochastic approximation, the back propagation algorithm.

Text Book:

1. “Artificial Intelligence – Structures and Strategies for Complex Problem Solving”, George F. Luger, Th 4 Edition, Pearson Education , 2003.

2. Neural Networks & Fuzzy Systems, Bark Kosko, PHI Published in 1994.

Reference Books:

1. Artificial Intelligence, Knight, Tata McGraw Hill
2. Artificial Intelligence ‘a Modern Approach, Russell &Norvig, second edition, Pearson Education, 2003.
3. Fundamentals of Artificial Neural Networks, Mohamad H Hassoum, PHI
4. Neural Network Design, Hagan, Demuth and Beale, Vikas Publishing House.

ECE 4108 DIGITAL COMMUNICATION LABORATORY

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
1.5	-	-	3	3	50	50	100

1. Sample the given input signal for different sampling rates and recover the signal by means of appropriate low – pass filter.

2. Study the Pulse – Width Modulation for both AC and DC Modulating Signals and obtain the corresponding waveforms.
3. Study the Pulse – Position Modulation for both AC and DC Modulating Signals and obtain the corresponding waveforms.
4. Study the functioning of a given Analog to Digital Converter.
5. Study the functioning of a given Digital to Analog Converter.
6. Encode the given 4-Bit Data Word into 16-Bit Orthogonal Encoded Word using Hadamard Code.
7. Decode the 16-Bit Orthogonal Encoded Word to 4-Bit Data Word.
8. Study the performance of the given Continuously Variable Slope Delta Modulation (CVSD).
9. Obtain the characteristics of the Phase Shift Keying (PSK) Modulator.
10. Obtain the characteristics of the Frequency Shift Keying (FSK) Modulator.

ECE 4109 MICROWAVE ENGINEERING LABORATORY

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
2	-	-	3	-	50	50	100

- 1) Measurement of VSWR
- 2) V-I Characteristics of GUNN Diode
- 3) Measurement of Coupling Factor and Directivity of a 4-Port directional coupler
- 4) Measurement of Microwave frequency
- 5) Reflex Klystron Characteristics
- 6) Radiation Pattern of Horn Antenna
- 7) Fiber Optic Analog Link
- 8) Fiber Optic Digital Link

Other four experiments from the choice either from Microwave Engineering or from Antenna Theory

ECE 4201 PROJECT

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
14	-	-	28	-	50	50	100

III/IV B.TECH ECE (FOUR YEAR COURSE) & III/IV B.TECH + M.TECH (six year dual degree course)

(with effect from 2020-2021 admitted batch onwards)

B.Tech & B.Tech+M.Tech

II Year - I Semester

Course Credits code	Category	Course Title	Hours per week			Internal Marks	External Marks	Total Marks	C
			L	T	P				
EC-2101	BS	Mathematics III	3	0	0	30	70	100	3
EC-2102	PC	Analog Electronic Circuits	3	0	0	30	70	100	3
EC-2103	PC	Electrical Machines	3	0	0	30	70	100	3
EC-2104	PC	Signals & Systems	3	0	0	30	70	100	3
EC-2105	HSS	Managerial Economics	3	0	0	30	70	100	3
EC-2106	PC	Networks and Machine Lab	0	0	3	50	50	100	1.5
EC-2107	PC	Analog Electronics and Circuits Lab with Simulation	0	0	3	50	50	100	1.5
EC-2108	PC	Digital ICs and HDL Lab	0	0	3	50	50	100	1.5
EC-2109	SC	Matlab Programming	1	0	2	50	50	100	2
EC-2110	MC	Professional Ethics & Universal Human values	0	0	0	—	100	100	0
EC-2111	MC	NCC/NSS	0	0	2	—	—	—	0
Total Credits									21.5

B.Tech & B.Tech+M.Tech

II Year - II Semester

Course Credits code	Category	Course Title	Hours per week			Internal Marks	External Marks	Total Marks	C
			L	T	P				
EC-2201	ES	MIV	3	0	0	30	70	100	3
EC-2202	BS/PC	Electromagnetic Field Theory and Transmission Lines	3	0	0	30	70	100	3
EC-2203	PC	Microprocessors and Microcontrollers	3	0	0	30	70	100	3
EC-2204	PC	Probability theory and Random Process	3	0	0	30	70	100	3
EC-2205	PC	Analog Communications	3	0	0	30	70	100	3
EC-2206	PC	Microprocessors & Microcontrollers Lab	0	0	3	50	50	100	1.5
EC-2207	PC	Analog Communications Lab	0	0	3	50	50	100	1.5
EC-2208	SC	Python Programming	1	0	2	50	50	100	2
EC-2209	MC	Environmental Science	0	0	0	—	100	100	0
Total Credits									20

Summer Internship(Community Service)

EC-2101 : MATHEMATICS-III

B.Tech & B.Tech+M.Tech

II Year - I Semester

(With effect from the admitted batch of 2020-2021)

Subject Code:	External Examination - Max. Marks: 70
No. of Credits: 3	Internal Examination - Max. Marks: 30
No. of Periods/ Week: 3	Total Marks: 100

OBJECTIVES:

In general, the students are introduced with a knowledge on the topics: Vector Calculus, Partial differential equations, their applications and Integral Transforms (Fourier transforms, FST, FCT) so as to facilitate them to use these concepts in core subjects.

The objectives, in particular are to learn:

- the basic knowledge and applications of Vector Calculus used in Engineering problems.
- About the gradient, divergence and curl under the differentiation of scalar and vector point functions, also on Line-, Surface- and Volume integrals under the integration of point functions along with their applications in Engineering issues.
- Transformation theorems such as Green's theorem in the plane, Stoke's theorem, Gauss Divergence theorem and their applications.
- How to formulate the Partial Differential Equations from the relation between the dependent and independent variables, the methods of solving first order first degree linear, non-linear Partial Differential Equations, Homogeneous and Non homogeneous linear partial differential equations with constant coefficients .
- The procedure to find out the solutions of Partial Differential Equations by using the method of separation of variables (product method) about the formulation of one dimensional wave (string equation), one-and two-dimensional Heat flow equations, Laplace's equation in Cartesian and polar coordinates, and how to solve these equations using the method of separation of variables.
- The concept of integral transforms, namely, Fourier transforms, Fourier Sine, Cosine and related inverse transforms, and their applications in solving several Physical and Engineering problems.

Unit-I : (VECTOR CALCULUS-DIFFERENTIATION) : Differentiation of vectors, curves in space, velocity and acceleration, relative velocity and relative acceleration, scalar and vector point functions, vector operator ∇ applied to scalar point functions- gradient, applied to vector point functions- divergence and curl. Physical interpretation of gradient, divergence and curl

(i.e., ∇), Irrotational and Solenoidal fields, the relations obtained after ∇ applied twice to point functions, ∇ applied to products of two functions.

Unit-II : (VECTOR INTEGRATION) : Integration of vectors, line integral, circulation, work done, surface integral-flux, Green's theorem in the plane, Stoke's theorem, volume integral, Gauss Divergence theorem. (All theorems without proofs) Introduction of orthogonal curvilinear coordinates, cylindrical and spherical polar coordinates

Unit-III : (PARTIAL DIFFERENTIAL EQUATIONS) : Formation of partial differential equations, solutions of partial differential equations- equations solvable by direct integration, linear equations of first order: Lagrange's Linear equation, non-linear equations of first order, Charpit's method. Homogeneous linear equations with constant coefficients- rules for finding the complementary function, rules for finding the particular integral (working procedure), non- homogeneous linear equations.

Unit-IV : (APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS) : Method of separation of variables, One dimensional wave equation- vibrations of a stretched string, one dimensional Heat flow equation, Two dimensional heat flow in steady state - solution of Laplace's equation in Cartesian and polar coordinates (two dimensional).

Unit-V : (INTEGRAL TRANSFORMS (Fourier Transform) : Introduction, definition, Fourier integral, Sine and Cosine integrals, Complex form of Fourier integral, Fourier transform, Fourier Sine and Cosine transforms, Finite Fourier Sine and Cosine transforms, properties of Fourier transforms. Convolution theorem for Fourier transforms, Parseval's identity for Fourier transforms, Fourier transforms of the derivatives of a function, simple applications to Boundary value problems.

TEXT BOOKS:

Scope and treatment as in "Higher Engineering Mathematics", by Dr. B.S.Grewal, 43rd Edition, Khanna Publishers.

REFERENCE BOOKS:

1. Graduate Engineering Mathematics by V B Kumar Vatti, I.K.International publications
2. Advanced Engineering Mathematics by Erwin Kreyszig.
3. A text book of Engineering Mathematics by N.P. Bali and Dr. Manish Goyal, Lakshmi Publications.
4. Mathematical Methods of Science & Engineering aided with MATLAB by Kanti B.Dutta, Cengage Learning India Pvt. Ltd.
5. Higher Engineering Mathematics by B. V. Ramana, Tata McGraw Hill Company.
6. Advanced Engineering Mathematics by H.K.Dass. S.Chand Company.

OUTCOMES: After going through this course , the students would be able to:

- operate the differential operator 'del' to the scalar and vector point functions, Calculate the Gradient, Divergence and Curl, Vector normal to a surface, maximum rate of change of a scalar field, test whether two surfaces are to cut orthogonally or not .
- find the rate per unit volume at which the physical quantity is issuing from a point, the rate of inflow minus out flow using the Divergence and the angular velocity of rotation at any point of the vector field using the Curl.
- **test** whether the given motion is irrotational or rotational, whether a vector force acting on a particle is conservative or not
- find out the potential function from a given vector field.
- obtain the well known Laplace and poisson equations from an irrotational field
- understand to determine the work done by a force field and circulation using a Line integral
- find out the Line, Surface and Volume integrals, find flux using surface integral and volumes using the volume integral.
- apply the vector integral theorems (Green's theorem in the plane, Stoke's and Divergence theorems) for evaluating the double and triple integrals as these are used to find areas and volumes.
- know the methods of solving Linear and Non linear first order and first degree partial differential equations.
- solve the Linear Partial Differential Equations with constant coefficients (homogeneous and non homogeneous) and know the procedure for finding the complementary function and particular integrals
- apply the method of separation of variables to obtain solutions to the boundary value problems involving Linear partial differential equations occurred in engineering studies
- solve wave equation, heat flow equation and the Laplace's equations in Cartesian and polar coordinates using the method of separation of variables.
- apply and extend the knowledge of Fourier transform techniques in solving several Initial and Boundary value problems of Engineering, such as in Conduction of heat / Thermodynamics, Hydraulics transverse vibrations of a string, oscillations of an elastic beam, bending of beams, electrical circuits, free and forced vibrations of a membrane and transmission lines , etc.

EC - 2102 : ANALOG ELECTRONICS CIRCUITS

Course Objectives:

- To prepare students to perform the analysis of any Analog electronics circuit.
- To empower students to understand the design and working of BJT / FET.
- To empower students to understand the design and working of amplifiers and oscillators.
- To empower students to understand the design and working of Operational Amplifier.
- To prepare the students for advanced courses in Communication system Circuit Design.

Course Outcomes:

- Acquire basic knowledge of physical and electrical conducting properties of semiconductors.
- Develop the Ability to understand the design and working of BJT / FET amplifiers and Operational Amplifier.
- Develop the Ability to understand the design and working of BJT / FET oscillators.
- Develop the Ability to understand the design and working of Communication system Circuit Design.

SYLLABUS

Small Signal High Frequency Transistor Amplifier models

BJT: Transistor at high frequencies, Hybrid- common emitter transistor model, Hybrid- conductance's, Hybrid-capacitances, validity of Hybrid-model, determination of high frequency parameters in terms of low frequency parameters, CE short circuit current gain, current gain with resistive load, cut-off frequencies, frequency response and gain bandwidth product.

FET: Analysis of common source and common drain amplifier circuits at high frequencies.

Multistage Amplifiers

BJT and FET RC Coupled Amplifiers – Frequency Response. Cascaded Amplifiers. Calculation of Band Width of Single and Multistage Amplifiers. Concept of Gain Bandwidth Product.

Feedback Amplifiers

Concept of Feedback Amplifiers – Effect of Negative feedback on the amplifier Characteristics. Four Feedback Amplifier Topologies. Method of Analysis of Voltage Series, Current Series, Voltage Shunt and Current Shunt feedback Amplifiers.

Sinusoidal Oscillators

Condition for oscillations –LC Oscillators – Hartley, Colpitts, Clapp and Tuned Collector Oscillators – Frequency and amplitude Stability of Oscillators – Crystal Oscillators – RC Oscillators – RC Phase Shift and Weinbridge Oscillators.

Power Amplifiers

Classification of Power Amplifiers – Class A, Class B and Class AB power Amplifiers. Series Fed, Single Ended Transformer Coupled and Push Pull Class A and Class B Power Amplifiers. Cross-over Distortion in Pure Class B Power Amplifier, Class AB Power Amplifier – Complementary Push Pull Amplifier, Derating Factor – Heat Sinks.

Tuned Voltage Amplifiers

Single Tuned and Stagger Tuned Amplifiers – Analysis – Double Tuned Amplifier – Bandwidth Calculation.

Text Books :

1. Integrated Electronics, Analog Digital Circuits and systems, Jacob Millman and D. Halkias, McGraw Hill, 1972
2. Electronic Devices and Circuits by Salivahanan, N.Suresh Kumar and A.Vallava Raj TMH, 2nd Edition, 1998.
3. Electronic Circuit Analysis, B.V.Rao, K.RajaRajeswari et.al, Pearson Publishers

References:

1. Electronic Devices and Circuits, G.S.N. Raju, IK International Publications, New Delhi, 2006.
2. Electronic Devices and Circuits – G.K.Mithal, Khanna Publishers, 23rd Edition, 2004.

EC- 2103 : ELECTRICAL MACHINES

Course Objectives:

- Study of DC machines.
- Study of Transformers
- To introduce the concepts of ideal synchronous machines and poly-phase induction machines.
- Applications which will be utilized in the electrical machines with its performance and theory of operation.

Course Outcomes:

- Explain the theory of ideal synchronous machines and, basic machine relation.
- Analyze and apply the concept of steady state analysis and electrical transients in single phase and poly phase machines.

- Evaluate the basic operation and performance of special machines and can select special machines for different purpose

SYLLABUS

DC MACHINES

Constructional Features, Function of Commutator, Induced EMF and Torque Expressions, Relationship Between Terminal Voltage and Induced EMF for Generator and Motoring Action, Different Types of Excitation and Performance Characteristics of Different Types of DC Machines, Starting and Speed Control of DC Motors, Losses and Efficiency, Efficiency by Direct Loading, Swinburne's Test and Hopkin's Test, Applications of DC Machines.

TRANSFORMERS

Constructional Details, EMF Equation, Equivalent Circuit, Voltage Regulation, Losses and Efficiency, Auto – Transformers, Instrument Transformers, Open/Short – Circuit Tests and Determination of Efficiency and Regulation.

THREE – PHASE INDUCTION MACHINES

Construction, Rotating Magnetic Field and 3ph Induction Motor, Power Flow Diagram, Torque and Torque-slip Characteristics, Condition for Max. Torque and its Value, Starting and Speed Control, Losses and Efficiency, Equivalent Circuit and Circle Diagram of Induction Motor, No – Load and Rotor – Blocked Tests and Efficiency and Torque – Speed Characteristics.

THREE – PHASE SYNCHRONOUS MACHINES

Generation of EMF, Constructional Details, Induced EMF, Synchronous Generator on No –Load and Load, Synchronous Impedance and Voltage Regulation. V – Curves and Inverted V – Curves, Synchronous Condenser, Starting of Synchronous Motors, Applications of Synchronous Machines.

SINGLE – PHASE MOTORS

Double Revolving Field Theory, Methods of Starting Single Phase Induction Motors, Universal Motor, Stepper Motor.

Text Books:

1. Electrical Machines, S. K. Bhattacharya, TMH Publications N. Delhi.
2. A First Course In Electrical Engineering, S. M. Tiwari, A. S. Binsaroor, Wheeler Publication.

EC-2104 : Signals & Systems

Course Objectives:

- To explain signals and systems representations/classifications and also describe the time and frequency domain analysis of continuous time signals with Fourier series.
- Fourier transforms and Laplace transforms.

- To understand Sampling theorem, with time and frequency domain analysis of discrete time signals with DTFS, DTFT and Z-Transform.
- To present the concepts of convolution and correlation integrals and also understand the properties in the context of signals/systems and lay down the foundation for advanced courses.

Course Outcomes:

- Analyze the discrete time signals and system using different transform domain techniques.
- Design and implement LTI filters for filtering different real world signals.
- Develop different signal processing applications using DSP processor.

SYLLABUS

Introduction to signals and linear time Invariant systems : Continuous – Time and Discrete –Time signals, Signal Energy and Power, Periodic Signals, Even and odd Signals, continuous- Time complex Exponential and Sinusoidal Signals, Discrete –Time complex Exponential and Sinusoidal Signals, Periodicity Properties of Discrete –Time Complex Exponentials, The Unit Impulse and Unit step Functions, The Discrete- Time Unit Step and Unit Impulse Functions, The Continuous-Time Unit impulse and Unit step Sequence, Continuous –Time and Discrete –Time Systems, Interconnections of Systems, Basic System Properties, Discrete –Time LTI Systems: The Convolution Sum, The Representation of Continuous –Time Signals in terms of Impulses, The Commutative property, Casual LTI Systems Described by Differential and Difference Equations, Singularity Functions.

Fourier Series Representation of Periodic Signals : Introduction, Fourier Series Representation of continuous time Periodic Signals, convergence of the Fourier Series, Properties of continuous time Fourier Series, Fourier Series representation of discrete time periodic signals, Properties of discrete time Fourier Series.

Continuous and Discrete time Fourier Transform : Introduction, Representation of Aperiodic signals, The continuous time Fourier Transform, The Fourier Transform for periodic signals, Properties of the continuous time Fourier Transform, The convolution Property, Multiplication property, Systems characterized by linear constant-coefficient differential equations. Discrete time Fourier Transform, Representation of Aperiodic signals discrete time Fourier Transform, Fourier Transform for periodic signals, Properties of the Discrete time Fourier Transform, The convolution property, The multiplication property, Duality, Systems characterized by linear constant co-efficient differential equations.

Convolution and correlation of signals : System analysis by Convolution, Convolution as a superposition of impulse response, some

Convolution relationships, Graphical interpretation of Convolution, Convolution of a function with a unit impulse, Signal comparison, Correlation and Convolution, Some properties of correlation functions, Correlation functions for nonfinite energy signals, Detection of periodic signals in the presence of Noise by correlation, Determination of the waveform of a periodic signal masked by Noise, Extraction of a signal from Noise by filtering.

Laplace Transform : Introduction, The Laplace Transform, the region of convergence for Laplace Transforms, The Inverse Laplace Transform, Geometrical evaluation of the Fourier transform from the Pole-Zero plot, Properties of Laplace Transforms, The initial and Final value theorems, Analysis and characterization of LTI systems using the Laplace Transforms.

Sampling Theorem and Z-transform : Introduction, reconstruction of a signal from its samples using interpolation, The effect of Undersampling: aliasing, Discrete time processing of continuous time signals, sampling of Discrete time signals. The ZTransform, The Inverse Z-Transform, Geometrical evaluation of the Z-Transform from the Pole-Zero plot, Properties of Z-Transform, The initial theorems, some common Z-transform pairs, Analysis and characterization of LTI systems using the Z-Transforms, System function algebra and block diagram representation, The unilateral Z-Transform.

Textbooks:

1. Signals and Systems, Alan V. Oppenheim, Alan S. Willsky and Ian T. Young, PHI, 2ndEdn.
2. Signals Systems and Communication, B. P. Lathi, BS Publication
3. Signals and Systems, K. Raja Rajeswari and B. V. Rao, Prentice Hall of India.

References:

1. Signals and Systems- Simon Haykin and Van Veen, Wiley 2ndEdn.
2. Signals and Systems – P.RameshBabu and R.AnandaNatarajan 3rdEdn.

EC-2105 : Managerial Economics

Course Objectives:

- To integrate the concept of price and output decisions of firms under various market structure.
- The objective of this course is to impart the knowledge of economics as a subject and its importance while business.
- The business decisions are made scientifically on the basis of all available information.
- To familiarize the students with the basic concept of microeconomics.

- To understand the demand and supply analysis in business applications
- To familiarize with the production and cost structure under different stages of production.
- To understand the pricing and output decisions under various market structure.
- To understand and apply the various decision tools to understand the market structure.

Course Outcomes:

- To understand the concepts of cost, nature of production and its relationship to Business operations.
- To apply marginal analysis to the “firm” under different market conditions.
- To analyze the causes and consequences of different market conditions.
- To integrate the concept of price and output decisions of firms under various market structure.

SYLLABUS

Significance of Economics and Managerial Economics: Economics: Definitions of Economics- Wealth, Welfare and Scarcity definition Classification of Economics- Micro and Macro Economics.

Managerial Economics: Definition, Nature and Scope of Managerial Economics, Differences between Economics and Managerial Economics, Main areas of Managerial Economics, Managerial Economics with other disciplines.

Demand Analysis : Demand - Definition, Meaning, Nature and types of demand, Demand function, Law of demand - Assumptions and limitations. Exceptional demand curve. (Two periods)

Elasticity of demand - Definition, Measurement of elasticity, Types of Elasticity (Price, Income, Cross and Advertisement), Practical importance of Price elasticity of demand, Role of income elasticity in business decisions, Factors governing Price Elasticity of demand.

Demand Forecasting - Need for Demand forecasting, Factors governing demand forecasting, Methods of demand forecasting: Survey methods- Experts' opinion survey method and consumers Survey methods.

Utility Analysis: Utility- Meaning, Types of Economic Utilities, Cardinal and Ordinal Utility, Total Utility, Marginal Utility, The law of Diminishing Marginal Utility and its Limitations.

Theory of Production and Cost analysis:

Production - Meaning, Production function and its assumptions, use of production function in decision making; Law of Variable Proportions: three stages of the law.

Cost analysis - Nature of cost, Classification of costs - Fixed vs. Variable costs, Marginal cost, Controllable vs. Non - Controllable costs, Opportunity cost, Incremental vs. Sunk costs, Explicit vs. Implicit costs, Replacement costs, Historical costs, Urgent vs. Postponable costs, Escapable vs. unavoidable costs, Economies and Diseconomies of scale.

Market Structures : Definition of Market, Classification of markets; Salient features or conditions of different markets - Perfect Competition, Monopoly, Duopoly , Oligopoly, Importance of kinked demand curve ; Monopolistic Competition.

Pricing Analysis : Pricing - Significance: Different Pricing methods- Cost plus pricing, Target pricing, Marginal cost pricing, Going -rate pricing, Average cost pricing, Peak load pricing , Pricing of joint Products, Pricing over the life cycle of a Product, Skimming pricing Penetration pricing, Mark-up and Mark- down pricing of retailers.

Business cycles, Inflation and Deflation: Business cycles - Definition , Characteristics , Phases, Causes and Consequences; Measures to solve problems arising from Business cycles.

Inflation -Meaning, Types, Demand- pull and Cost push inflation, Effects of Inflation, Anti- inflationary measures.

Deflation- Meaning, Effects of Deflation, Control of Deflation, Choice between Inflation and Deflation.

Text Books:

1. Sankaran, S., Managerial Economics, Marghan Publications, 2015, Chennai.
2. Aryasri, A.R., Managerial Economics and Financial Analysis, MC Graw Hill Education, New Delhi, 2015.

Reference Books:

1. Dwivedi, D.N., Managerial Economics, Vikhas Publishing House Pvt. Ltd. 6th Edition, New Delhi, 2004.
2. Dewett, K.K., Modern Economic Theory, S.Chand & Company Ltd., New Delhi, 2005.

EC-2106 : Networks and Machine Lab

Course Objectives:

- To verify Superposition Theorem
- To verify Reciprocity Theorem
- To verify Thevenin's Theorem
- To verify Ohm's law

- To verify Kirchhoff's law
- To verify no load and blocked rotor tests on 3-phase squirrel cage Induction motor
- To verify Open circuit test and short circuit test on 1-phase transformer

Course Outcomes:

- Understand the concepts of various theorems and open circuit and no load tests practically.

SYLLABUS

LIST OF EXPERIMENTS

I. NETWORK LAB EXPERIMENTS

1. Verification of Superposition Theorem
2. Verification of Reciprocity Theorem
3. Verification of Thevenin's Theorem
4. Calibration of UPF Wattmeter
5. Verification of Ohm's law
6. Verification of Kirchhoff's law

II. ELECTRICAL MACHINES LAB EXPERIMENTS

7. No load and blocked rotor tests on 3-phase squirrel cage Induction motor
8. Regulation of alternator by synchronous Impedance method
9. Open circuit test and short circuit test on 1-phase transformer
10. Swin burner's test
11. No load and load characteristics of self-excited Shunt generator

EC-2107 : Analog Electronics and Circuits Lab with Simulation

Course Objectives:

- To study various feedback Amplifiers, oscillators practically
- To study various feedback Amplifiers, oscillators through software simulations.

Course Outcomes:

- To understand the concepts of various feedback Amplifier, oscillators practically
- To understand the concepts of various feedback Amplifier, oscillators through software simulations.

SYLLABUS

LIST OF EXPERIMENTS

1. Current series feedback Amplifier
2. Colpitts oscillator
3. RC-Phase shift oscillator
4. Two stage RC-Coupled Amplifier
5. Wein bridge oscillator
6. Hartley Oscillator
7. Class-B Push pull Amplifier
8. Voltage series feedback Amplifier
9. Common source FET Amplifier
10. Tuned Voltage Amplifier
11. Applications of Operational Amplifier
12. Frequency response of Op-amp

(Software Simulation)

13. Common emitter and common source Amplifier
14. Two stage RC coupled Amplifier
15. RC Phase shift oscillator using transistors
16. Class-A Power Amplifier (transformer less)
17. Class-B complementary symmetry Amplifier
18. High frequency common base (BJT) and common gate (JFET) Amplifier

EC-2108 : Digital ICs and HDL Lab

Course Objectives:

- To study logic gates, realization of Gates by using universal building blocks practically.
- To study flip-flops, registers and counters practically.
- To study logic gates, realization of Gates by using universal building blocks through software simulations.

Course Outcomes:

- To understand the concepts of logic gates, realization of Gates by using universal building blocks practically.
- To understand the concepts of flip-flops, registers and counters practically.
- To understand the concepts of logic gates, realization of Gates by using universal building blocks through software simulations.

SYLLABUS

LIST OF EXPERIMENTS

HARDWARE EXPERIMENTS

1. Logic Gates

2. Realization of Gates by using universal building blocks
3. Realization of SOP and POS
4. Verification of Demorgan's Laws
5. Half Adder & Full adder
6. Function generation by using Decoders & Multiplexers.
7. Realization of Flip - flops
8. 4-bit Ripple counter
9. Mod-8 Synchronous counter.
10. 4 - bit Shift-register
11. Seven segment display

SIMULATION EXPERIMENTS

1. Simulation of Logic gates
2. Simulation of Full adder
3. Simulation of Multiplexer & De-Multiplexer
4. Simulation of Decoder & Encoder
5. Simulation of Flip flops (SR & D)
6. Simulation of Up-down counter & Shift register

EC-2109 : SKILL ORIENTED COURSE

MATLAB PROGRAMMING

Course Objectives:

1. To Impart the Knowledge to the students with MATLAB software. [This enhances programming knowledge in Research and Development].
2. To provide a working introduction to the Matlab technical computing environment. [Themes of data analysis, visualization, and programming].
3. To introduce students the use of a high-level programming language, Matlab. [scientific problem solving with applications and examples from Engineering].

Course outcomes:

- By the end of this course, the student will be able to
1. Understand the basics of Matlab
 2. Break a complex task up into smaller, simpler tasks
 3. Tabulate results and Analyse.

Chapter 1 : Introduction to MATLAB : The MATLAB desktop, the command window, the command history window, the MATLAB workspace, getting help, special symbols

Chapter 2 : MATLAB Basics : Matrices and Vectors: Input, Indexing (or subscripting), Matrix manipulation, Creating vectors. Matrix and Array

Operations: Arithmetic operations, Relational operations, Logical operations, Elementary math functions, Matrix functions, A Special Note on Array Operations.

Chapter 3 Introduction to plotting : Using simple x, y plots, printing a plot, exporting a plot as a graphical image, multiple plots, line color, line style, marker style, grid and legend.

Chapter 4 : Script files and functions. Command- Line Functions: Inline functions, Anonymous functions, Finding the determinant of a matrix, finding eigenvalues and eigenvectors, solving a linear system, roots of a polynomial, matrix factorizations, Generation of Various Signals and Sequences (Periodic and Aperiodic), such as Unit impulse, unit step, square, saw tooth, triangular, sinusoidal, ramp, sinc, exponential. generation of random numbers.

Text Books.

1. A Guide to MATLAB for beginners and Experienced users by Brian R.Hunt, Ronald R Lipsman.

2. Getting Started with MATLAB: A Quick Introduction for Scientists & Engineers by Rudra pratap.

Exercise :

1. Suppose that $x=3$ and $y=4$ Use MATLAB to evaluate the following expression:

2. Answer the following questions for the array shown here.

(a) What is the size of array1?

(b) What is the value of array1(1,4)?

(c) What is the size and value of array1(:,1:2:5)?

(d) What is the size and value of array1([1 3], end)?

3. Assume that array array1 is defined as shown, and determine the contents of the following subarrays

(a) array1(3, :) (b) array1(:,3) (c) array1(1:2:3,[3 3 4]) (d) array1([1 1],:)

4. The voltage across a resistor is related to the current flowing through it by Ohm's law $V=IR$ and the power consumed in the resistor is given by the equation $P=I^2R$. Write a program that creates a plot of the power consumed by a 1000 Ω resistor as the voltage across it is varied from 1 V to 200 V. Create two plots, one showing power in watts, and one showing power in dBW (dB power levels with respect to a 1 W reference).

5. The equation of a straight line is $y = mx + c$, where m and c are constants. Compute the y-coordinates of a line with slope $m = 0.5$ and the intercept $c = -2$ at the following x-coordinates: $x = 0, 1.5, 3, 4, 5, 7, 9$, and 10.

6. Create a vector t with 10 elements: 1, 2, 3, ..., 10.

Now compute the following quantities:

7. Plot $y = \sin x$, $0 \leq x \leq 2\pi$, taking 100 linearly spaced points in the given interval. Label the axes and put "plot created by your name" in the title
8. Assume that the complex function $f(t)$ is defined by the equation
Plot the amplitude and phase of function f for $0 \leq t \leq 4$
9. Write an M-file to evaluate the equation for all values of x between -1 and 3, in steps of 0.1. Do this twice, once with a for loop and one with vectors. Plot the resulting function using a 3-point thick dashed red line.
10. Create a mesh, surface plot and contour plot of the function for the interval $-1 \leq x \leq 1$ and $-2 \leq y \leq 2$. In each case, plot the real part of z versus x and y .
11. Create an upper triangular matrix with the following
 $A = \text{diag}(1:6) + \text{diag}(7:11, 1) + \text{diag}(12:15, 2)$.
Now use the upper off-diagonal terms of A to make A a symmetric matrix with the following command: $A = A + \text{triu}(A, 1)'$.
12. Create a 10 by 10 random matrix with the command $A = \text{rand}(10)$. Do the following operations.

EC-2110 : MANDATORY COURSE

Professional Ethics and Universal Human Values

(Effective from 2020-2021 Admitted Batches)

(Common for all Branches)

Course Objectives:

The objective of the course is Six fold:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- This course will illuminate the students in the concepts of laws and its applicability to engineers
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection, Development of commitment and courage to act and also enable the students to imbibe and internalize the Values and Ethical Behaviour in the personal and professional lives
- To enable the students to imbibe the Values and Ethical Behavior in the personal and Professional lives
- The students will learn the rights and responsibilities Individual, employee, team member and a global citizen

Course Outcomes:

By the end of the course Student will be able to:

- Grasp the meaning of the concept – Law and also Get an overview of the laws relating to Engineers and also Apprehend the importance of being a law abiding person and They would have better critical ability

- Self-explore by using different techniques to live in harmony at various levels
- Analyze themselves and understand their position with respect to the moral and ethical character needed for a successful and satisfactory work life
- Students are expected to become more aware of themselves and their surroundings (family, society, nature)
- They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
- They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society)

SYLLABUS

Need, Basic Guidelines, Content and Process for Value Education ,Self-Exploration—what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation - as the process for self-exploration, Continuous Happiness and Prosperity - A look at basic Human Aspirations, Right understanding, Relationship and Physical Facility - the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels. Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking, Include practice sessions and case studies.

Understanding Harmony in the Human Being - Harmony in Myself!

· Understanding human being as: a co-existence of the sentient 'I' and the material 'Body', the needs of Self ('I') and 'Body' - happiness and physical facility, the Body as an instrument of 'I' (I being the doer, seer and enjoyer), the characteristics and activities of 'I' and harmony in 'I', the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail, P to ensure Sanyam and Health, Include practice sessions and case studies. Understanding Harmony in the Family and Society - Harmony in Human – Human Relationship

· Understanding values in human-human relationship: meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship, the meaning of Trust; Difference between intention and competence, the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship, the harmony in the society (society being an extension of family), Resolution, Prosperity,

fearlessness (trust) and co-existence as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society, Universal Order from family to world family, Include practice sessions and case studies. Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

- Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature recyclability and self-regulation in nature, Understanding Existence as Co-existence of mutually interacting units in all – pervasive space, Holistic perception of harmony at all levels of existence, Include practice sessions and case studies. Concept of Law and Law of Torts

- Understanding Essentials of a Valid Contract and the basics of contract law protecting rights and obligations, Introduction to the Law of Torts and the basics to protect oneself and the company Law affecting the Workplace Employers Responsibilities/Duties Hiring Practices, Introduction to Intellectual Property Law, Professional Code of Conduct for Engineers, Relationship between Law and Ethics, Include practice sessions and case studies. Implications of the above Holistic Understanding of Harmony on Professional Ethics

- Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations, Include practice sessions and case studies.

Text Books

1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. R R Gaur, R Asthana, G P Bagaria, "Teachers' Manual for A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2
3. R. Subramanian, "Professional Ethics", Oxford University Press.

4. S.B. Srivastha, "Professional Ethics & Human Values", SciTech Publications (India) Pvt. Ltd. New Delhi.

5. D.R. Kiran, "Professional Ethics & Human Values", TATA Mc Graw Hill Education.

6. Saroj Kumar, "Business Law" and Avtar Singh, "Law of Contract"

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
2. A. N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book), Mohandas Karamchand Gandhi "The Story of My Experiments with Truth", E. F. Schumacher. "Small is Beautiful", Slow is Beautiful – Cecile Andrews, J C Kumarappa "Economy of Permanence", Pandit Sunderlal "Bharat Mein Angreji Raj" and Dharampal, "Rediscovering India
4. G K Kapoor, "Business Law" and Sen & Mitra, "Business & Commercial Laws" and Calvin Frank Allen, "Business law for Engineers"
5. Hilgard, E. R.; Atkinson, R. C. & Atkinson, R.L. (1975). *Introduction to Psychology*. 6th Edition. New Delhi: Oxford and IBH Publishing Co. Pvt. Ltd.
6. Govindarajan, M; Natarajan, G. M. & Senthilkumar, V.S. (2013). *Professional Ethics & Human Values*. Prentice Hall: New Delhi
7. Gogate, S. B. (2011). *Human Values & Professional Ethics*. Vikas Publishing: New Delhi.
8. Charles E Harris Jr., Michael S Pritchard, Michael J Rabins, "Engineering Ethics, Concepts Cases: 4e, Cengage learning, 2015.
9. Caroline Whitbec, " Ethics in Engineering Practice & Research: 2e, Cambridge University Press 2015.

EC-2201 : MATHEMATICS-IV

III/IV B.Tech. (Four Year Degree Course) & II/VI B.Tech.(Six Year Double Degree Course)

Semester-II : Mathematics – IV

(With effect from the admitted batch of 2020-2021)

Subject Code: External Examination - Max. Marks: 70
No. of Credits: 3 Internal Examination - Max. Marks: 30
No. of Periods/ Week: 3 Total Marks: 100

Objectives: The student should be able to use the concepts of difference equations, -transforms, Numerical differentiation and Sampling theory. The student should know the applications of the difference equations in the deflection of a loaded string. The student should be able to estimate

unknown parameters of population and apply the tests of hypothesis. They should be able to evaluate -transform, inverse -transforms and apply these transforms to solve difference equations. The student should be able to know the techniques in the evaluation of numerical solution of ordinary differential equations.

UNIT-I : (Functions of Complex Variables) : Introduction-Limit and continuity of $f(z)$ - Derivative of $f(z)$, Cauchy-Reimann Equations, Analytic Functions, Harmonic functions, Orthogonal systems, Applications to flow problems, Geometrical representation of $f(z)$. Integration of complex functions, Cauchy's theorem, Cauchy's integral formula and their applications.

Unit-II : (Conformal Mappings and Contour Integration) : Introduction to Conformal transformation, Bilinear transformation, Series of complex terms -Taylor's and Laurent's series (without proofs), Zero's and Singularities of analytic functions. Residues and Calculations of residues, Cauchy's Residue Theorem, Evaluation of real definite integrals: Integration around unit circle, semi circle.

UNIT-III : (Difference Equations & Z-transforms) : Introduction - Formation of difference equations - Linear difference equations - Rules for finding complementary function - Rules for finding particular integral - simultaneous difference equations with constant coefficients - Applications to deflection of a loaded string. Introduction to Z-Transforms - Some standard Z-transforms - Linear Property - Damping Rule - Shifting U_n to the right and to the left-multiplication by z -Two basic theorems - Some useful Z-transforms - Inverse Z-transformation - Convolution theorem - Convergence of Z-transform - Two sided Z-transform - Evaluation of inverse Z-transform - Application to Difference equations.

UNIT-IV : (Correlation, Regression and Distributions) : Introduction - correlation - coefficient of correlation -Lines of regression. Introduction to Discrete and Continuous Random Variables - Distributions: binomial distribution, Poisson distribution, exponential distribution, normal distribution.

UNIT-V : (Sampling Theory) : Introduction - Testing of hypothesis - Level of significance - Confidence limits - Test of significance of large samples - comparison of large samples- Test of significance for means of two large samples. Student t-distribution - Significance test of sample mean - Significance test of difference between sample means - Chisquare test - Goodness of fit - F-distribution.

TEXT BOOK:

Scope and treatment as in "Higher Engineering Mathematics", by Dr.B.S.Grewal, 43rd Edition, Khanna Publications.

REFERENCE BOOKS:

1. Graduate Engineering Mathematics by V B Kumar Vatti, I.K.International publications
2. Advanced Engineering Mathematics by Erwin Kreyszig.
3. A text book of Engineering Mathematics by N.P. Bali and Dr.Manish Goyal; Lakshmi publications.
4. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.
5. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.
6. Engineering Mathematics series by Chandrica Prasad.

EC-2202 : Electromagnetic Field Theory and Transmission Lines

Course Objectives:

- Define the Basic Electrostatic and Magneto static Law Derive the Maxwell's Equation and apply to the basic electromagnetic problem.
- Analyze the boundary conditions, at the interface of two different media and also time varying electric and magnetic fields.
- Explain the wave propagation in different types of mediums and also transmission line fundamentals.
- Demonstrate the smith chart-configuration

Course Outcomes:

- To evaluate the design and problem solving skills
- Able to define electrostatic and magneto static laws
- Able to derive the Maxwell's equations in static and dynamic fields
- Able to describe energy density on electric/magnetic fields' and poynting theorem.
- Able to analyze the EM wave propagation in different mediums
- Able to relate the wave propagation through transmission lines and compute the impedance using smith chart for matching the load impedance.

SYLLABUS

Electrostatics : Coulomb's Law, Electric Field Intensity – Fields due to Different Charge Distributions, Electric Flux Density, Gauss Law and Applications, Electric Potential, Maxwell's Two Equations for Electrostatic Fields, Energy ensity, Convection and Conduction Currents, Continuity Equation, Relaxation Time, Poisson's and Laplace's Equations; Capacitance.

Magneto statics : Biot-Savart Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Maxwell's Two Equations for Magneto static Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Inductances and Magnetic Energy.

Maxwell's Equations : Faraday's Law and Transformer emf, Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's Equations in Different Final Forms and Word Statements. Conditions at a Boundary Surface: Dielectric-Dielectric and Dielectric-Conductor Interfaces. Related Problems.

Electromagnetic Waves : Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves, Wave Propagation in Lossless and Conducting Media, Conductors & Dielectrics – Characterization, Polarization, Reflection and Refraction of Plane Waves – Normal and Oblique Incidences for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection, Surface Impedance. Poynting Vector and Poynting Theorem

Transmission Lines : Introduction to Transmission line equations, Primary & Secondary constants Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Losslessness /Low Loss Characterization, Distortion , Loading, SC and OC Lines, Reflection Coefficient, VSWR, $\Gamma/8$, $\Gamma/4$, $\Gamma/2$ line impedance Transformations, Smith Chart – Configuration and Applications.

Waveguides : Introduction, Rectangular Waveguides, electric and magnetic field patterns in TE₁₀ and TE₁₁ mode configuration, modes of TE wave in rectangular waveguide, field equations, impossibility of TEM wave propagation in waveguides, cutoff frequency of rectangular waveguide, propagation constant, wave impedance, phase velocity, group velocity, dominant mode and degenerate modes, related problems.

Textbooks

1. Electromagnetic Field Theory and Transmission Lines, Gottapu Sasibhushana Rao, Wiley India Pvt. Ltd. , New Delhi, 1st Ed., 2012.
2. Electromagnetics with Applications, Kraus and Fleisch, McGraw Hill, 1999.
3. Electromagnetic Field Theory and Transmission Lines, G.S.N. Raju, Pearson Education (Pvt., Ltd., New Delhi, 2005.

References:

1. Elements of Electromagnetic – Matthew N.O. Sadiku, Oxford Univ. Press, 3rd ed., 2001.
2. Engineering Electromagnetics, W. H. Hayt Jr., McGraw Hill – New York.
3. EM Waves and Radiating Systems, E. C. Jordan, PHI, 1997.

EC-2203 : Microprocessors and Microcontrollers

Course Objectives:

- To introduce the architecture and operation of typical microprocessors and microcontrollers.

- To familiarize with the programming and interfacing of microprocessors and microcontrollers.

- To provide strong foundation for designing real world applications using microprocessors and microcontrollers.

Course Outcomes:

- Assess and solve basic binary math operations using the microprocessor and explain the microprocessor's and Microcontroller's internal architecture and its operation within the area of manufacturing and performance.
- Apply knowledge and demonstrate programming proficiency using various addressing modes and data transfer instructions of the target microprocessor and microcontroller.
- Design electrical circuitry to the Microprocessor I/O ports in order to interface the processor to external devices.
- Evaluate assembly language programs and download the machine code that will provide solutions real world control problems.

SYLLABUS

8086/8088 MICROPROCESSORS Register organization of 8086, Architecture, signal description of 8086, physical memory organization, general bus operation, I/O addressing capability, special purpose activities, Minimum mode, maximum mode of 8086 system and timings, the processor 8088, machine language instruction formats, addressing mode of 8086, instruction set of 8086, assembler directives and operators.

PROGRAMMING WITH 8086 MICROPROCESSOR Machine level programs, programming with an assembler, Assembly language programs, introduction to stack, stack structure of 8086/8088, interrupts and interrupt service routines, interrupt cycle of 8086, non-mask able interrupt and mask able interrupts, interrupt programming.

BASIC AND SPECIAL PURPOSE PROGRAMMABLE PERIPHERALS AND THEIR INTERFACING WITH 8086/88

Semiconductor memory interfacing, dynamic RAM interfacing, interfacing i/o ports, PIO 8255 modes of operation of 8255, interfacing to D/A and A/D converters, stepper motor interfacing, control of high power devices using 8255. Programmable interrupt controller 8259A, the keyboard /display controller 8279, programmable communication interface 8251 USART, DMA Controller 8257.

ADVANCED MICRO PROCESSORS : Salient features of 80386DX, architecture and signal description of 80386, register organization of 80386 and addressing modes, data types of 80386, real address mode of 80386, protected mode of 80386, segmentation and Paging, virtual 8086 mode and enhanced mode. Instruction set of 80386. The coprocessor 80387.

8051 MICROCONTROLLER : Introduction to microcontrollers, 8051Microcontrollers, 8051pin description, connections, I/O ports and memory organization, MCS51addressing modes and instructions, assembly language programming tools.

PIC MICROCONTROLLERS AND ARM 32-BIT MICROCONTROLLER : Overview and features, PIC16Cx/7X instructions, interrupts in PIC 16C61/71, PIC 16F8XX Flash controllers, I/O ports and timers. Introduction to 16/32 Bit processors, ARM architecture and organization, ARM / Thumb programming model, ARM / Thumb instruction set.

TEXT BOOKS:

1. A.K.Ray, K.M.Bhurchandi , "Advanced Microprocessors and Peripherals", Tata McGraw Hill Publications, 2000.
2. N.Sentil Kumar, M.Saravanan, S.Jeevananthan, "Microprocessors and Microcontrollers", OxfordUniversity Press, 2010.

REFERENCES:

1. Ajay V Deshmukh, "Microcontrollers", TATA McGraw Hill publications, 2012.
2. Krishna Kant, "Microprocessors and Microcontrollers", PHI Publications, 2010.

EC- 2204 : Probability theory and Random Process

Course Objectives:

- Understand concepts of probability, conditional probability and independence.
- Understand random variables and probability distributions.
- Be familiar with some of the commonly encountered random variables, in particular the Gaussian random variable.
- Be able to obtain the distributions of functions of random variables.
- Be able to relate probability theory to real statistical analysis.
- Understand moment generating and characteristic functions.

Course Outcomes:

- To the axiomatic formulation of modern Probability Theory and think of random variables as an intrinsic need for the analysis of random phenomena.
- To obtain the concept of random processes and determine covariance and spectral density of stationary random processes.

SYLLABUS

Probability Theory : Sample spaces, Events, Probability definition and Axioms, Mathematical model of experiments, Probability as relative frequency, Joint and conditional probability, Properties of joint probability

and conditional probability, Total probability, Bayes' theorem, Independent events: Two events and multiple events, properties of independent events.

Random Variables and Operations on one random variable : Random variable concept, Distribution function, Density function, Gaussian random variable, Conditional distribution and density function, Expectation, Moments, Functions that give moment, Transformations of a random variable.

Multiple random variables : Vector random variables, Joint distribution and its properties, Joint density and its properties, Conditional distribution and density, statistical independence, Distribution and density of a sum of random variables, Central limit theorem.

Operations on multiple random variables : Expected values of a function of random variables: Joint moments about the Origin, joint central moments, Joint characteristic functions, Jointly Gaussian random variables: Two random variables, n-random variables, properties of Gaussian random variables, Transformations of multiple random variables: One function, Multiple functions, Inequalities of Chebyshev and Schwartz.

Random Processes : The Random Process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, concept of Stationarity and Statistical Independence, First-Order Stationary Processes, Second- Order and Wide-Sense Stationarity, (N-Order) and Strict-Sense Stationarity, Time Averages and Ergodicity, Mean-Ergodic Processes, Autocorrelation Function and Its Properties, Cross-Correlation Function and Its Properties, Covariance Function and their properties, Weiner-Kinchine Theorem ,Gaussian Random Processes, Poisson Random Process.

Linear Systems with Random Inputs : System Response – Convolution, Mean and Mean-squared Value of System Response, autocorrelation Function of Response, Cross-Correlation Functions of Input and Output, Power Density Spectrum of Response, Cross-Power Density Spectrums of Input and Output, Band pass, Band-Limited and Narrowband Processes.

Textbook:

1. Probability Theory and Random Signal Principles, Peyton Z. Peebles,Jr, 4th edition Tata McGraw Hill Publishers,2002.
2. Probability Theory and Random Processes, S. P. Eugene Xavier, S. Chand and Co. New Delhi, 1998 (2nd Edition).

References:

1. Fundamentals of Applied Probability and Radom processes, Oliver C.Ibe, Elsevier Publications, 2007.
2. Probability, Random Variables and Stochastic Processes – Athanasios Papoulis and S. Unnikrishna Pillai, PHI, 4th Edition, 2002.

3. Probability theory and Stochastic Processes, B.PrabhakaraRao, T.S.R.Murthy, BS Publications, Hyderabad, 2012.

EC 2205 : Analog Communication

Course Objectives:

- To introduce the concepts of analog communication systems.
- To equip students with various issues related to analog communication such as modulation, demodulation, transmitters and receivers and noise performance.

Course Outcomes:

- Gain the knowledge of components of analogue communication system.
- To analyze various methods of baseband/band pass Analog transmission and detection.
- Analyze and allocate performance objectives to components of an analog communication system and to design analogue communication systems.
- To evaluate the performance of analog communications in the presence of noise

SYLLABUS

Linear Modulation Systems: Need for Modulation, Frequency Translation, Method of Frequency Translation, Amplitude Modulation, Modulation Index, Spectrum of AM Signal, Modulators and Demodulators (Diode detector), DSB-SC Signal and its Spectrum, Balanced Modulator, Synchronous Detectors, SSB Signal, SSB Generation Methods, Power Calculations in AM Systems, Application of AM Systems.

Angle Modulation Systems: Angle Modulation, Phase and Frequency Modulation and their Relationship, Phase and Frequency Deviation, Spectrum of an FM Signal, Bandwidth of Sinusoidally Modulated FM Signal, Effect of the Modulation Index on Bandwidth, Spectrum of Constant Bandwidth FM, Phasor Diagram for FM Signals, FM Generation:Parameter variation method, Indirect method of Frequency Modulation (Armstrong Method), Frequency Multiplication, PLL FM Demodulator, Pre – emphasis and De –emphasis, Comparison of FM and AM.

Noise in AM and FM Systems: Sources of Noise, Resistor Noise, Shot Noise, Calculation of Noise in a Linear System, Frequency Domain representation of Noise, The effect of Filtering on the Probability density of Gaussian Noise, Effect of filter on the power spectral Density of Noise, Narrow Bandwidth, Quadrature components of Noise, Power spectral density of Noise, Probability Density of Noise and their time derivatives, representation of Noise using Orthonormal coordinates, Noise in AM Systems, Noise in Angle Modulation Systems, Comparison between AM and

FM with respect to Noise, Threshold Improvement in Discriminators, Comparisons between AM and FM.

Radio Transmitters:Classification of Radio Transmitters, Principle of a Radio Transmitters, AM and FM Transmitters, Radio Telegraph and Radio Telephone Transmitters, SSB Transmitters.

Radio Receivers:Radio receiver Types, AM Receivers – RF Section, Frequency Changing and Tracking, Intermediate Frequency and IF Amplifiers, Automatic Gain Control (AGC); FM Receivers – Amplitude Limiting, FM Demodulators, Ratio Detectors, ISB Receiver, Comparison with AM Receivers, Extensions of the Super-heterodyne Principles, Additional Circuits.

Pulse Analog Modulation methods:Pulse Modulation techniques, Sampling, Types of Sampling and its analysis, Time division Multiplexing, Pulse Amplitude Modulation, Pulse Width Modulation, Pulse position modulation, Pulse Code Modulation.

Text Books:

1. Principles of Communication Systems, H. Taub , D. L. Schilling and GouthamSahe, TMH 3rd edition, 2007.
2. Principle of Communication Systems, Simon Haykins (2nd Edition).
3. Electronic Communication Systems, G. Kennedy, McGraw Hill, 1977 (2nd Edition).

References:

1. Modern Digital and Analog Communication Systems, B. P. Lathi (2nd Edition).
2. Communication systems, R.P.Singh and S.D.Sapre 2nd edition TMH 2008
3. Electronic Communications Modulation and Transmission, Robert J. Schoenbeck, PHI N. Delhi, 1999.

EC- 2206 : Microprocessors and Microcontrollers Lab

Course Objectives:

- To study programming of 8086 ESA-86/88 kit for various operations like addition subtraction, multiplication etc
- To study 8086 programming using MASM 32 assembler.
- To study 8051 programming using KEIL software simulator

Course Outcomes:

- To understand the concepts of programming of 8086 ESA-86/88 kit for various operations like addition subtraction, multiplication etc
- To understand the concepts of programming of 8086 using MASM 32 assembler

- To understand the concepts of programming of 8051 using KEIL software simulator

SYLLABUS

LIST OF PROGRAMS 8086 ESA-86/88 KIT PROGRAMMING

1. Write a Program to add two 16 bit numbers stored in two memory locations 2000h and 2002h and store the result in another memory location 2004h.
 2. Write a Program to divide two 16 bit numbers stored in two memory locations 2000h and 2002h and store the result in another memory location 2004h.
 3. Write a Program to multiply two 16 bit numbers stored in two memory locations 2000h and 2002h and store the result in another memory location 2004h.
 4. Write a Program to add two 32 bit numbers stored in two memory locations 2000h and 2004h and store the result in another memory location 2008h.
 5. Write a program to find factorial of a given number. 8086 PROGRAMMING USING MASM32 ASSEMBLER
 6. Write a program to perform addition operation on two multi byte numbers.
 7. Write a program to perform subtraction operation on two multi byte numbers.
 8. Write a program to sort a given set of hexadecimal numbers.
 9. Write a program to find whether the given string is a palindrome or not.
 10. Write a program for inserting an element at a specified location in a given string.
 11. Write a program to convert BCD numbers into equivalent binary value. Write a subroutine for the conversion.
 12. Write a program to read a keyboard and display the characters on the PC screen using DOS/BIOS commands.
- ### **8051 PROGRAMMING USING KEIL SIMULATOR**
13. Write a program to generate a square wave of 50% duty cycle at pin P2.1 using timer 0 in mode1. Assume XTAL=11.0592MHz.
 14. Write a program to send a message "WELCOME" serially at 9600 baud rate continuously through serial port of 8051. 8086 INTERFACING
 15. Write a program to interface stepper motor.
 16. Write a program to interface keyboard with 8279 display controller

EC- 2207 : Analog Communications Lab

Course Objectives:

- To study various analog modulation and demodulation concepts practically.

Course Outcomes:

- To understand the concepts of analog modulation and demodulation concepts practically

SYLLABUS

LIST OF EXPERIMENTS

1. AM M Modulation and Demodulation
2. Low Pass Filter using passive components
3. High Pass Filter using passive components
4. Active Notch Filter
5. Frequency Modulation and Demodulation
6. Pre-emphasis and De-emphasis
7. T – Type attenuator
8. Band pass filter using passive components
9. Mixer characteristics
10. SSB-SC modulation and demodulation.

EC-2208 : SKILL ORIENTED COURSE/SOFT SKILL COURSE

Python Programming

Course Objectives:

The Objectives of Python Programming are

- To learn about Python programming language syntax, semantics, and the runtime environment
- To be familiarized with universal computer programming concepts like data types, containers
- To be familiarized with general computer programming concepts like conditional execution, loops & functions
- To be familiarized with general coding techniques and object-oriented programming

Course Outcomes:

- Develop essential programming skills in computer programming concepts like data types, containers
- Apply the basics of programming in the Python language
- Solve coding tasks related conditional execution, loops
- Solve coding tasks related to the fundamental notions and techniques used in objectoriented programming

Unit-1 : Introduction: Introduction to Python, Program Development Cycle, Input, Processing, and Output, Displaying Output with the Print Function, Comments, Variables, Reading Input from the Keyboard, Performing Calculations, Operators. Type conversions, Expressions, More about Data Output.

Data Types, and Expression: Strings Assignment, and Comment, Numeric Data Types and Character Sets, Using functions and Modules.

Decision Structures and Boolean Logic: if, if-else, if-elif-else Statements, Nested Decision Structures, Comparing Strings, Logical Operators, Boolean Variables. Repetition Structures: Introduction, while loop, for loop, Calculating a Running Total, Input Validation Loops, Nested Loops.

UNIT-2 : Control Statement: Definite iteration for Loop Formatting Text for output, Selection if and if else Statement Conditional Iteration The While Loop

Strings and Text Files: Accessing Character and Substring in Strings, Data Encryption, Strings and Number Systems, String Methods Text Files.

UNIT-3 : List and Dictionaries: Lists, Defining Simple Functions, Dictionaries Design with Function: Functions as Abstraction Mechanisms, Problem Solving with Top Down Design, Design with Recursive Functions

UNIT-4 : Modules: Modules, Standard Modules, Packages.

UNIT-5 : File Operations: Reading config files in python, Writing log files in python, Understanding read functions, read(), readline() and readlines(), Understanding write functions, write() and writelines(), Manipulating file pointer using seek, Programming using file operations

Text Books:

1) Fundamentals of Python First Programs, Kenneth. A. Lambert, Cengage.

2) Python Programming: A Modern Approach, Vamsi Kurama, Pearson.

Reference Books:

1) Introduction to Python Programming, Gowrishankar.S, Veena A, CRC Press.

2) Introduction to Programming Using Python, Y. Daniel Liang, Pearson.

EC-2209 : MADATARY COURSE ENVIRONMENTAL SCIENCE

(Effective from 2020-2021 Admitted Batches)

(Common for all Branches)

Course Objectives

The objectives of the Environmental Science course are to

- Familiarize the fundamental aspects of environment and the environmental management'

- Provide information of some of the important international conventions which will be useful during the future endeavors after graduation.

- Make realize the importance of natural resources management for the sustenance of the life and the society.

- Apprise the impact of pollution getting generated through the anthropogenic activities on the environment

- Provide the concept of Sustainable Development, energy and environmental management

- Impart knowledge on the new generation waste like e-waste and plastic waste.

Course Outcomes

After completion of the course the students will have

- Knowledge on the fundamental aspects of environment and the environmental management

- The knowledge on the salient features of the important international conventions

- Understanding of the importance of natural resources management for the sustenance of the life and the society.

- Familiarity on various forms of pollution and its impact on the environment.

- Understand the elements of Sustainable Development, energy and environmental management

- Knowledge on the new generation waste like e-waste and plastic waste.

SYLLABUS

Introduction: Structure and functions of Ecosystems-Ecosystems and its Dynamics-Value of Biodiversity-impact of loss of biodiversity, Conservation of bio-diversity. Environmental indicators - Global environmental issues and their impact on the ecosystems. Salient features of International conventions on Environment: Montreal Protocol, Kyoto protocol, Ramsar Convention on Wetlands, Stockholm Convention on Persistent Organic Pollutants, United Nations Framework Convention on Climate Change (UNFCCC), Natural Resources Management: Importance of natural resources management-Land as resource, Land degradation, Soil erosion and desertification, Effects of usage of fertilizer, herbicides and pesticide- watershed management.

Forest resources: Use and over-exploitation, Mining and dams – their effects on forest ecosystems and the living beings.

Water resources: Exploitation of surface and groundwater, Floods, droughts, Dams:benefits and costs.

Mineral Resources: Impact of mining on the environment and possible environmental management options in mining and processing of the minerals. Sustainable resource management (land, water, and energy), and resilient design under the changing environment.

Environmental Pollution: Local and Global Issues. Causes, effects and control measures. Engineering aspects of environmental pollution control systems.

Air pollution: impacts of ambient and indoor air pollution on human health. Water pollution: impacts water pollution on human health and loss of fresh water resources. Soil pollution and its impact on environment. Marine pollution and its impact on blue economy. Noise pollution.

Solid waste management: Important elements in solid waste management- Waste to energy concepts. Air (prevention and control of pollution) Act, Water (prevention and control of pollution) Act and their amendments. Salient features of Environmental protection Act, 1986.

Sustainable Development: Fundamentals of Sustainable Development– Sustainability Strategies and Barriers – Industrialization and sustainable development. Circular economy concepts in waste (solid and fluid) management.

Energy and Environment: Environmental Benefits and challenges, Availability and need of conventional energy resources, major environmental problems related to the conventional energy resources, future possibilities of energy need and availability. Solar Energy: process of photovoltaic energy conversion, solar energy conversion technologies and devices, their principles, working and applications, disposal of solar panel after their usage. Biomass energy: Concept of biomass energy utilization, types of biomass energy, conversion processes, Wind Energy, energy conversion technologies, their principles, equipment and suitability in context of India.

Management of plastic waste and E-waste: Sources, generation and characteristics of various e- and plastic wastes generated from various industrial and commercial activities; Waste management practices including onsite handling, storage, collection and transfer. E-waste and plastic waste processing alternatives. E-Waste management rules and Plastic waste management rules, 2016 and their subsequent amendments.

Text Books:

1. Bharucha, Erach (2004). Textbook for Environmental Studies for Undergraduate Courses of all Branches of Higher Education, University Grants Commission, New Delhi.

2. Basu, M., Xavier, S. (2016). Fundamentals of Environmental Studies, Cambridge University Press, India

3. Masters, G. M., & Ela, W. P. (1991). Introduction to environmental engineering and science. Englewood Cliffs, NJ: Prentice Hall.

4. Enger, E. and Smith, B., Environmental Science: A Study of Interrelationships, Publisher: McGraw-Hill Higher Education; 12th edition, 2010.

Reference Books:

1. Sharma, P. D., & Sharma, P. D. (2005). Ecology and environment. Rastogi Publications

2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.

3. Clark R.S. (2001). Marine Pollution, Clanderson Press Oxford (TB)

4. Jadhav, H & Bhosale, V.M. (1995). Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.

5. MoEF&CC, Govt. of India, CPCB: E-waste management rules, 2016 and its amendments 2018.

6. MoEF&CC, Govt. of India, CPCB: Plastic waste management rules, 2016.

MECHANICAL ENGINEERING SCHEME AND SYLLABI FOR B.TECH MECHANICAL ENGINEERING

(2019-2020 Academic Year: AICTE)

B.TECH III -YEAR I – SEMESTER

Code No	Course	Credits	Lecture	Lab	Total	Contact	Sessional	Exam	Total
Marks	Marks			Hrs	Hrs	Hrs	Hrs/Week	Marks	
MEC 3101	Dynamics of Machinery	3	4	-	4	30	70	100	
MEC 3102	Applied Thermodynamics-I/3	4	4	-	4	30	70	100	
MEC3103	Fluid Mechanics & Machinery	3	4	-	4	30	70	100	
MEC 3104	Operations Research	3	4	-	4	30	70	100	
MEC3105	Industrial Engineering & Management	3	4	-	4	30	70	100	
MEC3106	Elective-1	3	4	-	4	30	70	100	
MEC3107	Manufacturing Technology Lab-I	1.5	-	3	3	50	50	100	
MEC 3108	Dynamics of Machinery Lab	1.5	-	3	3	50	50	100	
MEC 3109	FMM LAB	1.5	-	3	3	50	50	100	
TOTAL		22.5	24	9	33	330	570	900	

B.TECH III -YEAR II – SEMESTER

Code No	Course	Credits	Lecture	Lab Total	Contact	Sessional	Exam Total
				Hrs	Hrs	Hrs/Week	Marks
Marks	Marks						
MEC3201	Measurements & CNC	3	4	-	4	30	70 100
MEC 3202	CAD/CAM	3	4	-	4	30	70 100
MEC3203	Applied Thermodynamics-II	3	4	-	4	30	70 100
MEC 3204	Elective-II	3	4	-	4	30	70 100
MEC3205	Production Planning and Control	3	4	-	4	30	70 100
MEC3206	Design of Machine Elements	3	4	-	4	30	70 100
MEC3207	I. C Engines Lab	1.5	-	3	3	50	50 100
MEC 3208	Manufacturing Technology Lab-II	1.5	-	3	3	50	50 100
MEC 3209	CAD/CAM Lab	1.5	-	3	3	50	50 100
TOTAL		22.5	24	9	33	330	570 900

B.TECH IV -YEAR I – SEMESTER

Code No	Course	Credits	Lecture	Lab Total	Contact	Sessional	Exam Total
				Hrs	Hrs	Hrs/Week	Marks
Marks	Marks						
MEC4101	Machine Design	3	4	-	4	30	70 100
MEC 4102	Elective -III	3	4	-	4	30	70 100
MEC4103	Elective-IV	3	4	-	4	30	70 100
MEC 4104	Refrigeration & Air - Conditioning	3	4	-	4	30	70 100
MEC4105	Heat And Mass Transfer	3	4	-	4	30	70 100
MEC4106	Statistical Quality Control	3	4	-	4	30	70 100
MEC4107	Metrology And Mechatronics Lab	1.5	-	3	3	50	50 100
MEC 4108	Industrial Engineering Lab	1.5	-	3	3	50	50 100
MEC 4109	Heat And Mass Transfer Lab	1.5	-	3	3	50	50 100
TOTAL		22.5	24	9	33	330	570 900

B.TECH IV -YEAR II – SEMESTER

Code No	Course	Credits	Lecture	Lab Total	Contact	Sessional	Exam Total
				Hrs	Hrs	Hrs/Week	Marks
Marks	Marks						
MEC4201	Project	13.5				50	50 100

Elective-I (3-1) : 1. Finite Element Analysis, 2. Work Study, 3. Advanced Foundry And Welding Technology

Elective-II (3-2): 1. Automobile Engineering, 2. Mechanical Vibrations, 3. Reliability Engineering

Elective-III (4-1): 1. Total Quality Management, 2. Optimization Design, 3. Tool Design

Elective-IV (4-1): 1. Instrumentation and Control Systems, 2. Supply Chain Management, 3. Condition Monitoring

Third Year 1st Semester

MEC- 3101 DYNAMICS OF MACHINERY

(Effective from the batch admitted during 2019-2020- AICTE)

Periods/week : 4 Th Ses. : 30 Exam : 70

Examination (Theory): 3hrs. Credits : 3

SYLLABUS

Gyroscopic Couple and Precessional Motion: Precessional and angular motion- gyroscopic couple- effect of gyroscopic couple on an aero plane and on a naval ship, stability of a four wheel vehicle moving in a curved path, stability of a two-wheel vehicle taking a turn.

Cams: Classification of followers and cams- Definitions- Motions of the follower- Uniform velocity- Simple harmonic motion- Uniform acceleration and retardation- Displacement- Velocity and acceleration diagrams. Construction of cam profiles- Cam with knife edged follower and roller follower- Cams with specified contours- Tangent cam with roller follower- Circular arc cam with flat faced follower.

Toothed gearing: Classification of toothed wheels, technical terms, conditions for constant velocity ratio of toothed wheels- Law of gearing- Velocity of sliding of teeth, forms of teeth- Length of contact, arc of contact, interference in involute gears, minimum number of teeth required on pinion to avoid interference- Methods of avoiding interference- Helical gears, Spiral gears- Efficiency of spiral gears.

Gear Trains: Types of gear trains- Simple, compound, reverted and epicyclic gear trains- Velocity ratio of epicyclic gear train- Tabular method- Algebraic method- Torques and tooth loads in epicyclic gear trains.

Balancing of Rotating and Reciprocating Masses: Balancing of a single rotating mass in the same plane and by two masses in different planes, balancing of several masses revolving in the same plane- Balancing of several masses revolving in different planes- Primary and secondary unbalanced forces of reciprocating masses, Partial balancing of unbalanced primary forces in a reciprocating engine, Partial balancing of locomotives- Effect of partial balancing of reciprocating parts of two cylinder locomotives-

Variation of tractive force, Swaying couple and hammer blow- Balancing of primary and secondary forces in multi cylinder in-line engines- Direct and reverse cranks- Balancing of V- Engines.

Vibrations: Definitions- Types of vibrations- Natural frequencies of free longitudinal vibrations of systems having single degree of freedom- Equilibrium method- Energy method and Rayleigh's method. Frequency of damped vibration and forced vibration with damping- Magnification factor or dynamic magnifier.

Transverse and Torsional Vibrations: Natural frequency of free transverse vibrations due to point load and uniformly distributed load acting over a simply supported shaft- Transverse vibrations for a shaft subjected to number of point loads- Energy method- Dunkerley's method, Critical speed of a shaft. Natural frequency of free torsional vibrations- Free torsional vibrations of single rotor system, two rotor system, three rotor system and gear system.

Text Book:

1. Theory of Machines by R.S.Khurmi&J.K.Gupta.

Reference books:

1. Theory of Machines by Thomas Bevan.
2. Theory of Machines by S.S. Rattan.

MEC- 3102 APPLIED THERMODYNAMICS-I

(Effective from the batch admitted during 2019-2020- AICTE)

Periods/week : 4 Th Ses. : 30 Exam : 70

Examination (Theory): 3hrs. Credits :3

SYLLABUS

Properties of Pure Substance: Definition of pure substance, phase change of a pure substance, p-T (Pressure-Temperature) diagram for a pure substance, p-V-T(Pressure-Volume- Temperature) surface, phase change terminology and definitions, property Diagrams in common use, Formation of steam, Important terms relating to steam formation, Thermodynamic properties of steam and steam tables, External work done during evaporation, Internal latent heat, Internal energy of steam, Entropy of water, Entropy of evaporation, Entropy of wet steam, Entropy of superheated steam, Enthalpy-Entropy (h-s) charts for Mollier diagram, Determination of dryness fraction-Tank or bucket calorimeter, throttling calorimeter, separating and throttling calorimeter.

Gases and Vapour Mixtures and Vapor Power Cycles : Introduction, Dalton's law and Gibbs-Dalton law, Volumetric Analysis of gas mixtures, Apparent molecular weight and gas constant, specific heats of gas mixture, Adiabatic mixing of perfect gases, Gas and vapour mixtures. Vapor power cycle- Rankine cycle- Reheat cycle- Regenerative cycle- Thermodynamic

variables effecting efficiency and output of Rankine and Regenerative cycles- Improvements of efficiency, Binary vapor power cycle.

Steam Nozzles: Type of nozzles- Flow through nozzles- Condition for maximum discharge- Nozzle efficiency- Super saturated flow in nozzles- Relationship between area velocity and pressure in nozzle flow- Steam injectors.

Steam Turbines: Classification of steam turbines- Impulse turbine and reaction turbine- Compounding in turbines- Velocity diagrams in impulse and reaction turbines- Degree of reaction- Condition for maximum efficiency of reaction turbines- Effect of friction on turbines constructional features governing of turbines.

Condensers: Classification of condenser- Jet, Evaporative and surface condensers- Vacuum and its measurement- Vacuum efficiency- Sources of air leakage in condensers- Condenser efficiency- Dalton's law of partial pressures- Determination of mass of cooling water- Air pumps.

Refrigeration: Bell Coleman cycle, Vapor compression cycle- effect of suction and condensing temperature on cycle performance, Properties of common refrigerants, Vapor absorption system, Electrolux refrigerator. Principles of psychrometry and Air conditioning - Psychrometric terms, psychrometric process, air conditioning systems.

Text Books:

1. A Treatise on Heat Engineering by Vasandhani and Kumar.
2. Applied Thermodynamics-II by R. Yadav.
3. Fundamentals of Engineering Thermodynamics by E. Radhakrishna, PHI.

References:

1. Thermal Engineering, by R. K. Rajput.
2. Fluid Flow Machines, by M.S. Govinda Rao, Tata McGraw Hill publishing company Ltd.
3. Refrigeration and Air-conditioning, by C.P.Arora and Domkundwar.
4. Thermal Science and Engineering by D.S. Kumar, S.K. Kataria and Sons
5. Refrigeration and Air-conditioning, by AhamadulAmeen, PHI.

MEC-3103 FLUID MECHANICS AND MACHINERY

(Effective from the batch admitted during 2019-2020 -AICTE)

Periods/week : 4 Th. Ses. : 30 Exam : 70

Examination (Theory): 3hrs. Credits:3

Properties of fluids- Introduction-Viscosity- Pressure and its measurement , Absolute, Gauge, Atmospheric and Vacuum pressure –

Manometers, Simple manometers, Differential manometers. Hydrostatic forces on surfaces - Total Pressure and Pressure Centre - Vertical, Horizontal, inclined and Curved plane surfaces submerged in liquid- Buoyancy and Floatation. Fluid Kinematics & Fluid Dynamics: Types of fluid flow - Continuity equation - Velocity potential function and Stream Function - Types of Motion, Linear Translation, Linear deformation, Angular deformation, Rotation, Vorticity and circulation-Vortex flow, forced and Free Vortex – Equation of Motion- Euler's equation - Bernoulli's equation and its applications- Venturimeter, Orifice Meter, Pitot tube-Momentum Equation-Momentum of momentum Equation- Free Liquid Jet- Flow net analysis.

Viscous Flow: Couette flow- Plane Couette flow, Favourable pressure gradient and adverse pressure gradient-Power absorbed in Viscous Flow- Flow through pipes- Hagen Poiseuille flow- Fanning's friction factor- Darcy's Weisbach friction factor- Loss of head due to friction in pipes, Minor Losses and Major losses - Flow through branched pipes- Power transmission through pipes-Two dimensional viscous flow: Navier -Stokes equations and solutions- Order of magnitude analysis- Boundary layer equations.

Laminar Boundary Layer: Definition- Laminar Boundary Layer-Laminar Sub layer- Boundary Layer thickness-Displacement thickness, Momentum thickness and Energy thickness-Momentum integral equation- Flow over a flat plate.

Turbulent Boundary Layer: Laminar- Turbulent transition- Momentum equations and Reynold's stresses- Fully developed turbulent flow through a pipe- Turbulent boundary layer on a flat plate- Laminar sub-layer- Boundary layer separation and control.

Impact of Jets; Impact of jet vane on stationary surfaces-Impact of jet on hinged surfaces-A moving curved vane high tangential entry of water- Radial flow over the vanes.

Hydraulic Machines: Hydraulic Turbines: Classification- Pelton wheel- Reaction turbines-Inward and outward radial flow reaction turbines- Francis turbine –Axial flow reaction turbine-Kaplan turbine- Draft tube-Types-Theory- and efficiency of draft tube.

Centrifugal Pumps: Main parts-Efficiency- Minimum speed for starting- Multi-stage centrifugal Pumps-Specific speed of a Centrifugal Pump-Priming of a Centrifugal Pump.

Reciprocating Pumps : Main parts-Classification-Velocity and acceleration variation in suction and delivery pipes due to piston acceleration-Effect of variation of velocity on friction in suction and delivery pipes -Air vessels.

Text Book:

1. Fluid Mechanics and Hydraulic Machines, by R. K. Bansal, Laxmi publications.

2. Fluid Mechanics, by A.K. Mohanty, Prentice Hall of India Pvt.Ltd.

3. Fluid Mechanics and Hydraulic Machinery by R .K .Bansal, Laxmi publications

References:

1. Fluid Mechanics and Fluid Power Engineering by Dr. D.S. Kumar, S.K. Kataria & Sons.

2. Foundations of Fluid Mechanics, by Yuan, Prentice Hall of India.

3. Fluid Mechanics and its Applications, by S. K.Gupta and A.K.Gupta, Tata McGraw Hill, New Delhi.

4. Fluid Mechanics and Hydraulic Machines by R. K. Rajput, S.Chand & Co.

5. Fluid Mechanics by Kothandaraman and Rudramoorthy.

MEC- 3104 OPERATIONS RESEARCH

(Effective from the batch admitted during 2019-2020- AICTE)

Periods/week : 4 Th Ses. : 30 Exam : 70

Examination (Theory): 3hrs. Credits :3

SYLLABUS:

Development: Definition, Characteristics and phase of Scientific Method, Types of models. General methods for solving operations research models.

Allocation: Introduction to linear programming formulation, graphical solution, Simplex method, Artificial variable technique, Duality theory and Dual simplex method.

Transportation Problem: Formulation optimal solution. Unbalanced transportation problems, Degeneracy. Assignment problem, Formulation optimal solution, Variations i.e., Non-square ($m \times n$) matrix restrictions.

Sequencing: Introduction, Terminology, notations and assumptions, problems with n-jobs and two machines, optimal sequence algorithm, problems with n-jobs and three machines, problems with n-jobs and m-machines, graphic solutions. Travelling salesman problem.

Waiting lines: Single channel Poisson arrivals, Exponential service times, Unrestricted queue with infinite population and finite population models; Single channel Poisson arrivals, Exponential service times with infinite population and restricted queue.

Replacement: Introduction, Replacement of items that deteriorate with time - value of money unchanging and changing, Replacement of items that fail completely.

Theory of games: Introduction, Two-person zero-sum games, The Maximum -Minimax principle, Games without saddle points - Mixed

Strategies, 2xn and mx2 Games - Graphical solutions, Dominance property, Use of L.P. to games, Algebraic solutions to rectangular games.

Inventory: Introduction, inventory costs, Independent demand systems: Deterministic models - Fixed order size systems - Economic order quantity (EOQ) - Single items, back ordering, Quantity discounts (all units quantity discounts), Batch - type production systems: Economic production quantity - Single items, Economic production quantity multiple items. Fixed order interval systems: Economic order interval (EOI) - Single items, Economic order interval (EOI) - Multiple items.

Network Analysis: Network definitions, Minimum spanning tree algorithm, Shortest route problem, Maximum flow model. Elements of project scheduling by CPM and PERT.

Text Books:

1. Operation Research, by Taha (PHI)
2. Operations Research Methods and Problems, by M.Sasieni, Yespal and L.Friedman.(John Wiley)
3. Operation Research by S.D.Sharma.(KedarnadhRamnadh& Co.,)
4. Operation Research by R.Pannervselvam, (PHI)

MEC- 3105 INDUSTRIAL ENGINEERING AND MANAGEMENT

(Effective from the batch admitted during 2019-2020- AICTE)

Periods/week : 4 Th Ses. : 30 Exam : 70

Examination (Theory): 3hrs. Credits: 3

SYLLABUS

Concepts of Industrial Management: Principles of management- Growth of management thought, Functions of management, Principles of organization, Types of organization and committees.

Introduction to personnel management- Functions, Motivation, Theories of motivation, Hawthorne studies, Discipline in industry, Promotion, Transfer, lay off and discharge, Labour turnover.

Industrial relations- Trade unions, Industrial disputes, Strikes, Lock-out, Picketing, Gherao, Settlement of industrial disputes, Collective bargaining, Industrial dispute act 1947 and factories act 1948.

Production Planning and Control: Types of productions, Production cycle, Product design and development, Process planning, Forecasting, Loading, Scheduling, Dispatching, Routing, Progress, Control, Simple problems.

Plant Layout: Economics of plant location, Rural Vs Suburban sites, Types of layouts, Types of building, Travel chart technique, Assembly line balancing simple problems.

Materials Handling- Principles, Concept of unit load, Containerization, Pelletization, Selection of material handling equipment, Applications of belt conveyors, Cranes, Forklift trucks in industry.

Plant Maintenance: Objectives and types.

Work Study: Concept of productivity, Method Study - Basic steps in method study, Process charts, Diagrams, Models and Templates, Principles of motion economy, Micro motion study, Therbligs, SIMO chart. Work Measurement - Stop watch procedure of time study, Performance rating, allowances, Work sampling, Simple problems.

Materials Management: Introduction, Purchasing, Objectives of purchasing department, Buying techniques, Purchase procedure, Stores and material control, Receipt and issue of materials, Store records. Inventory Control, EOQ model(Simple problems).

Quality Control - Control charts of variables and attributes (Use of formulae only). Single and Double sampling plans.

Text Book:

1. Industrial Engineering Management, by Dr. O. P .Khanna.

References:

1. Principles of Management by Koontz &Donnel.
2. Production and Operations Management by Everette Adam & Ronald Ebert.
3. Operations Management by John McClain & Joseph Thames.
- 4.. Industrial Engineering and Production Management by Telsay, S. Chand & Co.

ELECTIVE-1 MEC- 3106A FINITE ELEMENT ANALYSIS

(Effective from the batch admitted during 2019-2020- AICTE)

Periods/week : 4 Th Ses. : 30 Exam : 70

Examination (Theory): 3hrs. Credits :3

SYLLABUS

Fundamental Concepts: Introduction, Historical background, Outline of presentation, General procedure for FEA, Stresses and Equilibrium, Boundary conditions, Strain- Displacement relations, Stress-Strain relations, Plane stress, Plane strain problems, Temperature effects, Potential energy and equilibrium. The Rayleigh-Ritz method, Hamilton's principle.Galerkin's method, Saint Venant's principle.

One-dimensional Problems: Introduction, Finite element modeling, Coordinates and Shape functions. The potential energy approach.The Galerkin approach, Assembly of the global stiffness matrix- mass matrix and load vector, Treatment of boundary conditions, Quadratic shape functions, Temperature effects. Trusses: Introduction, Plane trusses, Three-

dimensional trusses, Assembly of global stiffness matrix for the Banded and Skyline solutions.

Two-dimensional Problems Using Constant Strain Triangles: Introduction, Finite element modeling, Constant strain triangle, In plane and Bending, problem modeling and boundary conditions.

Axisymmetric Solids Subjected to Axisymmetric Loading: Introduction, Axisymmetric formulation, Finite element modeling, Triangular element, Problem modeling and boundary conditions.

Two-dimensional Isoparametric Elements and Numerical Integration: Introduction, The four-node quadrilateral, Numerical integration, requirements, h-refinement and p-refinement, Higher-order elements, Convergence

Beams and Frames: Introduction, Finite element formulation, Load vector, Boundary considerations, Shear force and bending moment, Beams on elastic supports, Plane frames.

Text Book:

1. Introduction to Finite Elements in Engineering, by Tirupathi R. Chandrupatla, Ashok D. Belegundu (chapters 1 to 8 only).

References:

1. Introduction to Finite Element Method, by S.S. Rao
2. Finite Element Method, by O.C. Zienkiewicz.
3. Concepts and Applications of Finite Element Analysis, by Robert D. Cook.
4. Introduction to Finite Element Method, by J.N. Reddy.

ELECTIVE-1 MEC- 3106B WORK STUDY

(Effective from the batch admitted during 2019-2020- AICTE)

Periods/week : 4 Th Ses. : 30 Exam : 70

Examination (Theory): 3hrs. Credits :3

SYLLABUS

Introduction to work study: Scientific management – Productivity - Advantages of work study to management, Supervisors and workers.

Method Study: Introduction - Process charts, Critical Examination, Identification of key activities on process charts, Diagrams and Templates, Therbligs, Micro motion analysis, Memo motion study. Developing new method - Job survey report writing. Principles of Motion Economy: Related to human body, work place, equipment.

Work Measurement: Work measurement techniques – Rating - Measuring the job – Allowances - Standard time - Synthetic data - Analytical

estimating – PMTS, Work factor, MTM, Activity sampling, Its applications. Job Evaluation, Techniques of job evaluation - Merit rating - Incentive plans.

Ergonomics: Basics of Ergonomics, Anthropometry.

Text Books:

1. Introduction to Work Study - International Labour Organisation.
2. Elements of Work Study and Ergonomics by Dalela et al, Standard Publications.

References:

1. Motion and Time Study, by Barnes, John Wiely.

ELECTIVE-1 ME 3106C ADVANCED FOUNDRY AND WELDING TECHNOLOGY

(Effective from the batch admitted during 2019-2020- AICTE)

Periods/week : 4 Th Ses. : 30 Exam : 70

Examination (Theory): 3hrs. Credits :3

SYLLABUS

Moulding: Development of metal castings- Materials for moulding- Foundry sand control- Different types of cores- Core making processes- Materials for core making- Moulding and core making machines. Recent developments in core mould making- Cold set process- Investment process- Shell moulding- Hot box method- Shaw process. Vacuum moulding- moulding for mass production.

Melting and Solidification: Furnaces used in foundry for melting ferrous and nonferrous metals- principals of operation of cupola and charge calculations. Family of cast irons- Production of malleable and S.G. Irons- Methods of alloying and inoculants and their effects

on the structure and properties of cast iron. Principles of Solidification: Nucleation- Crystal growth- Morphology and structure of cast metals and alloys- Pure metals- Single phase alloys and eutectics. Solidification in sand and chill moulds.

Foundry Mechanization: Layout for ferrous and nonferrous foundries- Description of equipment used for mechanization- Sand conditioners- Conveyors- Cranes- Equipment for handling moulds, Cores and molten metal- Knock out of moulds- Fettling equipment.

Special Welding Processes: Resistance welding processes- Spot, Seam, Projection, Flash butt welding - Machine cycle for resistance welding- Parameters in resistance welding- Electrodes for resistance welding – Solid State Welding: Cold welding – Forge welding - Ultrasonic welding Diffusion welding – Radiation welding: Laser Beam Welding, Electron Beam Welding – Automatic welding systems.

Weldability of Metals: Factors influencing weldability of metals- Welding of Cast steels, Carbon steels, Stainless steels and Cast iron. Weldability of Cu and its alloys, Al and its alloys- Ti and its alloys- Mg and its alloys- Temperature changes in welding and their effects on mechanical properties. Absorption of gases by welds and their effects- Residual stresses and distortion- Heat treatment of welded parts. Welding Joints, Weld Symbols and Joint Design principles: Types of joints – types of welds – Variants of joints and weld types - Welding symbols – principles of weld joint design and evolving of good weld designs.

Text Books:

1. Foundry Technology, by Jain P.L.
2. Welding Engineering and Technology, by R.S. Parmar.

References:

1. Foundry Engineering, by Agarwal.
2. Foundry Engineering, by Taylor F. & Others.
3. Principles of Metal Castings, by Heine & Others.
4. Modern Welding Technology, by H.B. Cary.
5. Welding Technology, by Koenisburger.
6. Welding Metallurgy, S.Kou, 2nd edition, John Wiley and Sons, New York, NY (2003).

MEC -3107 MANUFACTURING TECHNOLOGY LAB-I

(Effective from the batch admitted during 2019-2020- AICTE)

Periods/week : 3 Lab Ses. : 50 Exam : 50

Examination (Theory): 3hrs. Credits : 1.5

LIST OF EXPERIMENTS:

Use of basic tools and operations of the following trades.

S. No.	Trade	No. of exercises
1.	Foundry	3
2.	Welding	2
3.	Lathe Step and taper turning	1
	Thread cutting Offset turning	11
4.	Milling	1 (Spur gear)
5.	Shaper	1

1. Cylindrical grinding, Surface grinding, Planing, Slotting and Capstan lathe (only demonstration in one class for the entire batch of students).

7. Disassembling and assembling of *
 - i. Machine Tool (Lathe)

- ii. I.C. engine
- iii. Pump
- iv. Gear box

* Not for examination.

MEC- 3108 DYNAMICS OF MACHINERY LAB

(Effective from the batch admitted during 2019-2020- AICTE)

Periods/week : 3 Lab Ses. : 50 Exam : 50

Examination (Theory): 3hrs. Credits : 1.5

List of Experiments:

1. Determination of inertia of the given flywheel and connecting rod.
2. Determination of modulus of rigidity of the given wire with torsion pendulum.
3. Verification of laws of balancing.
4. a) Determination of ratios of angular speeds of shafts connected by Hooke's joint.
b) Determination of the ratio of times and ram velocities of Withworth quick return motion mechanism.
5. To draw curves of slider displacement and crank angle and linear velocities w.r.t. time for a slider crank mechanism and compare with theoretical values.
6. To determine the relation of gyroscopic couple and compare with the theoretical values
7. To determine the radius of gyration of given bar by using bifilar and Trifilar suspension.
8. Find the CG of a connecting rod using free vibration techniques.
9. To determine natural frequency of free torsional vibrations of single rotor system.
10. Find the Natural frequency of the free un-damped vibrations of equivalent spring mass system.
11. Find the Natural frequency of the free damped vibrations of equivalent spring mass system.
12. Find the Natural frequency of the forced damped vibrations of equivalent spring mass system.
13. Find the Natural frequency of the forced un-damped vibrations of equivalent spring mass system.
14. Experiments with piezo-electric pick-up, Inductive pick-ups. Determination of characteristics- Displacement, Velocity and Acceleration.
15. Calibration of the given pressure gauge.

16. Calibration of Rotameter.
17. Calibration of Strain Gauges
 - a) Full Bridge
 - b) Half Bridge
 - c) Quarter Bridge

MEC- 3109 FMM LAB

(Effective from the batch admitted during 2019-2020- AICTE)

Periods/week : 3 Lab Ses. : 50 Exam : 50

Examination (Practical): 3hrs. Credits: 1.5

List of Experiments:

1. Calibration of flow meters,
 - a. Venturi meter
 - b. Orifice meter
 - c. Nozzle meter
2. Determination of coefficient of discharge for
 - a. small orifice
 - b. cylindrical mouth piece
3. Finding coefficient of discharge for
 - a. rectangular notch
 - b. triangular notch
 - c. trapezoidal notch
4. To draw the performance characteristics of C.F. pump.
5. To find the specific speed of
 - a. Pelton turbine
 - b. Francis turbine
6. To draw the characteristic curves for reciprocating pump.
7. To draw the pressure distribution and finding coefficient of drag for
 - a. a bluff body
 - b. an Aero foil
 - c. To draw the characteristic curves for the hydraulic ram

Third Year 2nd Semester

MEC- 3201 MEASUREMENTS & CNC

(Effective from the batch admitted during 2019-2020- AICTE)

Periods/week : 4 Th Ses. : 30 Exam : 70

Examination (Theory): 3hrs. Credits :3

Automatic screw lathes, Multi spindle automatic lathes, Turret lathes, Numerical control, NC operation, Coordinate system, Data input devices, Data storage, Programme editing, Machining centres, Turning centres, Vertical turning centres, Milling centres, Advantages of NC, Computers & NC, CNC, DNC, CNC part programming: Designation of co-ordinate axes for CNC machines, Functions of machine control units, Tape format, Manual part programming and computer assisted part programming (using APT language). Exercises involving simple contours and positioning.

ISO system of limits, Fits and Tolerances, Interchangeability, Plain limit gauges, Measurement of screw threads, major diameters, Minor diameters and effective diameter, Pitch, Limit gauges for internal and external threads, Measurement of spur gears, pitch, profile, lead, backlash, tooth thickness.

Tool maker's microscope, Straightness measurement, Slip gauges, Twisted strip mechanical comparator, Optical lever comparator, Optical projector, Electric comparator, Pneumatic comparator, Squareness testing, Optical bevel protractor, Sine bar, Angle gauges, Precision level, Autocollimator, Angle dekkor, Optical dividing heads and rotary tables, Flatness measurement, Roundness measurement. Co-ordinate measuring machines.

Surface texture: Parameters, sampling length, Specification, Stylus instruments for surface roughness measurement. Acceptance tests on machine tools: Lathe, Milling machine, Radial drill, Laser equipment.

Text Books:

1. Process & Materials of Manufacture, R.A.Lindberg, 4th edition, Prentice-Hall of India, New Delhi.
2. A Text Book of Engineering Metrology, I.C.Gupta, Dhanpat Rai & Sons, Delhi.
3. CNC and Computer Aided Manufacturing, T.K.Kundra, P.N.Rao & N.K.Tewari, Tata McGraw-Hill Publishing Company Ltd, Delhi.

References:

1. A.S.T.M.E., Hand book of Industrial Metrology, Prentice-Hall of India, New Delhi.
2. A.S.T.M.E., Hand book of Manufacturing Engineering.
3. Manufacturing Processes & Materials for Engineers, L.E.Doyle & others, Prentice-Hall of India, New Delhi.

MEC- 3202 CAD/CAM

(Effective from the batch admitted during 2019-2020- AICTE)

Periods/week : 4 Th Ses. : 30 Exam : 70

Examination (Theory): 3hrs. Credits :3

SYLLABUS

COMPUTER AIDED DESIGN :

Fundamentals of CAD - Introduction - The design process - Application of computers for design - Operating systems - Hardware in CAD: The design work station - I/O Devices - CAD system configuration - Creating database for manufacturing - Benefits of CAD.

Interactive Computer Graphics - Graphic display devices- Graphics system- Graphics standards - Graphical user interface- Transformation systems- 2D and 3D transformations - Linear transformation- windowing – clipping - Geometric Modeling - Modeling Techniques - Wire frame Modeling - Surface Modeling - 3 D Solid Modeling.

Introduction to Finite Element Analysis – Steps of FEM for solving physical problem, CAD techniques to finite element data preparation- Automatic mesh generation- Presentation of results - CAD applications of FEM.

COMPUTER AIDED MANUFACTURING

Group technology: Merits & demerits, Organization, Classification and Coding systems, Cellular manufacturing.

Computer aided process planning: Introduction to process planning, Methods of process planning, Computer aided process planning, CAPP systems

Computer aided material handling: Robots: Structure and operation of Robots, robot sensors and applications. Automatic conveyor systems. Automated guided vehicles.

Computer aided inspection and quality control: Quality assurance and quality control. Contact and Non-contact inspection -Coordinate measuring machine.

FMS & CIMS: Building blocks of Flexible Manufacturing Systems (FMS), Machining systems of FMS, Tool management systems, Advantages of FMS, Computer integrated manufacturing systems (CIMS).

Text Books:

1. CAD/CAM- Computer Aided Design & Manufacturing, by M.D.Groover&E.W.Zimmer.

2. Computer Aided Design and Manufacturing, by Dr.Sadhu Singh, Khanna Publishers.

References:

1. Computer Aided Design in Mechanical Engineering, by V.Rama Murthy.

2. Elements of Computer Aided Design & Manufacturing, by Y.C.Pao.

3. Computer Aided Kinetics for Machine Design, by D.L.Ryan.

4. Computer Aided Design and Manufacturing, by C.B.Besant&C.W.K.Lui.

5. Computer-Aided Analysis & Design by S. Ghosal, Prentice Hall of India.

6. CAD/CAM/CIM by Radhakrishna, New age international.

7. Computer Integrated Design and Manufacturing, by David D.Bedworth, Mark R.Henderson& Philip M.Wolfe, McGraw-Hill Book Company, Singapore.

8. Computer Aided Manufacturing, by P.N.Rao, N.K.Tewari&T.K.Kundra, Tata McGraw- Hill publishing company Ltd, NewtDelhi.

MEC 3203 APPLIED THERMODYNAMICS-II

(Effective from the batch admitted during 2019-2020 AICTE)

Periods/week : 4 Th Ses. : 30 Exam : 70

Examination (Theory): 3hrs. Credits :3

SYLLABUS

I.C. engines: classification-comparison of two stroke and four stroke engines- comparison of S.I. and C.I. engines-Air cycles-Otto, Diesel, Dual, Stirling, Ericson and Atkinson cycles and their analysis-Valve timing and port timing diagrams- Efficiencies- air standard efficiency,indicated thermal efficiency, brake thermal efficiency, mechanical efficiency, volumetric efficiency and relative efficiency-Testing and performances of I.C. engines-Basic principles of carburetion and fuel injection.

Combustion in I.C. Engines: S.I. engines- Normal combustion and abnormal combustion- Importance of flame speed and effect of engine variables-types of abnormal combustion pre- ignition and knock, Fuel requirements and fuel rating, anti-knock additions- Combustion chamber requirements and Types of combustion chamber- Design principles of combustion chambers-C.I. engines- Stages of combustion- Delay period and its importance- effect of engine variables, diesel knock, suction compression and combustion induced turbulence, open and divided combustion chambers.

Reciprocating and Rotary Compressors: Reciprocating compressors-effect of clearance in compressors, volumetric efficiency-single stage and multi stage compressors-effect of inter cooling in multi stage compressors-Vane type blower-centrifugal compressor- Adiabatic efficiency- Diffuser-Axial flow compressors- Velocity diagrams, degree of reaction, performance characteristics.

Gas Turbines: Simple gas turbine plant- Ideal cycle, closed cycle and open cycle for gas turbines-Efficiency, work ratio and optimum pressure ratio for simple gas turbine cycle- Parameters of performance- Actual cycle, regeneration, Inter-cooling and reheating, closed and semi-closed cycle-Jet propulsion and Rockets.

Nuclear power plants: Classification of reactors-Thermal utilization-Fuels, Fuel moderator and coolant, Control and safety rods, Special

properties of structural materials required, Induced radio-activity-Gas cooled reactors, Radiation hazards and shielding-Radio active waste disposal.

Direct Energy Conversions and non conventional energy sources: Solar Energy- Introduction, Solar radiation, Solar collectors, Energy storage-Wind Energy- Wind mills- Thermo Electric- MHD.

Text Books:

1. A Treatise on Heat Engineering by Vasandhani and Kumar.
2. Applied Thermodynamics-II by R. Yadav.

References:

1. Thermal Engineering, by R.K.Rajput.
2. I.C. Engines, by Mathur and Nehata.
3. Gas Turbines, by Cohen and Rogers.
4. Fluid Flow Machines, by M.S. GovindaRao, Tata McGraw Hill publishing company Ltd.
5. I.C. Engines by V. Ganesan.
6. Power Plant Engineering, P.K.Nag
7. Non Conventional Energy Sources, G.D.Rai
8. Internal Combustion Engines by R.K. Mohanty, Standard Book House

ELECTIVE-II MEC- 3204A AUTOMOBILE ENGINEERING

(Effective from the batch admitted during 2019-2020- AICTE)

Periods/week : 4 Th Ses. : 30 Exam : 70
Examination (Theory): 3hrs. Credits :3

SYLLABUS

Introduction: Definition of automobile, Automobile Layout, Chassis and Transmission: Introduction to Drive Train: Clutch, Gearbox, Hook's Joint, Propeller /Drive Shaft, Slip Joint, Final Drive and Differential, Front and Rear Axles, Wheels and Tires, Control systems: Introduction to Steering, and Brakes. Electrical system: Introduction to Starting System, Ignition, dynamo/alternator, cut-out and wiring. Automobile Body: Parts and Stream lining, Automobile types: Front, Rear and Four wheel drive and Automotive materials.

Engine (Power Plant): Multi cylinder engine parts, Classification: 'In-line' and 'V' type, Multi-Valve Engines, VCR Engines, Super Charging/Turbo charging, Air filters, Fuel Systems: Petrol Engines: Carbureted and MPFI, Ignition Systems: Conventional and Electronic, Diesel Engines: Conventional, CRDI, and Dual Fuel engines., Performance, Combustion and Exhaust Emissions, Air pollution and their control: EGR and Catalytic

Converters, EURO/Bharat Stage Norms: I, II, III, IV and V., Manifolds and Mufflers, Engine Cooling and Lubrication.

Clutch: Necessity, Clutch Assembly: Construction and Working Principle, Types: Single and Multiple Plates, Free-Play, Fluid coupling/Torque converter, Clutch Troubles and Remedies.

Gearbox: Necessity of Transmission and Transaxle, Construction and Working Principle, Selector Mechanism, Types: Sliding mesh, Constant mesh, Synchromesh, and Epicyclical. Three, Four and Five- Speed Gearbox, Overdrive, Automatic Gearbox, Gearbox Troubles and Remedies.

Drive shaft and Final Drive: Drive Shaft: Constructional Features: Universal/Hooks Joints, Slip Joint, and Working Principle., Types of Propeller shafts, Final drive and Differential:

Necessity, Constructional Features and Working Principle., Front/Rear Axles: Constructional Features and Types of Rear Axle Floating, Wheels: Disc and Drum type, Tires: Tire Construction, Tube and Tubeless Tires, Radial Tires, Tire specification, Tire rotation and Tire Maintenance.

Suspension System and Vehicle Control: Coil and Leaf Springs, Shock absorbers, Wheel alignment: Kingpin angle, Caster, Camber, Toe-in, and Toe-out., Necessity of vehicle control, Steering Mechanism and its Elements: Steering gear box and its types, Steering gear ratio, Constant Velocity Joints and linkages. Power Steering, Brake system: Necessity, Parking and Power Brakes, Parts and Working Principle of Mechanical, Air and. Hydraulic Brakes: Mater and Wheel cylinder, Properties of Brake Fluids, Brake Diagnostics and Service: Brake Bleeding, Anti-lock Braking System, Automobile Accessories and Tips for Safe Driving.

Electrical and Electronic Systems: Basics of Electrical/Electronic Systems: Battery, Starting system, Charging System, Lighting and Signaling System, A/C Electrical System, Electronic Engine Management system, Automotive Embedded Systems: Vehicle Security System and Working Principle of Computer Sensors: Temperature, Flow, Cam, knock, and Oxygen, and ECU/ ECM.

Trouble shooting and Maintenance: Engine and Vehicle Troubles: Diagnostic Information: Symptom descriptions and their Causes and Remedies, Periodic, Preventive and Break down Maintenance: Engine tuning, Fuel and Air filters, Lubricants, Maintenance of Battery and Electrical/Electronic System, and Tires. The Motor Vehicle Act (India).

Introduction to Electric and Hybrid vehicles: Performance and emission characteristics of electric and hybrid vehicles

Text Books:

1. Automotive Mechanics (10/e) - William H. Crouse and Donald L. Anglin, Tata McGraw- Hill Publishing Company Limited, ISBN: 0-07-059054-0

2. Automobile Engineering – KK Jain/ RB Asthana, Tata McGraw-Hill Publishing Company Limited, ISBN: 0-07-044529-X

3. Internal Combustion Engines and Air Pollution- E.F. Obert, Harper & Row International Publishers Inc., ISBN: 0-06-350561-4

Reference Books:

1. Automotive Mechanics – S. Srinivasan, Tata McGraw-Hill Publishing Company Limited, ISBN: 0-07-044941-6

2. Internal Combustion Engines – Heywood, John, B. McGraw-Hill Publications Limited.

3. Automotive Engines- S Srinivasan, Tata McGraw-Hill Publishing Company Limited, ISBN: 0-07-040265-5

ELECTIVE-II MEC- 3204B MECHANICAL VIBRATIONS

(Effective from the batch admitted during 2019-2020- AICTE)

Periods/week : 4 Th Ses. : 30 Exam : 70

Examination (Theory): 3hrs. Credits :3

SYLLABUS

Single degree freedom systems -Introduction - Single degree freedom systems-free and forced vibrations - Damping classification and damped systems .

Two degree freedom systems - Free, forced damped and undamped motions - Use of influence coefficients, Matrix methods and Lagrange's equations - Phenomenon of beat - Dynamic absorbers – Applications.

Transient (Shock) vibrations as applied to single and two degree freedom systems - Use of mathematics and graphical techniques in the analysis (superposition integral, Laplace transformations, phase plane techniques).

Multi degree freedom systems - Free and forced motions in longitudinal, torsional and lateral modes - damped and undamped, critical speeds of rotors.

Continuous systems - free and forced vibrations of string, bars and beams - Principle of orthogonality Classical and energy methods by Rayleigh, Ritz and Gelerkin.

References:

1. Mechanical Vibrations/G.K.Groover/Nem Chand and Bros
2. Mechanical Vibrations / SS Rao/ Pearson/ 2009, Ed 4
3. Mechanical Vibrations by Den Hartog.
4. Mechanical Vibrations by R.Venkatachalam
5. Mechanical Vibrations/Schaum Series/ McGraw Hill
6. Vibration Problems in Engineering by Timoshenko and Young.

7. Mechanical Vibrations/Debabrata Nag/Wiley

8. Mechanical Vibrations and Noise engineering/ A.G.Ambekar/ PHI

ELECTIVE-II MEC- 3204C RELIABILITY ENGINEERING

(Effective from the batch admitted during 2019-2020 AICTE)

Periods/week : 4 Th Ses. : 30 Exam : 70

Examination (Theory): 3hrs. Credits :3

SYLLABUS

Introduction: Concepts of quality and reliability, a brief history, terms, definitions, reliability function, MTTF, Hazard rate function, bath tub curve, conditional reliability.

Constant failure rate models: Exponential reliability, failure modes, failure modes with exponential distribution, applications, two parameter exponential distribution, Poisson process.

Time dependent failure models: Weibull distribution, burn-in screening for Weibull, three parameter Weibull distribution, Normal and Lognormal distributions

Reliability of systems: Series, parallel configurations, combined systems, k-out-of-n systems, complex configurations, common failure modes, minimal cuts and minimal paths.

State dependent systems: Markov analysis, load sharing, standby systems, degraded systems

Physical reliability models: Static models- random stress and random strength, dynamic models- periodic models, random loads.

Design for reliability: Reliability specification, Lifecycle costs, reliability allocation, design methods, failure analysis, FTA.

Reliability testing: Life testing, burn-in testing, acceptance testing- binomial acceptance testing.

Reliability growth testing: Reliability growth process, idealized growth curve, Duane growth model.

Text Book:

1. Introduction to Reliability and Maintenance engineering by Charles E Ebeling, Tata McGrawhill, India.

References:

1. Introduction to Reliability Engineering by E.E. Lewis, John Wiley & Sons, New York
2. Reliability based design by S.S.Rao, McGraw-Hill, New York

MEC- 3205 PRODUCTION PLANNING AND CONTROL

(Effective from the batch admitted during 2019-2020- AICTE)

Forecasting : Importance – Types of forecasting– Forecasting techniques – qualitative methods and quantitative methods.

Inventory management : Functions of inventories – relevant inventory costs – EOQ model – Inventory control systems – ABC analysis – VED analysis Material Requirement Planning, Bill of material, MRP II, Master Production Scheduling.

Aggregate planning.: Chase planning, Expediting, controlling aspects.

Routing : Definition – Routing procedure –Route sheets — Factors affecting routing, procedure – Difference with loading

Scheduling: Policies – Types of scheduling- Forward and Backward Scheduling – Gantt Charts – Flow shop Scheduling – n jobs and 2 machines, n jobs and 3 machines – Job shop Scheduling – 2 jobs and n machines – Line of Balance.

Dispatching : Activities of dispatcher – Dispatching procedure – follow up – priority rules for dispatching jobs.

Applications of computer in production planning and control.

Text Books:

1. Elements of Production Planning and Control / Samuel Eilon.
2. Modern Production/ operation managements / Baffa&RakeshSarin

References:

1. Operations Management – S.N. Chary.
2. Inventory Control Theory and Practice / Martin K. Starr and David W. Miller.
4. Production Control A Quantitative Approach / John E. Biegel.
5. Operations Management / Joseph Monks.

MEC- 3206 DESIGN OF MACHINE ELEMENTS

(Effective from the batch admitted during 2019-2020- AICTE)

Periods/week : 4 Th Ses. : 30 Exam : 70
Examination (Theory): 3hrs. Credits :3

SYLLABUS

Introduction to Mechanical engineering design: traditional design methods, different design models, Problem formulation, Design considerations, engineering materials and processes and their selection, BIS designation of steels, Mechanical properties, Load determination, manufacturing considerations in design.

Design against static loads: Modes of failure, Factor of safety, Axial, bending and torsional stresses, Stress concentration factors. Static failure theories.

Fluctuations and fatigue stresses, Soderberg, Goodman and modified Goodman diagrams, fatigue failure, design consideration in fatigue

Threaded and welded joints: forms of threads, basic types of screw fastenings, ISO metric screw threads, eccentrically loaded bolted joints, Torque requirement for bolt tightening, Fluctuations loads on bolted joints, fasteners, Joints with combined stresses. Power screws, Force analysis. Collar friction, Differential and compound screws design. Types and strength of weld joints subjected to bending and fluctuating loads, cotter and knuckle joints, welded joints, different types welded joints and their design aspects, welding inspection

Shafts, keys and couplings: shafts design on strength basis, torsional rigidity basis, Design of hollow shafts, flexible shafts, ASME codes for shafts, Keys and cotter design, Flat, square keys, Splines, Rigid and flange couplings, Flexible couplings

Spring Design: classification and spring materials, Spring end formation, Design of helical compression springs, helical extension springs, torsion springs, laminated springs, Protective coatings, Equalized stress in spring leaves. Multi - leaf springs. Surge in springs, Nipping and shot peening.

Text Books:

1. Design of Machine Elements by V.B.Bhandari, TMH Publishing Co. Ltd., New Delhi

References:

1. Machine Design by Jain, Khanna Publications.
2. Machine Design by Pandya and Shaw, Charotar publications
3. Machine design , an integrated approach by R.L.Norton, 2nd edition, Pearson Education

MEC- 3207 I. C ENGINES LAB

((Effective from the batch admitted during 2019-2020 AICTE)

Periods/week : 3 Lab Ses. : 50 Exam : 50
Examination (Practical): 3hrs. Credits : 1.5

List of Experiments:

1. Study and valve timing diagrams for four-stroke and study & PTD of two-stroke engines.
2. Determination of volumetric efficiency of the given air compressor by (i) plate orifice method and (ii) tank capacity method.
3. a) Determination of flash and fire points and

4. b) Canradsons carbon residue test.
5. Determination of calorific value of flues (solid, liquid and gaseous) by Bomb calorimeter/Gas calorimeter.
6. Determination of the kinematic and absolute viscosity of the given sample oils.
7. Load test and smoke test on I.C. Engines.
8. Morse test on multi-cylinder engine.
9. Heat balance sheet on I.C. Engines.
10. Study of multi-cylinder engines and determination of its firing order.
11. Calculations of efficiencies of the given air compressor.

MEC- 3208 MANUFACTURING TECHNOLOGY LAB-II

(Effective from the batch admitted during 2019-2020 AICTE)

Periods/week : 3 Lab
: 50

Ses. : 50 Exam

Examination (Theory): 3hrs. Credits :1.5

LIST OF EXPERIMENTS:

1. Experiments on Lathe to establish the following curves
 - a) Depth of cut Vs Cutting force.
 - b) Feed Vs Cutting force.
 - c) Cutting speed Vs Cutting force.
2. Grinding of single point cutting tool as per given specifications (to check the tool angles).
3. Study of chip formations on shaping machine (with lead sample).
4. Torque measurement on drilling/milling machine.
5. Effect of speed and feed on surface roughness.
6. Measurement of cutting tool temperature in turning.
7. Sieve analysis to evaluate G.F.No.
8. Moisture and clay content test.
9. Green compression and shear test.
10. Shatter Index & Hardness Testing

MEC- 3209 CAD/CAM LAB

(Effective from the batch admitted during 2019-2020- AICTE)

Periods/week : 3 Lab Ses. : 50 Exam : 50

Examination (Theory): 3hrs. Credits :1.5

CAD experiments:

1. Initiating the graphics package; Setting the paper size, space; setting the limits, units; use of snap and grid commands.

2. Drawing of primitives (line, arc, circle, ellipse, triangle etc.)
3. 3D GEOMETRIC MODELING: Creation of 3D Models, Wire Frame, Surface, Solid modeling Techniques Using CAD Packages–CSG, B- Rep Approaches in Solid Modeling Feature Based Modeling Technique– Assembly–Detailing Exposure to Industrial Components – Application of GD&T

4. Drawing a flange.
5. Drawing a Bushing assembly.
6. Dimensioning the drawing and adding text.
7. Setting the layers and application of the layers.
8. Isometric and orthographic projections.
9. Viewing in Three dimensions.
10. Removal of hidden lines - Shading and rendering.

CAM experiments:

1. Preparation of manual part programming for CNC turning/Milling.
2. Part programming preparation through AutoCAD.
3. APT part programming for 2D - contour.
4. Machining of one job on CNC machine tool.
5. Robot programming through Teaching Box method.
6. Robot programming through computer.

FOURTH YEAR 1st SEMESTER

MEC- 4101 MACHINE DESIGN

(Effective from the batch admitted during 2019-2020- AICTE)

Periods/week : 4 Th Ses. : 30 Exam : 70

Examination (Theory): 3hrs. Credits :3

SYLLABUS

Classification of gears. Standard tooth systems. Spur, Helical, Bevel and Worm gears. Terminology of each. Tooth failure. Face width and beam strength. Lewis equation. Design for dynamic and wear loads. Force analysis of Bevel and Worm gears. Thermal design considerations of worm gears.

Engine parts: I.C. engine design. Design of cylinders and heads. Design of pistons. Design of cross-head, connecting rods and crank shafts.

Friction clutches. Torque capacity multi-plate clutches. Design considerations. Energy considerations and Temperature rise friction materials. Centrifugal clutches. Brakes. Energy equations. Band and block brakes. Internal expanding shoe brakes, self locking, brake design.

Sliding contact bearings. Lubrication modes. Temperature effect on viscosity. Journal bearing design. Bearing modulus. McKee equations.

Heating of bearings. Collar and thrust bearings. Roller and ball bearings. Static and dynamic load capacity. Equivalent bearing load. Load-life relationships. Load factor. Selection of bearings from manufacturers catalogue.

Design of crane hooks, Wire rope construction and classification. Stresses in wire ropes. Design for service like lifts and winches. Chain drives, Nomenclature: Brief outline and simple applications of composite materials.

Text books:

1. Design of Machine Elements by V.B. Bhandari, TMH publishing Co. Ltd., New Delhi.

References:

1. Machine Design by R.K. Jain, Khanna publications.
2. Mechanical Engineering Design by Joseph E. Shingley.

ELECTIVE- III: MEC-4102A. TOTAL QUALITY MANAGEMENT

(Effective from the batch admitted during 2019-2020- AICTE)

Periods/week : 4 Th Ses. : 30 Exam : 70

Examination (Theory): 3hrs. Credits :3

SYLLABUS

Concepts of TQM: Philosophy of TQM, Customer focus, Organization, Top management commitment, Team work, Quality philosophies of Deming, Crosby and Muller.

TQM process: QC tools, Problem solving methodologies, New management tools, Work habits, Quality circles, Bench marking, Strategic quality planning.

TQM systems: Quality policy deployment, Quality function deployment, Standardization, Designing for quality, Manufacturing for quality.

Quality system: Need for ISO 9000 system, Advantages, Clauses of ISO 9000, Implementation of ISO 9000, Quality costs, Quality auditing, Case studies.

Implementation of TQM: Steps, KAIZEN, 5S, JIT, POKAYOKE, Taguchi methods, Case studies.

References:

1. Total Quality Management by Rose, J.E., Kogan Page Ltd., 1993.
2. The Essence of Total Quality Management by John Bank, PHI, 1993.
3. Beyond Total Quality Management by Greg Bounds, Lyle Yorks et al, McGraw Hill, 1994.

4. The Asian Productivity Organization by Takashi Osada, 1991.
5. KAIZEN by Masaki Imami, McGraw Hill, 1986.

ELECTIVE-III MEC- 4102B OPTIMIZATION DESIGN

(Effective from the batch admitted during 2019-20 AICTE)

Periods/week : 4 Th Ses. : 30 Exam : 70

Examination (Theory): 3hrs. Credits :3

SYLLABUS

Introduction to Optimization: Engineering applications of optimization- Statement of an optimization problem- Classification of optimization problem- Optimization techniques.

Classical Optimization Techniques: Single variable optimization- Multivariable optimization with equality constraints- Multivariable optimization with inequality constraints.

Nonlinear Programming: One-Dimensional Minimization: Unimodal function- Elimination methods- Unrestricted search- Exhaustive search- Dichotomous search- Fibonacci method-

Golden section method- Interpolation methods- Quadratic interpolation method- Cubic interpolation method- direct root method.

Nonlinear Programming: Unconstrained Optimization Techniques: Direct search methods- Random search methods- Univariate method- Pattern search method- Rosenbrock's method of rotating coordinates- The simplex method- Descent methods- Gradient of function- Steepest descent method- Conjugate gradient method (Fletcher-Reeves method)- Quasi-Newton methods- Variable metric method (Davidon- Fletcher-Powell method).

Nonlinear Programming: Constrained Optimization Techniques: Characteristics of a constrained problem- Direct method- The complex method- Cutting plane method- Methods of feasible directions- Indirect methods- Transformation techniques- Basic approach in the penalty function method- Interior penalty function method- Convex programming problem- Exterior penalty function method.

Geometric programming (G.P): Solution of an unconstrained geometric programming, differential calculus method and arithmetic method. Primal dual relationship and sufficiency conditions. Solution of a constrained geometric programming problem (G.P.P). Complimentary geometric programming(C.G.P)

Dynamic programming(D.P): Multistage decision processes. Concepts of sub optimisation, computational procedure in dynamic programming calculus method and tabular methods.Linear programming as a case of D.P., Continuous D.P.

Integer programming(I.P): Graphical representation. Gomory's cutting plane method. Bala's algorithm for zero-one programming problem.Integer non linear programming.

Text Book:

1. Optimization Theory and Applications, by S.S.Rao, Wiley Eastern Limited, New Delhi.

References:

1. Optimization of Design of Machine Elements, by R.C.Johnson.
2. Computer Aided Analysis and Design of Machine Elements, by Rao V.Dukkipati, M.AnandaRao and R.B.Bhat.
3. Engineering optimization methods and applications, by G.V.Reklaitis, A.Ravindarn and K.M.Ragsdell, by Publications John Wiley and Sons.

ELECTIVE-III MEC- 4102C TOOL DESIGN

(Effective from the batch admitted during 2019-2020- AICTE)

Periods/week : 4 Th Ses. : 30 Exam : 70

Examination (Theory): 3hrs. Credits :3

SYLLABUS

Locating and Clamping Devices: Principles of Jigs and Fixtures design- Locating principles- Locating elements-Standard parts-Clamping devices-Mechanical actuation-Pneumatic & hydraulic actuation-Analysis of clamping forces-Tolerance and error analysis.

Jigs & Fixtures: Drill bushes-Different types of Jigs-Plate latch, channel, box, post, angle plate, angular post, turnover, pot jigs- Automatic drill jigs- Rack & Pinion Operated, Air operated Jigs Components. General principles of lathe, milling and broaching fixtures-Grinding, Drilling and shaping fixtures, Assembly, Inspection and Welding fixtures-Modular fixtures.Design and development of Jigs and fixtures for simple components.

Press Tools: Press working terminology-Presses and Press accessories-Computation of capacities and tonnage requirements-Design and development of various types of cutting, forming and drawing dies.

Tool Design for Numerically Controlled Machine Tools: Fixture Design for Numerically Controlled Machine Tools, Cutting Tools for Numerical Control, Tool-holding Methods for Numerical Control

Design of Limit Gauges: Elements, types and application of limit gauges, Gauge materials, their selection, Taylor's principles of gauge design, Types and methods to provide gauge tolerances. Design steps and design of plug & ring / snap gauge for given dimension and application.

Text Books:

1. Donaldson. C, Tool Design, Tata McGraw-Hill, 1986

2. "ASTME Handbook of Fixture Design ".Prentice Hall of India Pvt. Ltd.

3. Basu, Mukherjee, Mishra, Fundamentals of Tool Engg. Design, Oxford & IBH Publishing, N. Delhi

References:

1. A. K. Goroshkin, " Jigs and Fixtures Handbook ", Mir Publishers, Moscow, 1983.
2. "Die Design Handbook ", IvanaSuchy, McGraw Hill Book Co., 2005.
3. Production technology, HMT,Tata McGraw Hill.
4. P. Eugene Ostergaard, "Basic Die Making" - McGraw Hill Book, 1963.
5. Principle of Machine Tool. Sen& Bhattacharya,New Central Book Agencies, 1975.
6. Production tooling equipments,S. N. Parsons,Macmillan, 1966.

ELECTIVE-IV MEC- 4103A INSTRUMENTATION AND CONTROL SYSTEMS

(Effective from the batch admitted during 2019-2020- AICTE)

Periods/week : 4 Th Ses. : 30 Exam : 70

Examination (Theory): 3hrs. Credits :3

Instrumentations: Concepts of measurements, static performance, characteristics accuracy of measurement and its analysis. Instrumentation, for measurement: Force, torque, strain. pressure, flow, temperature and vibration. Optical Methods of Measurement: Introduction, Laser beam as a light pointer, length/displacement measurement, temperature sensors, seismographic measurement. Introduction to fiber optics, fiber types, properties of optical fibres and a fibre optic sensor configuration.

Introduction: Control systems, Feedback and its effects. Transfer Function, Block Diagram and Signal Flow Graph: Impulse response and Transfer functions of linear systems, Block diagrams.

Mathematical Modeling of Physical Systems: Equations of electrical networks, Modeling of mechanical system elements, Equations of mechanical systems. State-variable Analysis of Linear Dynamic Systems: Matrix representation of state equations, State transition matrix, State transition equation, relationship between state equations and high-order differential equations, relationship between state equations and transfer functions, Characteristic equation, eigen values and eigen vectors.

Time-Domain Analysis of Control Systems: Typical test signals for the time response of control systems, Time- domain performance of control systems- The steady- state error, Time- domain performance of control systems- Stability of control systems- stability, Characteristic equation and

the state transition matrix, Methods of determining stability of linear control systems, Routh- Hurwitz criterion.

Frequency-domain Analysis of Control Systems: Introduction, Nyquist stability criterion, Application of the Nyquist criterion, Stability of multi loop systems, Stability of linear control systems with time delays.

Text Books:

1. Automatic Control Systems, by Benjamin C. Kuo.
2. Mechanical Measurements, by R.S.Sirohi, H.G. Radha Krishna, Wiley Eastern, New Delhi.

References:

1. Experimental Methods for Engineers, by J.P.Holman, McGraw-Hill.
2. Instrumentation for Engineering Measurements, by R.H. Cerni and L.E.Foster, J.Wiley& Sons, New York.

ELECTIVE-IV MEC- 4103B SUPPLY CHAIN MANAGEMENT

(Effective from the batch admitted during 2019-2020- AICTE)

Periods/week : 4 Th Ses. : 30 Exam : 70

Examination (Theory): 3hrs. Credits :3

SYLLABUS

Role of supply chain management in Economy and Organization- Introduction to SCM, Evolution, Key concepts, Decisions and Importance of SCM.

Supply chain strategy and Performance Measures- Competetive supply chain strategies, CRM strategy, Supplier relationship strategy- Performance Measures (Financial, Productivity, Quality and cycle time).

Supply chain drives- Introduction, Facilities, Inventory, Transportation and Information. Supply chain design- Network design and operation models.

Sourcing and Transportation- Role of sourcing, Supplier selection and contracts, Procurement process, Role of Transportation, Design options for transportation network. Planning and Managing Inventories-Introduction, cycle/safety/seasonal stock, Inventory for short life cycle products, Multi echelon inventory. Information Technology in SCM- Role of IT, E-business and future trends. Supply chain innovations- Introduction, Supply chain integration, Restructuring, Agile supply chains.

References:

1. Supply chain management text and cases: Janat Shah, Pearson Education, 2009.
2. Supply chain management strategy, planning and operation, Sunil Chopra, Peter Meindl, PHI.
3. Supply chain management: Chopra, Pearson Education, 2009.

4. Business logistics/ Supply chain management, 5/e: Ballou, Pearson Education.

ELECTIVE-IV MEC- 4103C CONDITION MONITORING

(Effective from the batch admitted during 2019-2020- AICTE)

Periods/week : 4 Th Ses. : 30 Exam : 70

Examination (Theory): 3hrs. Credits :3

Introduction: Failures – System, Types of failures, Causes of failures, Maintenance Schemes – objectives – types and economic benefits, break down, preventive, predictive and Reliability monitoring.

Vibration Monitoring: Basic vibration theory, vibration measurement and analysis, machine vibration; Rotational machine faults and vibration characteristics. Applications of vibration monitoring to rotating machines. Vibration monitoring in practice - overall vibration monitoring and experience based spectrum analysis to detect machine condition and faults in bearings and gears. Current diagnostic techniques/tools commercially available, Commonly witnessed machinery faults diagnosed by vibration analysis.

Thermal Monitoring: Introduction to thermal monitoring; thermal monitoring techniques, application of thermal monitoring to manufacturing processes. Thermal imaging camera, and its application as a condition monitoring tool.

Lubricant analysis/monitoring: Introduction to tribology - lubricant types and their properties. Introduction to wear debris monitoring; collecting and quantifying wear debris; wear debris and oil analysis in practice.,SOAP, Ferrography and other spectrometric analysis techniques for wear rate evaluation and interpretation.

Sensors for condition monitoring: Accelerometers, strain gauges, eddy current probes and LVDT for measurement of displacement, velocity and acceleration. Lock in amplifier for signal conditioning. Thermocouples, thermistors, resistance thermometers and junction semiconductor devices for temperature measurement.Radiation pyrometers for temperature measurement, Thermal imaging devices.

Data acquisition and Analysis for condition monitoring: Fourier analysis and FFT, Sampling, Shannon's theorem, Analogue to digital conversion. Static characteristics of signals including mean, standard deviation, skewness and kurtosis, probability density function, power spectral density and autocorrelation.

Electrical Condition Monitoring: Overview of electrical plant and how the interaction of inherent stresses causes degradation of plant Components and affects equipment operation; Electrical contact methods for assessing electrical plant condition; Acoustic measurement of electrical plant condition; RF/UHF assessment of electrical plant condition; Chemical methods of assessing electrical plant condition

References

1. Rao J. S., Vibration Condition Monitoring, Narosa Publishing House, 2/e 2000.
2. Isermann R., Fault Diagnosis Application, Springer-Verlag Berlin, 2011.
3. Allan Davis, Hand book of Condition Monitoring, Chapman and Hall, 2000.
4. Choudary K K., Instrumentation, Measurement and Analysis, Tata McGraw Hill.
5. Collacott, R. A., Mechanical Faults Diagnosis, Chapman and Hall, London, 1990
6. Collacot R.A.- Mechanical fault diagnosis and condition monitoring
7. Hunt, T.M., (1993), Handbook of wear debris analysis and particle detection in liquids, Elsevier applied science, London and New York
8. Rao, B. (1996), Handbook of condition monitoring, Elsevier advanced technology, Oxford.
9. A Davis – Handbook of condition monitoring.
10. P Girdhar – Machinery vibration analysis and predictive maintenance
11. R G Eisenmann et-al – Machinery malfunction diagnosis and correction
12. John S Mitchell – Machinery analysis and monitoring
13. Mechanical Vibrations Practice with Basic Theory by V. Ramamurti, Narosa Publishing House.
14. Machinery Condition Monitoring: Principles and Practices by A. R. Mohanty (ISBN: 9781466593046, CRC Press, 2014)
15. NPTEL II Video Lectures: Machinery Condition Monitoring and Signal Processing by A R MOHANTY (NPTEL, 2013)

MEC- 4104 REFRIGERATION & AIR-CONDITIONING

(Effective from the batch admitted during 2019-2020- AICTE)

Periods/week : 4 Th Ses. : 30 Exam : 70
Examination (Theory): 3hrs. Credits :3

SYLLABUS

Principles of Refrigeration: Refrigeration and II law of thermodynamics- Methods of Refrigeration- Unit of Refrigeration- Applications of Refrigeration. Air cycle Refrigeration: Reversal Carnot cycle- Bell Colman cycle- Selection of Refrigeration systems for air crafts- Boot strap system- Regenerative cycle- Reduced ambient type- Comparisons of different systems.

Vapour Compression Refrigeration: Wet versus Dry compression- Effect of evaporator pressures and temperatures. Simple vapour

compression Refrigeration cycle and its analysis. Advantages and disadvantages of vapour compression Refrigeration system over Air compression Refrigeration system- Methods of improving C.O.P.- Multi compression system- Multiple evaporators expansion valves- Flash inter cooler- Defrosting- Hot gas defrosting.

Classification of Refrigerants: Nomenclature- Properties- Secondary refrigerants- Selection of refrigerants- Condensers- Air cooled, Water cooled and evaporative type- Evaporators- Once through, flooded, shell and tube Baudelot cooler- Expansion devices- Capillary expansion device, Thermostatic expansion device.

Absorption Refrigeration System: Basic absorption system- Aqua ammonia absorption system- Li-Br absorption refrigeration system- Electrolux refrigeration- C.O.P. of absorption refrigeration system- Comparison of vapour compression and vapour absorption system. Steam jet refrigeration system and analysis- Advantages and limitation- Ejector compression system. Psychrometry: Psychrometric properties and relations- Psy chart- Psy processes- Human comfort and comfort chart- Effective temperature and factors governing effective temperature. Air conditioning: Summer, Winter and year round air conditioning- Different types of Air conditioning load - By pass factor, RSHP, GSHP- Fresh air quantity- Cooling coils and Dehumidity- Air washers.

Text Books:

1. Refrigeration and Air conditioning, by C.P.Arora.
2. Refrigeration and Air conditioning, by P.L.Bellany.

References:

1. Refrigeration and Air conditioning, by Jordan R.C. and Priester G.B.
2. Principles of Refrigeration, by Dossat.
3. Refrigeration and Air-conditioning, by W.P.Stoecky.

MEC- 4105 HEAT AND MASS TRANSFER

(Effective from the batch admitted during 2019-2020- AICTE)

Periods/week : 4 Th Ses. : 30 Exam : 70
Examination (Theory): 3hrs. Credits :3

SYLLABUS

Introduction: Basic modes of heat transfer- Rate equations- Generalized heat conduction equation in Cartesian, Cylindrical and Spherical coordinate systems.

Steady state heat conduction solution for plain and composite slabs, cylinders and spheres- Critical thickness of insulation- Heat conduction through fins of uniform and variable cross section- Fin effectiveness and

efficiency. Unsteady steady state heat conduction- Transient heat conduction- Lumped system analysis, and use of Heisler charts.

Convection: Continuity, momentum and energy equations- Dimensional analysis- Boundary layer theory concepts- Free, and Forced convection- Approximate solution of the boundary layer equations- Laminar and turbulent heat transfer correlation- Momentum equation and

velocity profiles in turbulent boundary layers- Application of dimensional analysis to free and forced convection problems- Empirical correlation.

Radiation: Black body radiation- radiation field, Kirchoff's laws- shape factor- Stefan Boltzman equation- Heat radiation through absorbing media- Radiant heat exchange, parallel and perpendicular surfaces- Radiation shields.

Heat Exchangers: Types of heat exchangers- Parallel flow- Counter flow- Cross flow heat exchangers- Overall heat transfer coefficient- LMTD and NTU methods- Fouling in heat exchangers- Heat exchangers with phase change.

Boiling: Different regimes of boiling- Nucleate, Transition and Film boiling. Condensation: Laminar film condensation- Nusselt's theory- Condensation on vertical flat plate and horizontal tubes- Dropwise condensation.

Mass Transfer: Conservation laws and constitutive equations- Isothermal equimass, Equimolar diffusion- Fick's law of diffusion- diffusion of gases, Liquids- Mass transfer coefficient.

Text Books:

1. Heat Transfer, by J.P.Holman, Int. Student edition, McGraw Hill book company.
2. Analysis of Heat transfer, by Eckert and Drake, Int.Student edition, McGraw Hill Kogakusha Ltd.

References:

1. Heat and Mass Transfer by R.K. Rajput, S. Chand & Co.
2. Heat and mass transfer by Sachjdeva.
3. Heat and mass transfer by Kothandaramanna, New Age International

MEC- 4106 STATISTICAL QUALITY CONTROL

(Effective from the batch admitted during 2019-20 AICTE)

Periods/week : 4 Th Ses. : 30 Exam : 70
Examination (Theory): 3hrs. Credits :3

SYLLABUS

Introduction to quality, definitions, Taguchi's loss function, examples of off-line and on-line quality control techniques, quality costs, Deming's philosophy, introduction to six sigma concept.

Shewart's normal bowl, control charts for variables, 'X', R and sigma control charts, theory of runs, ARL and ATS, Type-I and Type-II errors

Control charts for attributes, p-chart, standardized p-chart, np-chart, c-chart, u-chart, demerit control chart.

Process capability analysis: using frequency distribution and control charts. Process capability ratios, Cp and Cpk Process capability ratios for nominal the better type, smaller the better type and larger the better type product specifications.

Sampling plans: single, double, multiple and sequential sampling plans, rectifying inspection, AOQ, AOQL, and ATI. Use of Dodge Romig Tables, Design of single and sequential sampling plans.

Text Books:

1. Introduction to statistical quality control by E.L. Grant
2. Introduction to statistical quality control by D.C. Montgomery

MEC- 4107 METROLOGY AND MECHATRONICS LAB

(Effective from the batch admitted during 2019-2020-AICTE)

Periods/week : 3 Lab Ses. : 50 Exam : 50

Examination (Theory): 3hrs. Credits :1.5

METROLOGY LAB. EXPERIMENTS - (Any Five)

1. Calibration of the following instruments: (using slip gauges)
 - i. Calibration of Micrometer. ii. Calibration of Mechanical Comparator.
 - iii. Calibration of Vernier Caliper. iv. Calibration of Dial Gauge.
2. Measurement of taper angle using
 - i. Bevel Protractor ii. Dial Gauge iii. Sine-Bar iv. Auto-Collimator.
3. Alignment tests:
 - i. Parallelism of the spindle ii. Circularity & Concentricity of the spindle
 - iii. Trueness of running of the spindle.
4. Gear parameters Measurement
 - i. diameter, pitch/module ii. Pitch circle diameter iii. Pressure angle iv. Tooth thickness.
5. Check the flatness of a surface plate.
 - i. Using spirit level ii. Using Auto-collimator

6. Using light wave interference:
 - i. Study of flatness of slip gauges ii. To find the height of a slip gauge.
7. Tool Maker's Microscope:
 - i. Establish the thread details ii. To find the cutting tool angles.
8. Miscellaneous:
 - i. To find the diameter of a cylindrical piece ii. Taper angle of a V-block

iii. Central distance of two holes of a specimen.

MECHATRONICS LAB. EXPERIMENTS - (Any Five)

I. Training on Programmable Logic Controller (any ONE of the Following)

- i) Lift Control Using Ladder Logic Programme
- ii) Traffic Signal Control using Ladder Logic Programme

II. Training on Programmable Logic Controller - Sensor Training Kit

- a) Proximity Switch
- b) Photo Electric Switch
- c) Limit Switch

III. Training on Sensor and Transducer (any ONE of the Following) i). Linear position or Force applications

- a. LVDT (Linear variable differential transformer)
- b. The strain gauge Transducer

ii). Rotational Speed or Position Measurement (The inductive Transducer) iii). Linear or Rotational Motion

- a. D.C. Solenoid
- b. D.C. Relay

IV. Training on Automation Studios i). Punch Machine operation

ii). Hydraulic Cylinder operation

V. Training on Material Handling

VI. Training on any Controller Package

VII. Training on Servo Fundamental Trainer.

MEC- 4108 INDUSTRIAL ENGINEERING LAB

(Effective from the batch admitted during 2019-2020 AICTE)

Periods/week : 3 Lab Ses. : 50 Exam : 50

Examination (Theory): 3hrs. Credits :1.5

LIST OF EXPERIMENTS:

1. To measure the skill and dexterity in the movement of Wrist and Fingers using pin board.
2. To measure the Heart beat using Stethoscope.
3. To show that the sample means from a normal universe follow a normal distribution.
4. To draw the control chart for fraction defective for a given lot of marble balls.
5. To determine the cycle time using PMTS.
6. To draw two handed process charts for
 - i. Bolt, Washer and nut assembly
 - ii. Assembly of electric tester.
7. To study the changes in heart rate for different subjects using Tread mill.
8. To draw Multiple Activity chart using an electric toaster.
9. To determine the percentage utilization using work sampling.
10. To study the process capability of a given process.
11. To measure the Heart rate during working and recovery periods of the subjects under different loads, using Bicycle ergometer.
12. To draw flow process charts on activities in Workshop/ Laboratory/Office.
13. To determine the time required to perform motion sequence using work factor system.
14. To draw SIMO charts for
 - i. Ball point pen assembly
 - ii. Electric plug assembly.
15. To conduct time study of the bulb holder assembly operation of the existing method.
16. To collect the anthropometrics data using 'Anthropolometer'.

MEC- 4109 HEAT AND MASS TRANSFER LAB

(Effective from the batch admitted during 2019-2020 AICTE)

Periods/week : 3 Lab Ses. : 50 Exam: 50

Examination (Theory): 3hrs. Credits :1.5

LIST OF EXPERIMENTS:

1. Study of conduction phenomena in the composite slab system.
2. Determination of emissivity, time constant, FouriesBiot module and study of variation of temperature with respect to time on a circular disc.
3. Study of heat transfer by forced convection through a horizontal test section.

4. Study of heat transfer by forced convection through a vertical test section.
5. Determination of free convective heat transfer coefficient from a horizontal cylinder in air.
6. Determination of thermal conductivity of brass employing it as a fin.
7. Tests on natural convection and pool boiling.
8. Study of forced convection with turbulence promoters.
9. Study of condensation on fin.
10. Tests on film condensation.
11. Determination of COP of a vapour compression refrigeration system.
12. Study of vapour compression air conditioning system.

FOURTH YEAR 2nd SEMESTER

MEC-4201 PROJECT WORK

(Effective from the batch admitted during 2019-2020 AICTE)

Code No	Course	Credits	Lecture	Lab	Total	Contact	Sessional	Exam	Total
			Hrs	Hrs	Hrs	Hrs/Week		Marks	
MEC4201	Project Work	13.5					50	50	100

METALLURGICAL ENGINEERING

SCHEME OF INSTRUCTION & SYLLABUS FOR BTECH (METALLURGICAL ENGINEERING)

(Effective from 2019 -20 admitted Batch - As per AICTE Scheme)

III / IV First semester

Code No	Subject	Periods	Exam	Sessionals	Exam	Total	Credits
		L T P	Hours		Marks	Marks	
MET 311	Materials Characterization	3 1 —	3	30	70	100	3
MET 312	Advances in Iron making	3 1 —	3	30	70	100	3
MET 313	Non-Ferrous Extractive Metallurgy - I	3 1 —	3	30	70	100	3
MET 314	Steel Making	3 1 —	3	30	70	100	3
MET 315	Metal Joining Processes	3 1 —	3	30	70	100	3
MET 316	PEC-I: Foundry Technology	3 1 —	3	30	70	100	3
MET 317 P	Metal Casting Lab	— — 3	3	50	50	100	1.5
MET 318	Soft Skills	— — 3	3	50	50	100	1.5
TOTAL		30	24	280	520	800	21

III / IV Second semester

Code No	Subject	Periods	Exam	Sessionals	Exam	Total	Credits
		L T P	Hours		Marks	Marks	
MET 321	Heat Treatment	3 1 —	3	30	70	100	3
MET 322	Foundry Practices	3 1 —	3	30	70	100	3
MET 323	Metal Forming	3 1 —	3	30	70	100	3
MET 324	Advances in Steel Making & Production of Ferro Alloys	3 1 —	3	30	70	100	3
MET 325	Non-Ferrous Extractive Metallurgy - II	3 1 —	3	30	70	100	3
MET 326	PEC-II: Composite Materials	3 1 —	3	30	70	100	3
MET 327	Mandatory Course (MC): Indian Constitution/Essence of Indian Traditional Knowledge	- - -	-	100	-	100	0
MET 328 P	Heat Treatment Lab	— — 3	3	50	50	100	1.5
MET 329 P	Materials Processing Lab	— — 3	3	50	50	100	1.5
TOTAL		30	24	280	520	800	21

BTECH (METALLURGICAL ENGINEERING)

(Effective from 2019 -20 admitted Batch - As per AICTE Scheme)

IV / IV First semester

Code No	Subject	Periods	Exam	Sessionals	Exam	Total	Credits
		L T P	Hours		Marks	Marks	
MET 411	Strengthening mechanisms	3 1 —	3	30	70	100	3
MET 412	Environmental degradation of Materials	3 1 —	3	30	70	100	3
MET 413	Engineering Materials	3 1 —	3	30	70	100	3
MET 414	Humanities (OEC-II): Entrepreneurship	3 1 —	3	30	70	100	3
MET 415	PEC-III: Nano materials	3 1 —	3	30	70	100	3
MET 416	PEC-IV: Powder Metallurgy	3 1 —	3	30	70	100	3
MET 417	PEC-V: Failure Analysis	3 1 —	3	30	70	100	3
MET 418 P	Electro-Metallurgy lab	— — 3	3	50	50	100	1.5
TOTAL		33	21	280	520	800	22.5

IV / IV Second semester

Code No	Subject	Periods	Exam	Sessionals	Exam	Total	Credits
		L T P	Hours		Marks	Marks	
MET 311	Materials Characterization	3 1 —	3	30	70	100	3
MET 421	Project	— — 20	—	50	50	100	15

TOTAL	20	—	50	50	100	15
Total Credits: 160						
Year	I Semester	II Semester	Total			
First	19	19.5	38.5			
Second	21	21	42			
Third	21	21	42			
Fourth	22.5	15	37.5			
Total Credits			160			

SYLLABUS - III / IV First semester

MET 311 – MATERIALS CHARACTERIZATION

Periods/week: 3L -1T Credits: 3 Sessionals: 30
Exam:70

Metallography- Macro and Micro examination of examination of metals and alloys, principles of construction of optical and electron microscopes. Resolution and magnification. Optical aberrations and correction for image quality. Specimen preparation, technique for transmission electron microscopy.

Production and properties of X-rays, Electromagnetic radiation, continuous and characteristics spectrum, absorption. Fillers. Diffraction. Bragg's law, scattering by atom, electron, unit cell, structure factor calculation.

Diffraction Methods: Laue's method, rotating crystal, Debye scherrer – Specimen preparation, film loading, powder method, Determination of crystal structure, determination of precision lattice parameter, sources of error in measurements.

Applications – Effect of plastic deformation. Determination of particle size, grain size, residual stresses, determination of phase diagrams, order-disorder transformation.

Text books:

1. X-ray diffraction – B.D.Cullity

MET 312 - ADVANCES IN IRON MAKING

Periods/week: 3L -1T Credits: 3 Sessionals: 30 Exam: 70

Sponge Iron making: Principles and classification of sponge iron processes, Coal based processes: Rotary kiln process; Rotary hearth furnace process (Fastmet process, ITmk3 process); Gas based processes – Finmet process, Midrex process, HYL processes (HYL -III & HYL -IVM processes).

Smelting Reduction (SR): Fundamental of SR, Classification and important SR processes: Mini Blast Furnace process, COREX process, Finex process, Fastmelt process, Hismelt process, Romelt process.

Text books:

1. Iron making & Steel Making- Theory and Practice- Ahindra Ghosh, Amit Chatterjee
2. Sponge Iron Production by Direct reduction of Iron Oxide – Amit Chatterjee
3. Hot metal production by Smelting Reduction of Iron Oxide - Amit Chatterjee

MET 313 - NON FERROUS EXTRACTIVE METALLURGY –I

Periods/week: 3L -1T Credits: 3 Sessionals: 30 Exam: 70

Extraction of Metals. Aluminum. Uses. Ores. Bayer's process of Alumina production. Hall-Heroult process. Cryolite and carbon electrode manufacture. Hoopes process of refining. Indian plant practice. New processes. Alcoa process.

Magnesium. Uses. Ores. Pidgeon's process. Extraction by Dows process.

Tin: Uses. Ores. Concentration, smelting and refining.

Copper. Uses. Pyro-metallurgical processes. New processes. Flash smelting. WORCA and Noranda processes. Hydro-metallurgy of copper. Copper production in India.

Nickel: Brief description of Ni extraction from sulphide ores.

Lead. Uses. Ores. Treatment of ore and production of metal.

Zinc. Uses. Pyro-metallurgical and hydro-metallurgical extraction methods. Imperial smelting process.

Text books:

1. Extraction of Non-Ferrous Metals, HS Ray, R Sridhar and KP Abraham

References:

1. Metallurgy of Non-Ferrous Metals, Dennis, WH
2. Non-Ferrous Metallurgy, Sebyukov, N Min, Pub. Moscow

MET 314 - STEEL MAKING

Periods/week: 3L -1T Credits: 3 Sessionals: 30 Exam: 70

History of Steel Making: Cementation and crucible processes.

Principles Steel Making: Chemistry of Steel Making processes, Theories of slag. Oxidation of Si, Mn and C. Desulphurization, Dephosphorization and deoxidation. Mixers, Raw materials for steel making

Pneumatic Steel Making Process: Acid and basic Bessemer process, Side blown converter.

Open Hearth Process: Operation and chemistry of the process. Developments in OHP: AJAX, TANDEM, Tilting and twin hearth process.

BOF Process: LD, LD-AC, LAM process, OG process, Kaldo, Rotor and OBM.

Electric Furnace Process: Various electric processes, their advantages and limitations. EAF construction, lining and operation. Discussion on manufacture of stainless steel.

Casting: Pit side process and teeming methods. Ingot moulds. Solidification of steel. Ingot defects and remedies. Continuous casting of steel.

Text books:

1. Steel Making, R.H.Tupkary
2. Steel Making, Kudrin
3. Steel Making, Biswas

References:

1. The making, shaping and treating of steel-USS.

MET 315 - METAL JOINING PROCESSES

Periods/week: 3L -1T Credits: 3 Sessionals: 30 Exam: 70

Introduction. Importance and classification. Basic concepts in arc welding and gas welding. General theory of arc welding. Principle, operation and application of shielded metal arc welding. Tungsten inert gas, plasma arc, studs, submerged arc, metal inert gas and CO₂ welding processes. Electro-slag welding.

Resistance welding processes. Spot, seam, flash butt, upset butt, Thermit welding, Electron beam and laser beam welding. Solid state welding processes. Diffusion bonding, ultrasonic. Explosive, friction welding. Soldering and brazing.

Text books:

1. Welding and Welding Technology, R.L.Little
2. Welding Technology, N.K.Srinivasan

MET 316 - FOUNDRY TECHNOLOGY

Periods/week: 3L -1T Credits: 3 Sessionals: 30 Exam: 70

Introduction. Status of foundry industry and comparison with other manufacturing processes. Types of foundries. Basic operations.

Patterns. Pattern making. Materials for pattern making. Types of patterns. Pattern allowance. Core boxes.

Moulding materials. Properties. Preparation and testing.

Moulding processes. Sand moulding. Moulding techniques. Hand and machine compaction. Machine moulding. Cores and core making. Sodium silicate processes. Shell, Investment and Die-casting. Centrifugal casting.

Solidification – Crystallization and development of cast structure. Directional solidification and single crystal growth. Foundry characteristics.

Principles of gating and risering. Casting design considerations.

Text books:

1. Principles of Metal Casting, Heine, Loper and Rosenthal, Tata Mc Grawhill
2. Foundry Technology, PC Jain, Tata Mc Grawhill
3. Foundry Technology, PR Beely, London-Butterworths.

MET 317 P- METAL CASTING LAB

Periods/week: 3P Credits: 1.5 Sessionals: 50 Exam: 50

List of Experiments

Various sand tests will be carried out like:

1. Permeability test
2. Green Compression
3. Green Shear
4. Dry Compression
5. Dry shear
6. Toughness
7. Hardness
8. Shatter Index
9. Clay content
10. AFS grain size measurement

MET 318 – SOFT SKILLS

Periods/week: 3P Credits: 1.5
Sessionals: 100

1. Basic skills, Listening, Speaking, Reading, Writing
2. Non-Verbal, Grooming (Personnel Appearance), Using Space, Body Language, Paralanguage
3. Basic Etiquette, Introducing, Conversation-Small talks, Table Manners, Telephone / Cell phone manners
4. Goal Setting, Immediate, short term, long term, Smart Goals, Strategies to achieve goals
5. Time-Management, Types of time, Identifying time wasters, Time Management Skills

6. Using Telephone, Making and receiving calls, Handling wrong numbers and unnecessary calls, Intonation, Enunciation

7. Leadership and Team Management, Qualities of good leader, Leadership styles, Decision Making, Problem solving, Negotiation skills

8. Assertiveness, Assertiveness and aggressiveness, Disagreement, Openness and Expressiveness, Self Concept, Positive thinking

9. Group Discussion, Purpose (intellectual ability, Creativity, Approach to a problem, solving, Tolerance, Qualities of a leader), Group behaviour, Analysing Performance

10. Job Interview, Identifying Job Openings, Preparing a Resume (Basic, Functional, specific), Covering letter (solicited / unsolicited), Interview (Opening, Body-Answer Q, Close-Ask Q), Types of questions, Handling difficult questions

Reference Books

1. '*Technical Communication*' *Principles & practice* by Meenaskshi Raman and Sangeetha Sharma, Oxford University Press.

2. '*Development Communication Skills*' by Krishna Mohan & Meera Banerji, Macmillan Publishers.

3. '*Technical Writing*' *Process and Product* by Sharon J.Gerson & Steven M.Gerson, Pearson Education Publishers

4. '*Technical Communication skills*' by Rizvi, Tata McGraw Hill Publications

5. '*The Oxford Guide to Writing and Speaking*' by John Seely, Oxford University Press

SYLLABUS - III / IV Second semester

MET 321 - HEAT TREATMENT

Periods/week: 3L -1T Credits: 3 Sessionals: 30
Exam: 70

Phase transformation in Fe-C system, Critical temperatures. Austenite grain size designation. Inherently fine-grained and inherently coarse grained steel. Importance of grain size and its determination. Heat Treatment Furnaces and atmospheres.

T-T-T Curves. Effect of cooling on transformation of austenite, pearlite, bainite and martensite. Annealing, normalizing, hardening and tempering of steels. Austempering. Martempering. Patenting and spheroidizing.

Effect of alloying elements. Hardenability of steels. Factors affecting and its determination. Thermo-mechanical treatments. Ausforming.

Surface hardening. Carburising, nitriding, cyaniding, carbonitriding. Induction and flame hardening.

Text books:

1. Heat treatment, Rajan

2. Heat treatment of metals, Zakharov

References:

1. Physical Metallurgy, V.Raghavan

2. Introduction to Physical Metallurgy, S.H.Avner

3. Physical Metallurgy Principles, R.E. Reed-Hill.

4. Physical Metallurgy for Engineers, Clark and Varney

MET 322 - FOUNDRY PRACTICES

Periods/week: 3L -1T Credits: 3 Sessionals: 30
Exam: 70

· General principles of melting Cupola and its operation. Modern developments in cupola. Melting practice of Al, Cu and Mg alloys.

· Defects in castings.

· Fettling.

· Inspection and quality control.

· Metallurgy of cast irons. Foundry practices of white, gray, SG and malleable irons. Alloy cast irons.

· Steel foundry practice.

· Modernization and mechanization of foundries

Text books:

1. Principles of Metal Casting, Heine, Loper and Rosenthal, Tata McGrawhill

2. Foundry Technology, PC Jain, Tata McGrawhill

3. Foundry Technology, PR Beely, London-Butterworths.

MET 323 - METAL FORMING

Periods/week: 3L -1T Credits: 3 Sessionals: 30
Exam: 70

Fundamentals of metal working. Classification of forming processes. Flow-stress determination. Temperature in metal working. Strain-rate effects. Metallurgical Structure. Friction and Lubrication.

Forging classification. Forging equipment. Open die and closed die forging. Calculation of forging loads in closed die forging. Forging defects. Rolling classification. Rolling mills and accessories. Hot and cold rolling. Forces and geometric relationships in rolling. Rolling variables. Problems and defects in rolled products.

Extrusion. Classification. Extrusion equipment. Hot extrusion. Deformation, lubrication and defects in extrusion. Hydrostatic extrusion.

Extrusion of tubing. Miscellaneous working operations . Drawing of rods wires and tubes.. Sheet metal forming.

Text Books

1. Mechanical Metallurgy by G.E. Dieter McGraw Hill Book Co.,

MET 324 - ADVANCES IN STEEL MAKING & PRODUCTION OF FERRO ALLOYS

Periods/week: 3L -1T Credits: 3 Sessionals: 30
Exam: 70

Hybrid Steel making processes, SIP and EOF process.

Continuous steel making processes: WOCRA, IRSID, Spray steel making, Recent trends in steel making processes.

Secondary steel making processes: Stirring Treatments, Synthetic slag refining, Injection metallurgy, Plunging Techniques, Post solidification treatments, vacuum treatments, decarburization techniques, secondary refining furnaces (LF furnace).

Gases in steel, vacuum treatment of liquid steel

Production of Ferro alloys: Fe-Si, Fe-Mn, Fe-Cr, Fe-V, Silico-Manganese.

Text books:

1. Steel Making, R.H.Tupkary
2. Steel Making, Kudrin
3. Steel Making, Biswas

References:

1. The making, shaping and treating of steel-USS.

MET 325 - NON FERROUS EXTRACTIVE METALLURGY –II

Periods/week: 3L -1T Credits: 3 Sessionals: 30 Exam: 70

Production flow sheets of extraction of Gold and Silver.

Uranium. Extraction of Uranium. Production flow sheet of Jaduguda ore. Production flow sheets of extraction of Thorium.

Brief outlines of extraction of Plutonium.

Titanium. Production of Titanium chloride from Ilmenite. Production of Ti sponge.

Zirconium production in India.

Nuclear Reactor Technology. Fuel for nuclear reactors. Basic components of a reactor characteristics and requirements. Types of reactors.

Text books:

1. Extraction of Non-Ferrous Metals, HS Ray, R Sridhar and KP Abraham

References:

1. Metallurgy of Non-Ferrous Metals, Dennis, WH
2. Non-Ferrous Metallurgy, Sebyukov, N Min, Pub. Moscow

MET 326 - COMPOSITE MATERIALS

Periods/week: 4 Credits: 3 Sessionals: 30
Exam: 70

Introduction: Definition, classification, properties, applications, advantages and limitations of composites, Types of matrix and reinforcements, and their properties. Mechanics of Composites, Iso strain and Iso stress conditions, Role of fibers, Critical fiber length.

Fabrication of Polymer Matrix Composites (PMCs): Properties, Applications and Limitations of PMCs; Various fabrications methods- Hand Layup technique, Spray Up Technique, Filament welding, Pultrusion, Autoclave based methods, Injection moulding, Extrusion.

Fabrication of Metal Matrix Composites (MMCs): Properties, Applications of MMCs; Fabrications methods: Liquid methods- Duralcan process, Spray forming, Squeeze casting, Stir casting; Solid state process-Diffusion bonding.

Fabrication of Ceramic Matrix Composites (CMCs): Properties, Applications and limitations of CMCs; Various fabrications methods: Cold pressing and sintering, Hot pressing, Liquid infiltration, Lanxide process.

Fabrication of Carbon-Carbon Composites (CCCs): Properties, Applications and limitations of CCCs; Processing of CCC- Solid, Liquid and Gas phase pyrolysis processes.

Text books:

1. Materials Science and Engineering: An Introduction - William D Callister Jr
2. Composite Materials-Krishma K Chawla

Reference books:

1. ASM Handbook Volume 21: Composites

MET 327: MANDATORY COURSE (MC):

INDIAN CONSTITUTION / ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

Periods/week: 0 Credits: 0 Sessionals: 100
Exam: 0

Course content

1. Meaning of the constitution law and constitutionalism

2. Historical perspective of the Constitution of India
3. Salient features and characteristics of the Constitution of India
4. Scheme of the fundamental rights
5. The scheme of the Fundamental Duties and its legal status
6. The Directive Principles of State Policy – Its importance and implementation
7. Federal structure and distribution of legislative and financial powers between the Union and the States
8. Parliamentary Form of Government in India – The constitution and status of the President of India
9. Amendment of the Constitutional Powers and Procedure
10. The historical perspectives of the constitutional amendments in India
11. Emergency Provisions : National Emergency, President Rule, Financial Emergency
12. Local Self Government – Constitutional Scheme in India
13. Scheme of the Fundamental Right to Equality
14. Scheme of the Fundamental Right to certain Freedom under Article 19
15. Scope of the Right to Life and Personal Liberty under Article 21

MET 328 P - HEAT TREATMENT LAB

Periods/week: 3P Credits: 1.5 Sessionals: 50 Exam:

50

List of Experiments:

1. Annealing, Normalizing, hardening and tempering of steels.
2. Recovery and recrystallization of cold worked metal.
3. Effect of quenching media on hardening
4. Study of welded structures.
5. Jomney End Quench Test.
6. Pack carburizing of low carbon steels.
7. Age hardening of aluminum alloys
8. Effect of time and temperature on tempering

MET 329 P - MATERIALS PROCESSING LABORATORY

Periods/week: 3P Credits: 1.5 Sessionals: 50 Exam: 50

Use of basic tools and operations of the following trades

S.No.	Trade	Number of jobs

1	Foundry	4
2	Welding	4
3	Machining	Step and taper turning-2

SYLLABUS - IV / IV First semester

MET 411 - STRENGTHENING MECHANISMS

Periods/week: 3L -1T Credits: 3 Sessionals: 30 Exam: 70

Strengthening from grain boundaries, Hall-Petch relation, ASTM grain size measurement, yield-point phenomenon, strain aging.

Solid solution strengthening: Elastic interaction, modulus interaction, stacking fault interaction, electrical interaction, short range order interaction, long range order interaction.

Cold working: Strain hardening of single crystals, annealing of cold worked metal, recovery, recrystallization and grain growth.

Strengthening from fine particles: Principle, mechanisms and examples of Precipitation hardening (age hardening), Dispersion hardening. Fiber strengthening, strength and moduli of composites (Iso-strain and Iso-stress condition), influence of fiber length, orientation and concentration

Strengthening by phase transformations: Annealing, Normalizing and Hardening. Martensite strengthening.

Text Books:

1. Mechanical Metallurgy - George E Dieter
2. Mechanical Behaviour of Materials - Thomas H Courtney
3. Materials Science and Engineering an Introduction - William D Callister Jr
4. Materials Science and Engineering – V Raghavan

MET 412 - ENVIRONMENTAL DEGRADATION OF MATERIALS

Periods/week: 3L -1T Credits: 3 Sessionals: 30 Exam: 70

Corrosion – Electrochemical aspects of Corrosion. Corrosion cells/Electro chemical cells, Determination of Electrode potential. Thermodynamic aspects - Nernst equation, Galvanic series. Polarization resistance , Linear polarization technique

Corrosion – Practical aspects .Importance. Direct and indirect losses. Types and Forms of Corrosion. Uniform Corrosion, Pitting Corrosion, Galvanic Corrosion, and Intergranular Corrosion, Stress Corrosion cracking. Cavitation Erosion, Erosion Corrosion. Corrosion Fatigue.. Effect of velocity, flow-rate, concentration, temperature and inhibitors on corrosion rates. Corrosion rate calculations. Coatings and anodizing Method. Cathodic and Anodic protection.

Text books:

1. An introduction to Electrometallurgy, Sharan and Narain, Standard Publishers

2. Corrosion Engineering, MG Fountana, Mc-Graw Hill book company

MET 413 - ENGINEERING MATERIALS

Periods/week: 3L -1T Credits: 3 Sessionals: 30 Exam: 70

Classification, properties and applications of:

- Carbon Steels: Low, medium and high carbon steels, HSLA, Dual Phase steels
- Alloy Steels: High strength structural steels, Tool steels, Stainless steels, High Temperature alloys
- Cast irons: White cast iron, Malleable Cast iron, Grey Cast iron, Ductile Cast iron
- Light alloys: Al, Mg, Ti, Be and its alloys
- Copper and its alloys

Text Books

1. Introduction to Physical Metallurgy - SH Avner

2. Physical Metallurgy Principles and Practice –Raghavan.V

MET 414 - HUMANITIES (OEC-II): INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP

Periods/week: 3L -1T Credits: 3 Sessionals: 30 Exam: 70

Unit-I : Basic Concepts of Management: Management: - Definition, Nature and Importance ; Functions of the Management; Levels of Management; F.W Taylor's Scientific Management; Henry Fayol's Principles of Management; (Eight Periods)

Unit-II:Forms of Business Organizations: Introduction, Types of Business organizations: Private Sector- Individual Ownership , Partnership, Joint stock companies and Co-Operative organizations; Public sector- Departmental Organizations, Public Corporations and Government Companies; The Joint sector Management.(Eight periods)

Unit-III:Production and operations Management: Plant location-Factors to be considered in the selection of Plant location; Break - even analysis- Significance and managerial applications; Importance of Production Planning and Control and its Functions; Human Resource Management and Functions of Human Resource Manager (in brief); Functions of Marketing; Methods of Raising Finance. (Ten periods)

Unit-IV:Entrepreneurship: Definition, Characteristics and Skills , Types of Entrepreneurs, Entrepreneur vs. Professional Managers, , Growth

of Entrepreneurs, Nature and Importance of Entrepreneurs, Women Entrepreneurs, Problems of Entrepreneurship.(Six periods)

Unit-V: Entrepreneurial Development and Project Management: Institutions in aid of Entrepreneurship Development, Idea generation: Sources and Techniques; Stages in Project formulation ; Steps for starting a small enterprise - Incentives for Small Scale Industries by Government. (Eight periods)

Text Books:

(1) Sharma,S.C, and Banga, T.R., Industrial Organization & Engineering Economics, Khanna Publishers, Delhi, 2000.

(2) Vasant Desai , The Dynamics of Entrepreneurial Development and Management (Planning for future Sustainable growth), Himalayan Publishing House, 2018.

Reference Books:

(1) Aryasri , A.R., Management Science, McGraw Hill Education (India Private Limited , New Delhi 2014.

(2) Sheela, P. and Jagadeswara Rao, K., Entrepreneurship, Shree Publishing House, Guntur, Andhra Pradesh, 2017.

MET 415 –NANO MATERIALS

Periods/week: 3L -1T Credits: 3 Sessionals: 30 Exam: 70

Importance of Nano–Technology, Emergence of Nano–Technology, Bottom-Up and Top–down approaches, challenges in Nano–Technology.

Zero-dimensional Nano particles through homogeneous nucleation: Growth of nuclei, synthesis of metallic nano particles, Nano particles through heterogeneous nucleation:

One-dimensional Nano wires and rods, Spontaneous growth: Evaporation and Condensation growth,

Two Dimensional Nano-structures, Physical Vapour Deposition (PVD), Chemical Vapour Deposition (CVD), Atomic Layer Deposition (ALD).

Carbon Nano tubes (CNTs) and Applications of Nano materials.

Text Books:

1. Nanostructures and Nanomaterials: Synthesis, properties and applications Guozhong Cao – Imperial College Press.

MET 416- POWDER METALLURGY

Periods/week: 3L -1T Credits: 3 Sessionals: 30 Exam: 70

Introduction: Advantages and limitations of powder metallurgy.

Powder production methods: Mechanical, Chemical, Electrolytic and atomization Methods. Commercial production of metallic powders.

Powder characteristics: Composition and structure, particle size, shape, specific surface, surface topography, flow rate, apparent and tap density, pressing properties.

Compaction of metal powders: Pressure and Pressureless compaction techniques: Die compaction, Cold Isostatic pressing, Powder rolling, Powder forging, Explosive forming; High Temperature Compaction methods: Hot Pressing, Hot Extrusion, Spark Plasma Sintering, H I P.

Principles and practice of sintering: Sintering mechanisms, stages of sintering, Driving forces for sintering, sintering atmospheres, Liquid phase sintering, Post sintering operations.

Applications of powder metallurgy: Cermets, bearing materials, dispersion strengthened materials and other miscellaneous applications.

Text Books

1. Powder Metallurgy Science, Technology and Applications – P.C. Angelo & R. Subramanian
2. Powder Metallurgy – J.S. Hirschhorn
3. Treatise on Powder Metallurgy – C. Goetzl, vol. 1&2.
4. Powder Metallurgy Practice and Applications – R.L. Sands & C.R. Shakespeare.
5. Handbook of Powder Metallurgy – H. H. Hausner & M. Mal- 2nd Ed.

MET 417 -FAILURE ANALYSIS

Periods/week: 3L -1T Credits: 3 Sessionals: 30
Exam: 70

Sources of Failures, Steps in Failure Analysis, Characteristics of ductile and brittle fracture, ductile to brittle transition. High temperature failures, Fatigue failures, Corrosion failures and their identification, Failures of industrial components like casting and welding. Some case studies in failure analysis.

Text Books/Reference:

Analysis of Metallurgical failures-VJ Collangelo and PA Heiser

MET 418 P - ELECTRO METALLURGY LAB

Periods/week: 3L -1T Credits: 3 Sessionals: 30
Exam: 70

LIST OF EXPERIMENTS:

1. Experimental verification of Faraday's laws.
2. Determination of throwing power of electrolytes.
3. Electro plating of copper.
4. Electro plating of Nickel.

5. Anodizing of Aluminium.

B.TECH (IT) 4th YEAR I-SEMESTER SCHEME OF INSTRUCTION AND EXAMINATION

(For the 2019-2020 admitted batch)

Sub Ref.No	Name of the Subject	Periods			Maximum marks		Credits
		Theory	Tutorial	Lab	Exam	Internal	
CSE411	ELECTIVE-IV	3	1	—	70	30	100 3
CSE412	ELECTIVE-V	3	1	—	70	30	100 3
CSE413	GPS APPLICATIONS	3	1	—	70	30	100 3
IT414	BIO-INFORMATICS	3	1	—	70	30	100 3
CSE415	ENTREPRENEURSHIP	3	1	—	70	30	100 3
IT416	E-COMMERCE	3	1	—	70	30	100 3
CSE417	ELECTIVE-IV LAB	—	—	3	50	50	100 1.5
CSE418	ELECTIVE-V LAB	—	—	3	50	50	100 1.5
TOTAL		18	6	6	520	280	800 21

ELECTIVE-IV

1. BigDataAnalytics
2. MachineLearning
3. RProgramming

ELECTIVE-V

1. Cyber Security and Digital Forensics
2. IOT
3. CloudComputing

CSE411 ELECTIVE-IV BIGDATAANALYTICS

Common with 6years integrated B.Tech(CSE)+M.Tech and B.Tech(IT)

Instruction: 3Periods+1Tut/week, Univ.Exam:3 Hours Credits:3

Internal:30Marks UniversityExam: 70Marks Total:100Marks

Course Objectives

- To introduce Big Data and the Data analytics lifecycle to address business challenges that leverage big data.
- To understand the importance of mining data streams and social network graphs.
- To introduce big data analytics technology and tools including MapReduce and Hadoop

Course Outcomes

- Reframe a business challenge as an analytics challenge.

- Apply appropriate analytic techniques and tools to analyze big data.
- Create models and identify insights that can lead to actionable results.
- Effectively participate in big data and other analytics projects.
- Use tools such as Map Reduce / Hadoop

SYLLABUS

1. Big Data Concepts and Environment: Big Data Overview-Big Data Challenges and Opportunities- Data analytics lifecycle overview – Phases of Data Analytics: Discovery, Data preparation, Model planning, Model building.

2. Overview of Hadoop and HDFS: Introduction to Hadoop - The Distributed File System: HDFS, GPFS – The Design of HDFS – HDFS-Concepts-Blocks, Name Nodes and Data Nodes; Components of Hadoop-Hadoop Cluster Architecture-Batch Processing- Serialization - Hadoop ecosystem of tools-NoSQL .

3. Map Reduce: MapReduce Basics - Functional Programming Roots - Mappers and Reducers - The Execution Framework -MapReduce Algorithm Design –Shuffling, Grouping, Sorting- Custom Partitioners and Combiners- MapReduce Formats and Features.

4. Data Stream Mining: The Stream Data Model: A Data-Stream-Management System, Examples of Stream Sources, Stream Queries, Issues in Stream Processing. Sampling Data in a Stream, Filtering Streams (The Bloom Filter), Counting Distinct Elements in a Stream, Counting Ones in a Window, Decaying Windows.

5. Big Data Clustering: Overview of clustering techniques, Hierarchical Clustering, Partitioning Methods, CURE algorithm, Clustering stream

6. Mining Social Network Graphs: Link Analysis: Page Rank- Efficient computation of Page Rank- Topic Sensitive Page Rank- Link Spam- Hubs and Authorities. Mining Social Network Graphs: Web Advertising: Online and Offline Algorithms; Social Network Graphs: Clustering of Social Network Graphs- Direct Discovery of Communities- Partitioning of Graphs- Finding overlapping communities- Simrank Counting Triangles- Neighborhood properties of Graphs

Text Book

1.RadhaShankarmani,MVijayalakshmi,"BigDataAnalytics",2ndEdition, Wiley

Reference Books

1. AnandRajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, 2014

2. Data Warehousing in the Age of Big Data, Krish Krishnan Elsevier Inc, 2013

CSE411 ELECTIVE-IV MACHINELEARNING

Common with 6years integrated B.Tech (CSE)+M.Tech and B.Tech(IT)

Instruction: 3Periods+1Tut/week, Univ.Exam:3 Hours Credits:3

Internal:30Marks UniversityExam: 70Marks Total: 100Marks

Course Objectives

- To introduce students to the basic concepts and techniques of Machine Learning.
- To develop skills of using recent machine learning software for solving practical problems.
- To gain experience of doing independent study and research.

Course outcomes

By the end of the module, students should be able to:

- § Develop an appreciation for what is involved in Learning models from data
- § Understand a wide variety of learning algorithms
- § Understand how to evaluate models generated from data
- § Apply the algorithms to a real problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models

SYLLABUS

1. Introduction to Machine Learning, Applications of Machine learning, Supervisory Learning: Learning classes from examples, Vapnik-Charvonenkis (VC) Dimension, Probably Approximately Correct(PAC) Learning, noise, learning multiple classes, regression, model selection and generalization, dimensions of supervised machine learning algorithms

2. Bayesian Decision Theory: Classification, losses and risks, discriminant functions, utility theory, value of information, Bayesian networks, Influence diagrams, Association rules, Parametric Methods: Maximum likelihood estimation, evaluating an estimator with bias and variance, Bayes' estimator, parametric classification, regression, tuning model complexity: bias vs variance dilemma, model selection procedures

3. Multivariate methods: Multivariate data, parameter estimation, missing value imputation, univariate normal distribution and classification, discrete features, regression, Dimensionality Reduction: Subset selection, PCA, Factor Analysis, multi-dimensional scaling, LDA

4. Clustering: Mixture densities, K-means clustering, Expectation Maximization algorithm, mixtures of Latent Variable Models, Supervised learning after clustering, Hierarchical clustering, choosing number of clusters

5. Non-parametric methods: Non-parametric methods density estimation, generalisation to multivariate data, nonparametric classification, condensed nearest neighbors, non-parametric regression: smoothing models, choosing smoothing parameters

6. Decision trees and Linear Discrimination: Univariate classification and regression trees, rule extraction from trees, Multivariate trees, Generalizing linear model, two class and multi-class geometry of linear discriminant, pairwise separation, gradient descent, logistic discrimination for binary and multi-class problems, Support vector machines, optimal separating hyperplane, kernel functions for non-separable spaces, SVM for regression.

7. Hidden Markov Models: Discrete Markov processes, Hidden Markov Models, Three basic problems of HMM, Evaluation problem, finding the state sequence, Learning model parameters, continuous observations, Model selection in HMM Assessing and comparing classification Algorithms: Cross-validation and resampling methods, measuring error, interval estimation, hypothesis testing, assessing performance of a classifier, comparing two classification algorithms, comparing multiple classification algorithms based on variance

Text Books

1. Introduction to Machine Learning by Ethem Alpaydin, Prentice-Hall of India, 2006
2. Machine Learning by Saikat Dutt and Subramanian Chandramouli

Reference Books

1. Machine Learning, Tom Mitchell, McGraw Hill, 1997
2. Pattern Classification, Richard O. Duda, Peter E. Hart and David G. Stork, John Wiley & Sons Inc., 2001

CSE411 ELECTIVE-IV R PROGRAMMING

Common with 6 years integrated B.Tech (CSE)+M.Tech and B.Tech(IT)

Instruction: 3 Periods+1 Tut/week, Univ. Exam: 3 Hours Credits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives

After taking the course, students will be able to

1. Use R for statistical programming, computation, graphics, and modeling,
2. Write functions and use R in an efficient way,
3. Fit some basic types of statistical models
4. Use R in their own research,
5. Be able to expand their knowledge of R on their own

Course Outcomes

At the end of this course, students will be able to:

1. List motivation for learning a programming language
2. Access online resources for R and import new function packages into the R workspace
3. Import, review, manipulate and summarize data-sets in R
4. Explore data-sets to create testable hypotheses and identify appropriate statistical tests
5. Perform appropriate statistical tests using R Create and edit visualizations

SYLLABUS

1. Introduction, How to run R, R Sessions and Functions, Basic Math, Variables, Data Types, Vectors, Conclusion, Advanced Data Structures, Data Frames, Lists, Matrices, Arrays, Classes.

2. R Programming Structures, Control Statements, Loops, - Looping Over Non vector Sets, - If-Else, Arithmetic and Boolean Operators and values, Default Values for Argument, Return Values, Deciding Whether to explicitly call return- Returning Complex Objects, Functions are Objective, No Pointers in R, Recursion, A Quick sort Implementation- Extended Example: A Binary Search Tree.

3. Doing Math and Simulation in R, Math Function, Extended Example Calculating Probability-Cumulative Sums and Products-Minima and Maxima-Calculus, Functions for Statistical Distribution, Sorting, Linear Algebra Operation on Vectors and Matrices, Extended Example: Vector cross Product- Extended Example: Finding Stationary Distribution of Markov Chains, Set Operation, Input/output, Accessing the Keyboard and Monitor, Reading and writing Files,

4. Graphics, Creating Graphs, The Workhorse of R Base Graphics, the plot() Function – Customizing Graphs, Saving Graphs to Files.

5. Probability Distributions, Normal Distribution – Binomial Distribution – Poisson Distributions Other Distribution, Basic Statistics, Correlation and Covariance, T-Tests, - ANOVA.

6. Linear Models, Simple Linear Regression, - Multiple Regression Generalized Linear Models, Logistic Regression, - Poisson Regression- other Generalized Linear Models-Survival Analysis, Nonlinear Models, Splines- Decision-Random Forests,

Text Books

- 1) The Art of R Programming, A K Verma, Cengage Learning.
- 2) R for Everyone, Lander, Pearson
- 3) The Art of R Programming, Norman Matloff, No starch Press

Reference Books

- 1) R Cookbook, Paul Teetor, Oreilly.
- 2) R in Action, Rob Kabacoff, Manning

CSE 412 ELECTVE-VCYBERSECURITYANDDIGITALFORENSICS

Instruction: 3Periods+1Tut/week Credits:3

Internal:30Marks UniversityExam: 70Marks Total:100Marks

Course Objective

- Understand the threats in networks and security concepts.
- Apply authentication applications in different networks.
- Understand security services for email.
- Awareness of firewall and it applications.

Course Outcomes

Having studied this course, you are expected to be able to:

- Differentiate among different types of security attacks.
- Define computer forensics.
- Identify the process in taking digital evidence.
- Describe how to conduct an investigation using methods of memory, operating system, and network and email forensics.
- Assess the different forensics tools.

SYLLABUS

1. Introduction to Information Security Fundamentals and Best Practices

- Protecting Your Computer and its Contents
 - Securing Computer Networks—Basics of Networking
 - Compromised Computers
 - Secure Communications and Information Security Best Practices
 - Privacy Guidelines
 - Safe Internet Usage
- #### **2. Ethics in Cyber Security & Cyber Law**
- Privacy
 - Intellectual Property
 - Professional Ethics
 - Freedom of Speech
 - Fair User and Ethical Hacking
 - Trademarks
 - Internet Fraud

- Electronic Evidence
- Cybercrimes

3. Penetration Testing

- Overview of the web from a penetration testers perspective
- Exploring the various servers and clients
- Discussion of the various web architectures
- Discussion of the different types of vulnerabilities
- Defining a web application test scope and process
- Defining types of penetration testing

4. Web Application Security

Common Issues in Web Apps

What is XSS, SQL injection, CSRF, Password Vulnerabilities, SSL, CAPTCHA, Session Hijacking, Local and Remote File Inclusion, Audit Trails, Web Server Issues

5. Forensics & Network Assurance

- Forensic Technologies
- Digital Evidence Collection
- Evidentiary Reporting
- Layered Defense
- Surveillance and Reconnaissance
- Outsider Thread Protection

6. Information Risk Management

- Asset Evaluation and Business Impact Analysis
- Risk Identification
- Risk Quantification
- Risk Response Development and Control
- Security Policy, Compliance, and Business Continuity
- Forensic investigation using Access Data FTK, En-Case

7. Cyber Incident Analysis and Response

- Incident Preparation
- Incident Detection and Analysis
- Containment, Eradication, and Recovery
- Proactive and Post-Incident Cyber Services
- CIA triangle

Reference Books

1. The Official CHFI Study Guide for Computer Hacking Forensic Investigator by Dave Kleiman
2. CISSP Study Guide, 6th Edition by James M. Stewart
3. www.nist.gov/

CSE412 ELECTIVE-V INTERNET OF THINGS

Common with 6 years integrated B.Tech(CSE)+M.Tech and B.Tech(IT)

Instruction: 3 Periods+1 Tut/week, Univ.Exam: 3 Hours Credits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course objectives

Students will be explored to the interconnection and integration of the physical world and the cyber space. They are also able to design & develop IOT Devices.

Course Outcomes

- Able to understand the application areas of IOT
- Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
- Able to understand building blocks of Internet of Things and characteristics.

SYLLABUS

1) Introduction to the internet of things. IoT Architecture: History of IoT, M2M –Machine to Machine, Web of Things, IoT protocols The Architecture The Layering concepts, IoT Communication Pattern, IoT protocol Architecture, The 6LoWPAN

2) Prototyping connected objects. Open-source prototyping platforms, Basics of IoT Networking (IOT components and Gateways)

3) Integrating internet services. XML and JSON. HTTP APIs for accessing popular Internet services (Facebook, Twitter, and others). Practical activities. IoT Application Development: Application Protocols MQTT, REST/HTTP, CoAP, MySQL, RPL,

4) Overview of IoT supported Hardware platforms such as: Raspberry pi, ARM Cortex Processors, Arduino and Intel Galileo boards

5) Ubiquitous computing, applications of IOT, Virtualization of network resources and physical devices in IOT.

6) Internet of Things Standardisation M2M Service Layer Standardisation OGC Sensor Web for IoT

Text Books

1. Internet Of Things: Converging Technologies For Smart Environments And Integrated Ecosystems, Marina Ruggieri H, River Publishers Series In Communications

CSE412 ELECTIVE-V CLOUD COMPUTING

Common with 6 years integrated B.Tech(CSE)+M.Tech and B.Tech(IT)

Instruction: 3 Periods+1 Tut/week, Univ.Exam: 3 Hours Credits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives

1. To import fundamental concepts in the area of cloud computing.
2. To understand the concept of Virtualization and cloud data storage.
3. To learn cloud Application Development and cloud Governance.
4. To gain competence in Map Reduce and Hadoop Overview

Course Outcomes

1. Identify the architecture and infrastructure of cloud computing.
2. Develop applications for cloud computing.
3. Design and Implement a novel cloud computing application

SYLLABUS

1. Introduction to cloud computing: Cloud computing components, Infrastructure services, storage applications, database services – introduction to SaaS, PaaS, IaaS, IDaaS, data storage in cloud

2. Virtualization: enabling technologies, types of virtualization, server virtualization, desktop virtualization, memory virtualization, application and storage virtualization-tools and products available for virtualization

3. SAAS and PAAS: Getting started with SaaS, SaaS solutions, SOA, PaaS and benefits.

4. IaaS and Cloud data storage: understanding IaaS, improving performance for load balancing, server types within IaaS, utilizing cloud based NAS devices, cloud based data storage, and backup services, cloud based block storage and database services

5. Cloud Application development: Client server distributed architecture for cloud designing cloud based solutions, coding cloud based applications, traditional Apps vs cloud Apps, client side programming, server side programming overview-fundamental treatment of web application frameworks.

6. Cloud Governance and economics: Securing the cloud, disaster recovery and business continuity in the cloud, Managing the cloud, migrating to the cloud, governing and evaluating the cloud's business impact and economics,

7. Inside Cloud: Introduction to MapReduce and Hadoop-over view of big data and its impact on cloud

Text Books

1. Cloud Computing: SaaS, PaaS, IaaS, Virtualization, Business Models, Mobile, Security and More, Kris Jamsa, Jones & Bartlett Publishers, Paper back edition, 2013

2. Hadoop Map Reduce cookbook, Srinath Perera and Thilina Gunarathne, Packt publishing

Reference Book

1. Cloud Computing: A Practical Approach, Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, Tata McGraw Hill Edition

CSE413 GPS APPLICATIONS

Common with 6 years integrated B.Tech(CSE)+M.Tech and B.Tech(IT)

Instruction: 3 Periods+1 Tut/week, Univ. Exam: 3 Hours Credits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives

1. To import fundamental concepts in the area of Global Positioning System.

2. To understand the concept of Satellite configuration and GPS working principle.

3. To learn GPS Signal generation and Coordinate Systems.

4. To understand the concept of GAGAN

Course Outcomes

1. Identify the architecture and infrastructure of Global Positioning System.

2. Develop applications for Global Positioning System.

SYLLABUS

1. Development of NAVSTAR GPS. GPS Satellite configuration- Space segment, Control segment, User segment.

2. GPS working principle, basic equations for finding user position, user position determination with least squares estimator.

3. Other Global Satellite Constellations, GLONASS, GALILEO, Comparison of 3 GNSS (GPS, GALILEO, GLONASS) in terms of constellation and services provided.

4. GPS Signal generation, Pseudorandom noise (PRN) code, C/A code, P code, Navigation data, Signal structure of GPS, signal power.

5. Coordinate Systems: Geoid, Ellipsoid, Coordinate Systems, Geodetic and Geo centric coordinate systems, ECEF coordinates, world geodetic 1984 system, Conversion between Cartesian and geodetic coordinate frame.

6. GPS Error sources, ionospheric effects on GPS signals and its mitigation methods.

7. Satellite based augmentation system-need for GPS augmentation, GPS Aided GEO Augmented System (GAGAN)

Text Books

1. GSRAO, Global Navigation Satellite Systems, McGraw-Hill Publications, New Delhi, 2010

2. Pratap Mishra, Global positioning system: signals, measurements, and performance, Ganga-Jamuna Press, 2006.

Reference Books

1. Scott Gleason and Demoz Gebre- Egziabher, GNSS Applications and Methods, Artech House, 685 Canton Street, Norwood, MA 02062, 2009.

2. James Ba – Yen Tsui, 'Fundamentals of GPS receivers – A software approach', John Wiley & Sons (2001).

3. B. Hoffmann- Wellenhopf, GPS theory and practice, 5th Edition, Springer 2001.

IT414 : BIOINFORMATICS

Instruction: 3 Periods+1 Tut/week, Univ. Exam: 3 Hours Credits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives

1. To import fundamental concepts in the area of Bioinformatics.

2. To understand the concept of DNA Sequence analysis and Protein Information Resources.

3. To learn Pairwise alignment techniques and Secondary data bases searching.

4. To gain competence in Analysis packages.

Course Outcomes

- Able to understand the application areas of Bioinformatics.

- Able to realize the revolution of Bioinformatics in present areas

- Able to understand building blocks of Bioinformatics and characteristics.

SYLLABUS

1. Introduction: Definitions, Sequencing, Biological sequence/structure, Genome Projects, Pattern recognition and prediction, Folding problem, Sequence Analysis, Homology and Analogy.

2. Protein Information Resources: Biological databases, Primary sequence databases, Protein Sequence databases, Secondary databases, Protein pattern databases, and Structure classification databases.

3. Genome Information Resources : DNA sequence databases, specialized genomic resources

4. DNA Sequence analysis :Importance of DNA analysis, Gene structure and DNA sequences, Features of DNA sequence analysis, EST (Expressed Sequence Tag) searches, Gene hunting, Profile of a cell, EST analysis, Effects of EST data on DNA databases

5. Pair wise alignment techniques : Database searching, Alphabets and complexity, Algorithm and programs, Comparing two sequences, sub-sequences, Identity and similarity, The Dot plot, Local and global similarity, different alignment techniques, Dynamic Programming, Pair wise database searching.

6. Multiple sequence alignment :Definition and Goal, The consensus, computational complexity, Manual methods, Simultaneous methods, Progressive methods, Databases of Multiple alignments and searching

7. Secondary database searching: Importance and need of secondary database searches, secondary database structure and building a sequence search protocol

8. Analysis packages:Analysis package structure, commercial databases, commercial software, comprehensive packages, packages specializing in DNA analysis, Intranet Packages, Internet Packages

Text Books

1. Introduction to Bioinformatics, T K Attwood & D J Parry-Smith Addison WesleyLongman

2. Bioinformatics- A Beginner's Guide, Jean-Michel Claveriw, CerdricNotredame WILEY dreamlech India Pvt.Ltd

ReferenceBook

1. Introduction to Bioinformatics, Arthur M.Lesk, OXFORD publishers (Indian Edition)

CSE 415 ENTREPRENEURSHIP

Common with 6years integrated B.Tech(CSE)+M.Tech and B.Tech(IT)

Instruction: 3Periods+1Tut/week,Univ. Exam: 3 Hours Credits: 3

Internal: 30 Marks

University Exam: 70 MarksTotal: 100 Marks

Course objectives

1. to introduce students to importance of management and the various forms of business organizations

2. to provide students the knowledge of various managerial functions such as production planning, marketing and finance

3. to understand the importance of entrepreneurs, sources for idea generation, steps for starting a small enterprise and support / incentives provided by Government for small scale industries.

Course outcomes

By the end of the course, the student should be able to:

1. appreciate the importance of management in organizations and understand the various forms of business organizations

2. understand the managerial functions in areas of production planning, marketing and finance including raising finance

3. appreciate the importance of entrepreneurship, the various opportunities and incentives provided by Government and institutions to start small enterprises.

SYLLABUS

1. Basic Concepts of Management: Management: Definition, Nature and Importance ; Functions of the Management; Levels of Management; F.W Taylor's Scientific Management; Henry Fayol's Principles of Management;

2. Forms of Business Organizations: Introduction, Types of Business organizations: Private Sector- Individual Ownership, Partnership, Joint stock companies and Co-Operative organizations; Public sector- Departmental Organizations, Public Corporations and Government Companies; The Joint sector Management.

3. Production and operations Management: Plant location- Factors to be considered in the selection of Plant location; Break - even analysis- Significance and managerial applications; Importance of Production Planning and Control and its Functions; Human Resource Management and Functions of Human Resource Manager (in brief); Functions of Marketing; Methods of Raising Finance.

4. Entrepreneurship: Definition, Characteristics and Skills, Types of Entrepreneurs, Entrepreneur vs. Professional Managers, , Growth of Entrepreneurs, Nature and Importance of Entrepreneurs, Women Entrepreneurs, Problems of Entrepreneurship.

5. Entrepreneurial Development and Project Management: Institutions in aid of Entrepreneurship Development, Idea generation: Sources and Techniques;, Stages in Project formulation ; Steps for starting a small enterprise - Incentives for Small Scale Industries by Government.

Text Books

1. Sharma,S.C, and Banga, T.R., Industrial Organization & Engineering Economics, Khanna Publishers, Delhi, 2000.

2. Vasant Desai The Dynamics of Entrepreneurial Development and Management (Planning for future Sustainable growth),Himalayan Publishing House, 2018.

Reference Books

1. Aryasri , A.R., Management Science, McGraw Hill Education (India Private Limited , New Delhi 2014.

2. Sheela, P. , and JagadeswaraRao, K., Entrepreneurship, Shree Publishing House, Guntur, Andhra Pradesh, 2017.

IT416 E-COMMERCE

Instruction: 3Periods+1Tut/weekUniv. Exam: 3 Hours Credits:3

Internal: 30 Marks

University Exam: 70 MarksTotal: 100 Marks

Course objectives

1. introduce students to electronic commerce andits various applications
2. provide knowledge of electronic payment systems and risks involved, electronic data interchange, inter-organizational and intra-organizational commerce
3. introduce students to concepts of information based marketing including online marketing, advertising on internet, consumer search
4. provide knowledge of multimedia concepts including digital video and electronic commerce, video conferencing and video processing.

Course outcomes

By the end of the course, the student should be able to:

1. understand the framework of electronic commerce and its various applications
2. explain the types of electronic payment systems and risks involved in such systems
3. understand online marketing and information based marketing concepts including consumer search, information retrieval, advertising on internet.

SYLLABUS

1. Introduction: Electronic Commerce-Frame Work, Anatomy of E-Commerce Applications, E- Commerce Consumer Applications, E-Commerce Organization Applications. Consumer Oriented Electronic Commerce - Mercantile ProcessModels.
2. Electronic Payment Systems – Types of Electronic Payment Systems, Digital Token-Based, Smart Cards, Credit Cards, Risks in Electronic Payment Systems, Designing Electronic Payment Systems
3. Electronic Data Inter Change, Inter Organizational Commerce - EDI, EDI Implementation, Value AddedNetworks.
4. Intra Organizational Commerce, Macro Forces and Internal Commerce, Work Flow Automation and Coordination, Customization and Internal Commerce, Supply ChainManagement.
5. Business Cases for Document Library, Digital Document Types, Corporate DataWare-Houses.

6. Advertising And Marketing: Information Based Marketing, Advertising On Internet, Online Marketing Process, Market Research. Consumer Search and Resource Discovery, Information Search and Retrieval, Commerce Catalogues, InformationFiltering.

7. Multimedia-Key Multimedia Concepts, Digital Video and Electronic Commerce, Desktop Video Processing, Desktop VideoConferencing.

Text Book

1. Frontiers of Electronic Commerce, Kalakata and Whinston,Pearson.

Reference Books

1. E-Commerce fundamentals and Applications, Hendry Chan, Raymond Lee, Tharam Dillon, Ellizabeth Chang, JohnWiley.
2. E-Commerce, S.Jaiswal,Galgotia.
3. E-Commerce, Efrain Turbon, Jae Lee, David King, H.MichaelChang.
4. E-Commerce - Business, Technology and Society, Kenneth C.Taudon, Carol GuyericoTraver.

CSE417 ELECTIVE-IVLAB BIGDATAANALYTICSLAB

Common with 6years integrated B.Tech(CSE)+M.Tech and B.Tech(IT)

Instruction:3Periods/week, Univ. Exam:3Hours

Credits:1.5

Internal:50Marks UniversityExam:50Marks Total:100Marks

Getting Hadoop Up and Running inacluster

1. Setting up Hadoop on standalonemachine.
 2. Wordcount Map Reduce program using standaloneHadoop.
 3. Adding the combiner step to the Wordcount Map Reduceprogram.
 4. Setting upHDFS.
 5. Using HDFS monitoringUI
 6. HDFS basic command-line fileoperations.
 7. Setting Hadoop in a distributed clusterenvironment.
 8. Running the WordCount program in a distributed clusterenvironment.
 9. Using Map Reduce monitoringUI
- #### **Hadoop Map Reduce Applications**
1. Choosing appropriate Hadoop datatypes
 2. Implementing a custom Hadoop Writable datatype
 3. Implementing a custom Hadoop keytype
 4. Emitting data of different value types from amapper
 5. Choosing a suitable Hadoop Input Format for your input dataformat

6. Formatting the results of Map Reduce Computation – using Hadoop OutputFormats

Analytics

1. Simple analytics using MapReduce.
2. Performing Group-By using MapReduce.
3. Calculating frequency distributions and sorting using MapReduce.
4. Plotting the Hadoop results using GnuPlot.
5. Calculating histograms using MapReduce.
6. Calculating scatter plots using MapReduce.
7. Parsing a Complex dataset with Hadoop.
8. Joining two datasets using MapReduce

TextBook

1.Hadoop Map Reduce Cook book, Srinath Perera & Thilina Gunarathne, 2013, PACKT PUBLISHING.

CSE417 ELECTIVE-IV LAB MACHINE LEARNING LAB

Common with 6 years integrated B.Tech(CSE)+M.Tech and B.Tech(IT)

Instruction: 3 Periods/week, Univ.Exam: 3 Hours Credits: 1.5

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

Course objectives

This course will enable students to

1. Make use of Data sets in implementing the machine learning algorithms.
2. Implement the machine learning concepts and algorithms in any suitable language of choice.

Course outcomes

The student should be able to:

1. Understand the implementation procedures for the machine learning algorithms.
2. Design Java/Python programs for various Learning algorithms.
3. Apply appropriate data sets to the Machine Learning algorithms.
4. Identify and apply Machine Learning algorithms to solve real world problems

Description

1. The programs can be implemented in either JAVA or Python.
2. For Problems 1 to 6 and 10, programs are to be developed without using the built-in classes or APIs of Java/Python.
3. Data sets can be taken from standard repositories (<https://archive.ics.uci.edu/ml/datasets.html>) or constructed by the students

Lab Experiments

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.

2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.

3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

4. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.

5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.

6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.

7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.

8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.

9. Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.

10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs

CSE417 ELECTIVE- IV LAB R-PROGRAMMING LAB

Common with 6 years integrated B.Tech(CSE)+M.Tech and B.Tech(IT)

Instruction: 3 Periods/week, Univ.Exam: 3 Hours Credits: 1.5

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

Lab Experiments

Implement the Following

- a. To create a data frame df1 to contain 10 observations and 3 variables, column with letters, column 2 with random numbers and column 3 with first 10 natural numbers.
- b. Create df3 by merging df1 by column1 with another data frame df2 containing 20 observations and 2 variables column4 with letters, column5 with sequence of 20 real numbers from 0 to 1 in equal steps
- c. Find the dimensionality of data framedf3.
- d. Rename observations whose column1 value is 'D' from data framedf3
2. Implement the following
 - a. Create h1 to contain 1000 random numbers, distributed in normal distribution and plot the histogram with colors.
 - b. Create a data frame to contain randomly drawn samples of 25 cards from 52 distinct cards with replacements. Use 'table' function to find the 'duplicated' and tabulate the list of cards and their frequency of occurrence in the sample.
3. Write R Program using 'apply' group of functions to create and apply normalization function on each of the numeric variables/columns of iris dataset to transform them into
 - a. 0 to 1 range with min-max normalization.
 - b. a value around 0 with z-score normalization.
4. Create a data frame with 10 observations and 3 variables and add new rows and columns to it using 'rbind' and 'cbind' function.
5. Create a function to discretize a numeric variable into 3 quantiles and label them as low, medium, and high. Apply it on each attribute of iris dataset to create a new data frame. 'discrete_iris' with Categorical variables and the class label.
6. Write R program to find the approximate value of π (pi) by simulation using a large number of uniformly distributed data points with their coordinates in the range of [-1,1] and find the ratio of number of points within the circle of radius 1, to total number of data points. Observe the improvement in accuracy of result with the increased number of data points distributed.
7. Write R programs to find the probability of a variable to have a given value in different distributions like Uniform, Normal, Poisson and Binomial using 'pnorm', 'ppois', and the other such functions.
8. Apply 'ddply' for data summarization of iris dataset based on 'species' and get the same summarization using 'sqlf'
9. After attaching data set 'mtcars' to access its variables, use R statements to visualize the relationship between the variables of 'mtcars':
 - a. Using scatter plots with colors.

- b. Boxplots showing the spread of the variable 'mpg' for different values of 'cyl'.
- c. Find correlations between all pairs of variables.
10. Write R program to implement linear and multiple regression on 'mtcars' dataset to estimate the value of 'mpg' variable, with best R^2 and plot the original values in 'green' and predicted values in 'red'.
11. Write R program to create new variables in low dimensional space using
 - a. PCA and
 - b. SVD and use them for predicting the values of 'mpg' variable
12. Write R Programs to apply k-mean clustering on 'iris' data set and get the summary statistics. Implement a mini-project to process a collection of text documents / tweets and apply tokenization, stopword removal and stemming to represent the collection as a document – term matrix reflecting the term frequencies. Cluster the documents using a simple clustering algorithm and estimate the purity of the clustering solution

CSE418 ELECTIVE-VLAB CYBERSECURITY AND DIGITAL FORENSICS LAB

Common with 6 years integrated B.Tech(CSE)+M.Tech and B.Tech(IT)

Instruction: 3 Periods/week Univ.Exam: 3 Hours Credits: 1.5

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

Module-1:

The students will be exposed to different types of attack scenarios and hacking tools with respect to security. Open source tools will be used for the implementation of the lab experiments

Module-II

The students will be exposed to different case studies of cyber-attacks and using open source Cyber Forensic tools they will examine the case.

CSE418 ELECTIVE-VLAB: INTERNET OF THINGS LAB

Common with 6 years integrated B.Tech(CSE)+M.Tech and B.Tech(IT)

Instruction: 3 Periods/week Univ.Exam: 3 Hours Credits: 1.5

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

List of Experiments

1. Study Of Various Network Protocols Used In IOT.
2. Application of WIFI In IOT Systems.
3. Application of 6LoWPAN In IOT Systems.
4. Application of Bluetooth In IOT Systems.
5. Application of 802.15.4 Zigbee. In IOT Systems.

6. Design a Simple IOT System Comprising Sensors, Wireless Network Connection, Data Analytics

CSE418 ELECTIVE-V LAB : CLOUD COMPUTING LAB

Common with 6years integrated B.Tech(CSE)+M.Tech and B.Tech(IT)

Instruction:3Periods/week Credits:1.5

Internal:50Marks UniversityExam: 50Marks Total: 100Marks

Use Eucalyptus or Open Nebula or equivalent to setup the cloud and demonstrate.

1. Find procedure to run the virtual machine of different configuration. Check how many virtual machines can be utilized at particular time.
2. Find procedure to attach virtual block to the virtual machine and check whether it holds the data even after there lease of the virtual machine.
3. Install a compiler in the virtual machine and execute a sample program.
4. Show the virtual machine migration base don the certain condition from one node to the other.

B.TECH (IT) 4th YEAR II-SEMESTER SCHEME OF INSTRUCTION AND EXAMINATION

(For the 2019-2020 admitted batch)

Sub Ref.No	Name of the Subject				Periods	Maximum marks	Credits
			Theory	Tutorial	Lab	Exam	
	Internal	Total					
IT421	PROJECT	—	—	—	50	50	100
	14.5						
	TOTAL	—	—	50	50	100	14.5

GUIDELINES for doing the Project Work

1. Candidates can do their thesis work within the department or in any industry/research organization for one semester in the 4th year of their study. In case of project done in an industry/research organization, one advisor (Guide) should be from the department and one advisor (Co-Guide) should be from the industry/research organization.

2. Students should work in teams of 3 to 4 members and submit thesis on the project work done by them.

Format For Preparation Of Project Thesis For B. Tech (IT)

1. Arrangement Of Contents:

The sequence in which the project report material should be arranged and bound should be as follows:

1. Cover Page & TitlePage

2. Bonafide Certificate

3. Abstract

4. Table of Contents

5. List of Tables

6. List of Figures

7. List of Symbols, Abbreviations and Nomenclature

8. Chapters

9. Appendices

10. References

*The table and figures shall be introduced in the appropriate places.

B.TECH (IT) 3rd YEAR I-SEMESTER

SCHEME OF INSTRUCTION AND EXAMINATION

(For the 2019-2020 admitted batch)

Sub Ref.No	Name of the Subject	Periods			Maximum marks		Credits	
		Theory	Tutorial	Lab	Exam	Internal		Total
CSE311	COMPUTER NETWORKS	3	1	—	70	30	100	3
CSE312	OPERATING SYSTEMS	3	1	—	70	30	100	4
IT313	PRINCIPLES OF PROGRAMMING LANGUAGES	3	1	—	70	30	100	3
CSE314	OBJECT ORIENTED SOFTWARE ENGINEERING	3	1	—	70	30	100	4
CSE315	OPERATIONS RESEARCH	3	1	—	70	30	100	3
IT316	ELECTIVE-I	3	1	—	70	30	100	3
IT317	SOFTWARE ENGINEERING MINI PROJECTS LAB	—	—	3	50	50	100	1.5
CSE318	OPERATING SYSTEMS LAB	—	—	3	50	50	100	1.5
CSE319	SOFT SKILLS LAB	—	—	3	50	50	100	1.5
	TOTAL	18	6	9	570	330	900	24.5

ELECTIVE-I:

1. File Structures

2. Formal Languages and Automata Theory

3. Compiler Design

CSE311 : COMPUTER NETWORKS

Common with 6 years integrated B.Tech(CSE)+ M.Tech and B.Tech(IT)

Instruction: 3Periods+1Tut/week, Univ.Exam:3Hours Credits:3

Internal:30Marks UniversityExam: 70Marks Total:100Marks

Course Objectives

1. To make the students understanding of basic requirements of network hardware, software and its architecture.
2. Familiarize the students with layered architecture of the network software and hierarchical nature of the network physical infrastructure.
3. Study of various network interconnecting devices and other associated network hardware.
4. Introduction of advanced networking concepts and wireless and wireless sensor networks.

Course Outcomes

1. The student must be able to understand the design and estimate the requirements for practical setup of a given network scenario and size.
2. Realize the Operation, maintenance and management of the Internet by mapping the theoretical networking concepts to the real-time network scenarios.
3. Demonstrate the applications of wireless Networks and over view of advanced networking concepts.
4. Identify different networking devices and their usage and functionality

SYLLABUS

1. Introduction to Computer Networks: Introduction, Network Hardware, Network Software, Reference Models, Network Examples, Internet Based Applications.
2. The Medium Access Control: The Channel Allocation Problem, CSMA Protocols, Collision Free Protocols, The Ethernet, Wireless LANs, Bluetooth
3. Network Layer: Network Layer Design Issues, Routing Algorithms, Congestion Control Algorithms, Network Layer in the Internet, IP Protocol, IP Address, Subnets, and Internetworking.
4. Transport layer: Transport Service, Elements of Transport Protocols, TCP and UDP Protocols, Quality of Service Model, Best Effort Model, Network Performance Issues.
5. Application Layer: Over View of DNS, SNMP, Electronic Mail, FTP, TFTP, BOOTP, HTTP Protocols, World Wide Web, Firewalls.
6. Network Devices: Over View of Repeaters, Bridges, Routers, Gateways, Multiprotocol Routers, Hubs, Switches, Modems, Channel

Service Unit CSU, Data Service Units DSU, NIC, Wireless Access Points, Transceivers, Firewalls, Proxies.

7. Overview of Cellular Networks, Ad-hoc Networks, Mobile Ad-hoc Networks, Sensor Networks

Text Books

1. Computer Networks, Andrews S Tanenbaum., 5th Edition, Pearson Edu.
2. An Engineering Approach to Computer Networks-S.Keshav, 2nd Edition, Pearson Education.

Reference Books

1. Data Communications and Networking ,Behrouz A Forouzan , Tata McGraw-Hill Co
Ltd, Second Edition, ISBN: 0-07-049935-7
2. Computer networks, Mayank Dave, CENGAGE.
3. Computer networks, A system Approach, 5thed, Larry L Peterson and Bruce S Davie, Elsevier.
4. Understanding communications and Networks, 3rd Edition, W.A. Shay, Thomson

CSE312 OPERATINGSYSTEMS

Commonwith6yearsintegratedB.Tech(CSE)+M.TechandB.Tech(IT)

Instruction: 3Periods+1Tut/week, Univ.Exam:3Hours Credits:4

Internal:30Marks UniversityExam: 70Marks Total:100Marks

Course objectives

1. To understand evolution of Operating System.
2. To understand operating system as a layer of abstraction above physical hardware that facilitates usage convenience and efficient resource management of computer system resources.
3. To learn design and implementation of policies and mechanisms for OS subsystem.
4. To investigate case studies to understand the design philosophies / paradigm for popular multiuser or single user operating system

CourseOutcomes

1. The student understands OS evolution, its structure and services provided by it.
2. Learn process life cycle, process scheduling objectives, policies and mechanisms, process synchronization; inter process communication, deadlocks and other process subsystem related concepts.

3. Learn memory hierarchy, allocation and deallocation policies and mechanism for main and auxiliary memory; file system design and implementation issues.

4. Investigate UNIX/ LINUX and Windows OS platforms w.r.t similarities and differences in design philosophies

SYLLABUS

1. Introduction to Operating Systems: Over View of Operating Systems, Types of Operating Systems, Operating System Structures, Operating System Services, System Calls, Virtual Machines, Operating System Design and Implementation.

2. Process Management: Process Concepts, Operations on Processes, Cooperating Processes, Threads, Inter Process Communication, Process Scheduling, Scheduling Algorithms, Multiple- Processor Scheduling, Thread Scheduling.

3. Process Synchronization: The Critical Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classical Problems of Synchronization, Critical Regions, Monitors.

4. Deadlocks: System Model, Deadlock Characterization, Methods For Handling Deadlocks, Deadlock Prevention, Avoidance, Deadlock Detection, Recovery from Deadlocks

5. Memory Management: Logical versus Physical Address, Swapping, contiguous memory allocation, paging, structure of the page table , segmentation, Virtual Memory, Demand Paging, Page Replacement, Allocation of Frames, Thrashing, Memory-Mapped files

6. FileSystems,Implementation,andSecondary-storage Structure: Conceptofafile,Access Methods, Directory Structure, Protection, File System Structure, Allocation Methods, Free Space Management, Directory Management, Device Drivers, overview of Mass-storage structure, Disk structure, disk attachment, disk scheduling, swap-space management.

7. Case study: Overview of LINUX, Windows Operating systems

Text Books

1. Operating Systems, Abraham Silbers chatz, Peter Baer Galvin, and Greg Gagne, John Wiley Publ., Seventh Edition

2. Operating Systems; A Practical Approach. Rajiv Chopra

Reference Books

1. Modern Operating Systems, Andrew S. Tanenbaum,2ndedition, 1995,PHI.

2. Operating Systems, William Stallings 5th Edition -PHI

3. Operating Systems: A Design-Oriented Approach', Charles Crowley, 'Tata Hill Co., 1998 edition

IT313 PRINCIPLESOFPROGRAMMINGLANGUAGES

Instruction: 3Periods+1Tut/week, Univ. Exam:3Hours Credits:3

Internal:30Marks UniversityExam: 70Marks Total:100Marks

Course objectives

1. To learn the underlying principles and concepts of programming language.

2. To understand programming language translation process.

3. To expose students to the important paradigms of programming.

4. To understand the concepts of distributed processing and network programming

Course outcomes

1. Ability to compare different programming languages.

2. Ability to discuss the significant achievements in programming language history.

3. Ability to assess the programming languages in scientific manner

SYLLABUS

1. Language design issues: Studyprogramming Languages, History of programming Languages, role of programming Languages, Programming Environments.

2. Impact of Machine Architectures: Operation of a Computer, Virtual Computers and Binding Times; Language Translation Issues: Programming Language Syntax, Stages in Translation, Formal Translation Models, Recursive Descent Parsing; Modeling Language Properties: Formal Properties of Languages, Language Semantics.

3. Elementary Data Types: Properties of Types and Objects, Scalar Data Types, Composite Data Types Encapsulation: Structured Data Types, Abstract Data Types, Encapsulation by Subprograms, Type Definitions .Inheritance: Abstract Data Types Revisited ,Inheritance, Polymorphism

4. Sequence Control: Implement and Explicit Sequence Control, Sequence with Arithmetic Expressions, Sequence Control Between Statements, Sequencing with Non-arithmetic Expressions.

5. Subprogram Control: Subprogram Sequence Control Attributes of Data Control, Parameter Transmission, Explicit Common Environment.

6. Storage Management: Elements Requiring Storage, Programmer- and System - Controlled Storage, Static Storage Management, Heap Storage Management

7. Distributed Processing: Variations on Subprogram Control, Parallel Programming, Hardware Developments, and Software Architecture. Network Programming: Desktop Publishing, The World Wide Web

Text Books

1. Programming languages – Design and Implementation by Terrence W. Pratt Marvin V. Zelkowitz. 3rd Edition, Prentice Hall of India.

Reference Books

1. Concepts of Programming Languages by Robert L. Sebesta, 4th Edition, Pearson Education.

2. Fundamentals of Programming Languages, Design & Implementation by Seyed H. Roosta. Vikas publications.

3. Programming Languages by Paradigm and Practice – Doris Appleby Julius J. Vendekopple Tata McGraw Hill Edition

CSE314 OBJECTORIENTED SOFTWARE ENGINEERING

Common with 6 years integrated B.Tech(CSE)+M.Tech and B.Tech(IT)

Instruction: 3 Periods+1 Tut/week, Univ. Exam: 3 Hours Credits: 4

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course objectives

1. To explain the importance of OOSE in Software development.
2. To explain the students the importance of Requirements Engineering.
3. To explain the role of UML and Testing in Software Development.
4. To explain the entire Software Development Process with aid of case studies

Course Outcomes

1. Ability to define a problem and perform Requirements Engineering.
2. Ability to draw UML diagrams for the requirements gathered.
3. Ability to implement the designed problem in Object Oriented Programming Language and
4. Test whether all the requirements specified have been achieved or not

SYLLABUS

1. Introduction to Object Oriented Software Engineering: Nature of the Software, Types of Software, Software Engineering Projects, Software Engineering Activities, Software Quality, Introduction to Object Orientation, Software Process Models-Waterfall Model, Opportunistic Model, Phased Released Model, Spiral Model, Evolutionary Model, Concurrent Engineering Model.

2. Requirements Engineering: Domain Analysis, Problem Definition and Scope, Requirements Definition, Types of Requirements, Techniques for Gathering and Analyzing Requirements, Requirement Documents, Reviewing, Managing Change in Requirements.

3. Unified Modeling Language & Use Case Modeling: Introduction to UML, Modeling Concepts, Types of UML Diagrams with Examples; User-Centered Design, Characteristics of Users, Developing Use-Case Models of Systems, Use-Case Diagram, Use-Case Descriptions, Basics of User Interface Design, Usability Principles, User Interfaces.

4. Class Design and Class Diagrams: Essentials of UML Class Diagrams, Associations and Multiplicity, Other Relationships, Generalization, Instance Diagrams, Advanced Features of Class Diagrams, Interaction and Behavioral Diagrams: Interaction Diagrams, State Diagrams, Activity Diagrams, Component and Deployment Diagrams.

5. Software Design and Architecture: Process of Design, Principles Leading to Good Design, Techniques for Making Good Design Decisions, Good Design Document; Pattern Introduction, Design Patterns: Abstraction-Occurrence Pattern, General Hierarchical Pattern, Play-Role Pattern, Singleton Pattern, Observer Pattern, Delegation Pattern, Adaptor Pattern, Façade Pattern, Immutable Pattern, Read-Only Interface Pattern and The Proxy Pattern; Software Architecture Contents of Architecture Model, Architectural Patterns: Multilayer, Client-Server, Broker, Transaction Processing, Pipe & Filter and MVC Architectural Patterns.

6. Software Testing: Overview of Testing, Testing Concepts, Testing Activities, Testing Strategies, Unit Testing, Integration Testing, Function Testing, Structural Testing, Class Based Testing Strategies, Use Case/Scenario Based Testing, Regression Testing, Performance Testing, System Testing, Acceptance Testing, Installation Testing, OO Test Design Issues, Test Case Design, Quality Assurance, Root Cause Analysis, Post-Mortem Analysis.

7. Software Process Management: Introduction to Software Project Management, Rationale Management, Configuration Management, Activities of Software Project Management, Structure of Project Plan, Software Engineering Teams, Software Cost Estimation, Project Scheduling, Tracking and Monitoring

Text Books:

1. Object-Oriented Software Engineering Practical software development using UML and Java by Timothy C. Lethbridge & Robert, Langanieri McGraw-Hill

2. Software Engineering, K.K. Agarwal, New Age Publications 2008

3. Object-Oriented Software Engineering: Using UML, Patterns and Java, Bernd Bruegge and Allen H. Dutoit, 2nd Edition, Pearson Education Asia

Reference Books:

1. Software Engineering: A Practitioner's Approach, Roger S Pressman.

2. A Practical Guide to Testing Object-Oriented Software, John D. McGregor; David A.Sykes, Addison-Wesley Professional

CSE315 OPERATIONSRESEARCH

Commonwith6yearsintegratedB.Tech(CSE)+M.TechandB.Tech(IT)

Instruction: 3Periods+1Tut/week, Univ.Exam:3 Hours Credits:3

Internal:30Marks UniversityExam: 70Marks Total:100Marks

CourseObjectives

1. To discuss about basic Operation Research concepts, Formulation of LPP and its solution using graphical method.

2. To discuss about standard form of LPP. Solving LPP using various methods.

3. To study the various solutions of transportation problems and assignment problems.

4. To discuss about PERT and CPM charts

5. To discuss about replacement problems, inventory problems and game theory

Course Outcomes

1. Ability to solve LPP problems using various methods.

2. Ability to solve transportation and assignment problems using several methods.

3. Analyze the PERT and CPM charts.

4. Ability to solve replacement problems and game theory problems

SYLLABUS

1. Overview of Operations Research, Types of OR Models, Phases of Operations Research—OR Techniques, Introduction to Linear Programming, Formulation of Linear Programming Problem, Graphical Solution; Graphical Sensitivity Analysis.

2. Standard Form of LPP, Basic Feasible Solutions, Unrestricted Variables, Simplex Algorithm, Artificial Variables, Big M Method , Two Phase Simplex Method, Degeneracy, Alternative Optimal, Unbounded Solutions, Infeasible Solutions, Primal And Dual Problems And Their Relations, Dual Simplex Method.

3. Transportation Problem as LPP, Initial Solutions, North West Corner Rule, Lowest Cost Method, Vogel's Approximation Method, Optimum Solutions of TPP, Degeneracy in Transportation, Transportation Algorithms ,

4. Assignment Problem , Assignment Problem as LPP, Hungarian Method, Travelling Salesman Problem, Solutions Of TSP, Sequencing Problems, N-Jobs Two Machine Problems, N-Jobs K Machines Problems, Two-Jobs M-Machine Problems, Crew Scheduling Problems

5. Network Representation of A Project ,CP Mand PERT, Critical Path Calculations, Time– Cost Optimizations, PERT Analysis and Probability Considerations, Resource Analysis in Network Scheduling.

6. Replacement Problems- Individual And Group Replacement Policy, Reliability &System Failure Problems, Inventory-Factors Effecting Inventory-EOQ, Inventory Problems With and Without Shortages, Inventory Problems With Price Breakups, Multi Item Deterministic Problems. Probabilistic Inventory Problems.

7. Game Theory: Two Person Zero Sum Games, Mixed Strategy Games and Their Algorithms

Text Books

1. Operations Research, KantiSwaroop, P.K. Gupta, Man Mohan, Sulthan Chand& Sons Education

2. Publishers Operations Research– An Introduction, Handy A Taha– Pearson Education

Reference Books

1. Operations Research Panneer Selvan Prentice Hall Of India.

2. Operations Research By S.DSharma

3. Introduction To Operations Research, F.S. Hiller, G.J. Liberman,TMH

4. Operations Research, Richard Bronson, Schaum's Series, Mcgrawhill

IT316 ELECTIVE-I FILESTRUCTURES

Instruction: 3Periods+1Tut/week, Univ. Exam:3Hours Credits:3

Internal:30Marks UniversityExam: 70Marks Total:100Marks

Course Objectives

1. Provide an introduction to the fundamental file operations and storage systems.

2. Introducing fundamental concepts of file structure.

3. Introducing the most important high-level file structures tools which include indexing, co sequential processing, B trees, Hashing.

4. Applying the techniques in the design of C programs for solving various file management problems.

Course Outcomes At the end of this course student will

1) Understand the fundamental concepts of file processing operations and storage structures

2) Apply object orientation concepts to manipulate records

- 3) Apply concepts of sorting and merging on multiple files
- 4) Analyze the sequential and indexing file accessing techniques with appropriate data structures
- 5) Illustrate the usage of hashing techniques to organize file structures

SYLLABUS

1. File Processing Operations: Physical and logical files, opening, reading & writing and closing files in C, seeking and special characters in files, physical devices and logical files, file-related header files in C.
2. Secondary Storage: Disks – organization, tracks, sectors, blocks, capacity, non-data overhead, cost of a disk access, Magnetic Tape – types, performance, organization estimation of tape length and data transmission times, disk vs tape, CD-ROM – CD-ROM as a file structure, physical organization, strengths and weakness of cd-roms, storage hierarchy
3. Byte Journey and buffer Management: File manager, I/O buffer, I/O processing, buffer strategies and bottlenecks
4. File Structure Concepts: A stream file, field structures, reading a stream of fields, record structures and that uses a length indicator, Mixing numbers and characters – use of a hex dump, reading the variable length records from the files.
5. Managing records in C files: Retrieving records by keys, sequential search, direct access, choosing a record structure and record length, header records, file access and file organization
6. Organizing files for performance: Data compression, reclaiming space – record deletion and storage compaction, deleting fixed-length records for reclaiming space dynamically, deleting variable-length records, space fragmentation, replacement strategies.
7. Indexing, Index, A simple index with an entry sequenced file, basic operations on an indexed, entry sequenced file, indexes that are too large to hold in memory, indexing to provide access by multiple keys, retrieval using combination of secondary keys, improving the secondary index structure – inverted lists
8. Indexed sequential file access and prefix B+Trees: Indexed sequential access, maintaining a sequence set, adding a simple index to the sequence set, the tree, simple prefix B content of the index: separators instead of keys, the simple prefix B tree maintenance, index set block size, internal set block size, internal structure of index set blocks: a variable B+ tree order B- tree, loading a simple prefix
9. Special Note: Implementation in C only Hashing: Collisions in hashing, a simple hashing algorithms, hashing functions and record distributions, memory requirements, collision resolution by progressive overflow, buckets, deletions

10. Extendable hashing: Working of extendable hashing, implementation, deletion, extendable hashing performance

11. Designing file structure for CD-ROM: Tree structure on CD-ROM, hashing files on CD-ROM, CD-ROM file structure

Text Book

1. File Structures – An Object Oriented Approach with C++ by Michael J. Folk, Bill Zoellick and Greg Riccardi, Pearson

IT316 ELECTIVE-IFORMAL LANGUAGES & AUTOMATA THEORY

Instruction: 3 Periods + 1 Tut/week, Univ. Exam: 3 Hours Credits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course objectives

1. To introduce the concepts in automata theory and theory of computation to design grammars and recognizers for different formal languages.
2. To employ finite state machines to solve problems in computing.
3. To introduce finite state machines, context free grammars and Turing Machines and their properties as the basis for the formal expressivity of computer languages for solving linguistic decision problems.
4. To understand the concepts of tractability and decidability, the concepts of NP-completeness and NP-hard problem and also the challenges for Theoretical Computer Science and its contribution to other sciences

Course outcomes

1. Ability to think analytically and intuitively for problem solving situations in related areas of theory in computer science
2. Ability to describe the language accepted by an automata or generated by a regular expression or a context-free grammar;
3. Ability to Understand the functioning of Finite-State Machines, Deterministic Finite-State Automata, Nondeterministic Finite-State Automata and Pushdown Automata and Turing Machines

SYLLABUS

1. Definitions of alphabet, strings, language, grammar, types of grammar, types of machines, generation of languages from grammar, construction of grammar from the given description of languages.
2. Definition of finite state machine, Definite state machine, indefinite state machine, representations in mathematical diagram, tabular etc., id of finite state machine's, design of finite state machine from the given description, elimination of λ -transitions, indefinite state machine to definite state machine, optimization of finite state machine.

3. Conversion of regular grammar to finite state machine, finite state machine to regular grammar, discussion of pumping lemma, systematic way of construction of finite state machine.

4. Definition of regular expression, regular algebra, minimization of regular expressions, closure properties, construction of regular expression from the given description, regular expression to finite state machine, finite state machine to regular expression, construction of regular expression for the given finite state machine- a systematic way using Arden's theorem

5. Definition of push down machine, push down machine, types of push down machine's, push down machine to context free grammar, context free grammar to push down machine, design methodology of various push down machine's, push down machine by empty stack, push down machine by final states, conversion from one type to other type, applications of push down machine's.

6. Parsing tree, bottom-up parsing, top-down parsing, types of context free grammar's, left-most and right most derivations, productions, reductions, optimization of context free grammar's, elimination of ϵ productions, unit productions, normal forms- cnf, gnf.

7. Definition of Turing machine, ways of representing Turing machine's- tabular form, diagram, mathematical form, quintuples etc., design of Turing machine, id of Turing machine, types of Turing machine, halting problem, church's thesis, universal Turing machine, Gödel number, definitions of recursive functions- prf, rf, decidability.

NOTE: Theorem proofs are eliminated

Text Books

1. Introduction to automata theory, languages and computation, John.E.H.P croft/ Rajeev Motwani& JD Ullman—pearson education- III edition

2. Theory of computation, K.L.P.Mishra and N.Chandrasekhar, PHI

Reference Books

1. Theory of computation, formal languages and automata theory, G P SaradhiVarma, B.ThirupathiRao –Sci Tech publications.

IT316 ELECTIVE-I COMPILER DESIGN

Instruction: 3Periods+1Tut/week, Univ.Exam:3 Hours Credits:3

Internal:30Marks University Exam: 70Marks Total:100Marks

Course objectives

1. To explain the basic understanding of grammars and language definition and introducing various phases of designing a compiler.

2. To make the student to understand the concepts underlying the design and implementation of language processors and its mechanisms.

3. To extend the knowledge of parser by parsing LL parser and LR parser.

4. To enrich the knowledge in various phases of compiler and its use, code optimization techniques, loop optimization techniques, machine code generation, and use of symbol table

Course outcomes

1. Ability to design & conduct experiments for Intermediate Code Generation in compiler.

2. Ability to learn the new code optimization techniques to improve the performance of a program in terms of speed & space.

3. Ability to acquire the knowledge of modern compiler & its features

SYLLABUS

1. Introduction: Introduction to Compilers and Language processors, Programming Language basics, Structure & Different Phases of a Compiler, Review of Compiler Structure, Structure of Optimizing Compilation, Compiler construction tools, Boot strapping, Cross compilers.

2. Finite Automata &Lexical Analysis: Introduction to Lexical Analysis, Lexical Analyzers, Approaches to design Lexical Analyzers, Language for specifying lexical analyzers, Introduction to Finite automata, Regular Expressions & Languages, Recognition of Tokens, Transition Diagrams, Implementation of lexical analyzers, Lexical Analyzer Generator LEX.

3. Syntax Analysis: Syntactic Specification of Programming Languages, Context Free Grammars &Languages, Introduction to Parsers. Top-down parsing techniques: Brute force parsing, Recursive Descent Parsing, Predictive Parsing, Bottom-up Parsing: Shift reduce parsing, Operator parsing, LR(k) parsing.

4. Semantic Analysis and Intermediate Code Generation: Semantic Actions, Syntax Directed Translations, Translation on the parse Tree, Implementation of Syntax Directed Translator, Intermediate Codes, Syntax Directed translation to Postfix code, Syntax Trees, Intermediate Code Generation, Three Address Code- Translation of Expressions, Type Checking &Type Conversions.

5. Code Optimization: Principal sources of Code Optimization, Loop Optimization, Basic Blocks &Flow Graphs, DAG Representation of Basic Blocks, Applications of DAG, Local Optimization, Unreachable Code Elimination, Dead Code Elimination, Data Flow Analysis, Data Flow Equations &Computations, Peep-Hole Optimization. Machine Dependent Optimizations, Overview of Informal Compiler Algorithm Notation (ICAN), If Simplification, Loop Simplification, Loop Inversion, Branch Optimization and Prediction

6. Code Generation and Code Scheduling: Issues in Code Generation, Input to Code Generator, Instruction Selection, Register Allocation, Simple Target Machine Model, Program and Instruction Costs, Register allocation & Assignments, Code Generation Algorithm, Code Generators, Optimal Code Generation for Expressions, Code Generation From DAG.

7. Symbol Tables, Runtime Environment and Error Handling: Contents of a Symbol Table, Data Structures for Symbol Tables; Run time Environments, Implementation of a simple Stack allocation, Heap Management, Block Structured Languages; Error Detection & Recovery, Lexical Phase Errors, Syntactic & Semantic Errors, Error Handling Routines

Text Books

1. Principles of Compiler Design by Aho, D. Ullman, Lam and Ravi Sethi, Pearson Education Second Edition

2. Advanced Compiler Design and Implementation, Steven Muchnic, Elsevier Publications

Reference Books

1. Compiler Construction by Kenneth C. Louden, Vikas Pub. House.

2. Compiler Design, A.A. Pentambekar, Technical Publications

3. Modern Compiler Design, Grune D., Van Reeuwijk K, Bal H.E, Jacobs C J H, Langendoen K, Springer

IT317 SOFTWARE ENGINEERING MINIPROJECT LAB

Instruction: 3 Periods/week, Univ. Exam: 3 Hours Credits: 1.5

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

Course Objective

The purpose of the Software Engineering Lab course is to familiarize the students with modern software engineering methods and tools, Rational Products. The course is realized as a project-like assignment that can, in principle, by a team of three/four students working full time. Typically the assignments have been completed during the semester by each project team.

Course Outcomes

The goal of the Software Engineering Project is to have a walk through from the requirements, design to implementing and testing. An emphasis is put on proper documentation. Term projects are projects that a group student might take through from initial specification to implementation by giving equal importance to both design and implementation.

Cycle I: Practicing UML diagrams using IBM Rational Rose. 6*3 periods = 18 periods Before developing a mini-project, in this cycle, the student is acquainted with different UML diagrams using Rational Rose. The

experiments should include drawing UML diagrams listed below for two demo/example applications assigned by the lab Instructor. The input for the following experiments is problem statement for any two demo projects supplied by the instructor.

1. Introduction to Rational Rose and Practicing the following diagrams
 - a. Activity diagrams for the overall business process of the projects
 - b. Use-case diagram for the demo projects along with Use-case descriptions and sub-diagrams for Use-cases.
2. Class diagram- Class diagrams including the features like classes, relationships, attributes and methods along with their visibilities.
3. Interaction diagrams- Sequence diagrams and Collaboration diagrams for different scenarios of the systems with all features like actors, objects and interactions.
4. Activity diagrams, State chart and other diagrams - Activity diagrams including the features like fork join and swim lanes. State diagrams including composite states and transitions. Component diagrams, Package diagrams and Deployment diagrams.
5. Forward and Reverse Engineering- Forward Engineering Class diagrams to classes in C++ and Java and persistent classes to a database. Reverse Engineering C++ code, Java code and a database.

6. Documentation using Rational Rose clear quest

Cycle II: Mini-Project 8*3 periods = 24 periods

The project deliverables include

- v Problem statement
- v Requirements Analysis
- v Design
 - o A Software Design Description and a System Design.
 - o A test specification.
- v Implementation
 - o Implement the assigned project with one of the following web technologies
- § Front end: Java technologies/PHP/MS.NET Technologies
- § Backend: Oracle/My-SQL/SQL-Server
- v Testing

References

1. Project-based software engineering: An Object-oriented approach, Evelyn Stiller, Cathie LeBlanc, Pearson Education
2. Visual Modeling with Rational Rose 2002 and UML, Terry Quatrini, Pearson Education

CSE318 OPERATING SYSTEMS LAB

Common with 6 years integrated B.Tech(CSE)+M.Tech and B.Tech(IT)

Instruction: 3 Periods/week, Univ.Exam: 3 Hours Credits: 1.5

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

Course Objectives

1. To learn about UNIX/LINUX operating system, its intervals.
2. To learn system programming for UNIX/LINUX Operating System.
3. To understand UNIX/LINUX shell and its programming.
4. To understand resource management policies and mechanisms and their performance evaluation

Course Outcomes

1. The student practices UNIX commands, Vi editor, shell commands.
2. The student develops skill in writing C programs using system calls for process management, inter process communication and other aspects.
3. The student learns shell programming and develops skill for writing scripts for batch level tasks.
4. The student learns to simulate OS resource management aspects like process scheduling, page replacement and others to evaluate performance

Module I

1. OS lab familiarization, Home Assignment on Unix commands, Vi editor
2. Simple C programs using command line arguments, system calls, library function calls, make utility
3. C programs using fork system call to create processes and study parent, child process mechanism
4. C programs to create process chaining, spawning
5. C programs to handle errors using errno, perror() function
6. C programs to use pipe system call for inter process communication

Module II

1. Familiarization of Unix shell programming
2. Simple shell programming exercises
3. Shell programming using decision making constructs
4. Shell programming using loop constructs
5. Shell programming for file and directory manipulation

Module III

1. C programs to study process scheduling implementing FCFS, Shortest Job First, and Round Robin algorithms

2. C programs to study page replacement implementing FIFO, Optimal, and LRU page replacement algorithms

3. C programs to study deadlock avoidance and detection
4. C Programs to simulate free space management

References

1. UNIX concepts and applications by Sumitabha Das, TMH Publications.
2. UNIX programming by Stevens, Pearson Education.
3. Shell programming by Yashwanth Kanetkar.
4. Operating System Concepts by Silberschatz, and Peter Galvin

CSE319 SOFT SKILLS LAB

Common with 6 years integrated B.Tech(CSE)+M.Tech and B.Tech(IT)

Instruction: 3 Periods/week, Univ.Exam: 3 Hours Credits: 1.5

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

1. English Language Skills
2. Spoken English Skills
3. Presentation Skills

B.TECH (IT) 3rd YEAR II-SEMESTER SCHEME OF INSTRUCTION AND EXAMINATION

(For the 2019-2020 admitted batch)

Sub Ref.No	Name of the Subject	Periods			Maximum marks			Credits
		Theory	Tutorial	Lab	Exam	Internal	Total	
IT321	COMPUTER GRAPHICS AND MULTIMEDIA	3	1	—	70	30	100	3
CSE322	WEB TECHNOLOGIES	3	1	—	70	30	100	3
IT323	ELECTIVE-II	3	1	—	70	30	100	3
IT324	ELECTIVE-III	3	1	—	70	30	100	3
CSE325	DATA WAREHOUSING & DATA MINING	3	1	—	70	30	100	3
IT326	CRYPTOGRAPHY AND NETWORK SECURITY	3	1	—	70	30	100	3
IT327	NETWORK PROGRAMMING LAB	—	—	3	50	50	100	1.5
CSE328	WEB TECHNOLOGIES LAB	—	—	3	50	50	100	1.5
TOTAL		18	6	6	520	280	800	21

ELECTIVE-II

1. Distributed Systems
2. Information Retrieval
3. Soft Computing

ELECTIVE-III

1. ArtificialIntelligence
2. ImageProcessing
3. MobileComputing

IT321 COMPUTERGRAPHICS&MULTIMEDIA

Instruction: 3Periods+1Tut/week, Univ. Exam:3Hours Credits:3

Internal:30Marks UniversityExam: 70Marks Total:100Marks

Course Objective

- To study the graphics techniques and algorithms.
- To study the multimedia concepts and various I/O technologies.
- To enable the students to develop their creativity

Course Outcomes

1. Students will have an appreciation of the history and evolution of computer graphics, both hardware and software. Assessed by written homework assignment.
2. Students will have an understanding of 2D graphics and algorithms including: line drawing, polygon filling, clipping, and transformations.
3. Students will understand the concepts of and techniques used in 3D computer graphics, including viewing transformations, hierarchical modeling, color, lighting and texture mapping.
4. Students will be able to use a current graphics API (OpenGL). Assessed by programming assignments

SYLLABUS

1. Output Primitives: Introduction - Line - Circle and Ellipse Drawing Algorithms – Attributes – Two-Dimensional Geometric Transformations – Two-Dimensional Clipping and Viewing.
2. Three-Dimensional Concepts: Three-Dimensional Object Representations – Three-Dimensional Geometric and Modeling Transformations – Three-Dimensional Viewing – Color models – Animation.
3. Multimedia Systems Design: An Introduction – Multimedia applications – Multimedia System Architecture - Evolving technologies for Multimedia – Defining objects for Multimedia systems - Multimedia Data interface standards - Multimedia Databases.
4. Multimedia File Handling: Compression & Decompression – Data & File Format standards – Multimedia I/O technologies - Digital voice and audio – Video image and animation – Full motion video – Storage and retrieval Technologies.
5. Hypermedia: Multimedia Authoring & User Interface – Hypermedia messaging - Mobile Messaging – Hypermedia message component –

Creating Hypermedia message – Integrated multimedia message standards – Integrated Document management – Distributed Multimedia Systems

Text Books

1. Donald Hearn and M.Pauline Baker, "Computer Graphics C Version", Pearson Education, 2003. (UNIT I : Chapters 1 to 6; UNIT 2: Chapter 9 – 12, 15,16)
2. Prabat K Andleigh and KiranThakrar, "Multimedia Systems and Design", PHI, 2003. (UNIT 3 to5)

Reference Books

1. Judith Jeffcoate, "Multimedia in practice technology and Applications", PHI,1998.
2. Foley, Vandam, Feiner, Huges, "Computer Graphics: Principles & Practice", Pearson Education, second edition2003

CSE322 WEBTECHNOLOGIES

Commonwith6yearsintegratedB.Tech(CSE)+M.TechandB.Tech(IT)

Instruction: 3Periods+1Tut/week, Univ.Exam:3 Hours Credits:3

Internal:30Marks UniversityExam: 70Marks Total:100Marks

Course Objectives

Oncompletingthiscoursestudentwillbeableto

1. Understand the principles of Web based application development.
2. Design dynamic content in Web Pages using JavaScript.
3. Understanding the concepts of java Servlets, java Server Pages and design applications using them.
4. Understand the concepts of Component development and design applications by establishing connections to Databases

Course Outcomes

1. Students will be able to construct web based applications and Identify where data structures are appearing in them.
2. Students will be able to connect java programs to different databases.
3. Students will be able to develop EJB programs

SYLLABUS

1. Introduction to HTML, Core Elements, Links and Addressing, Images, Text, Colors and Background, Lists, Tables and Layouts, Frames, Forms, Cascading Style Sheets.
2. Introduction to Java Scripts, Elements of Objects in Java Script, Dynamic HTML with Java Script.

3. Document type definition, XML Syntax, XML Schemas, Document Object model, Presenting XML, Using XML Processors.

4. Introduction to Servlet, Servlet Life Cycles, Servlet Basics, Tomcat Web Server, Configuring Apache Tomcat, Handling Client Request and Response, Handling Cookies, Session Tracking.

5. Introduction to PHP, Language Basics, Functions, Strings, Arrays.

6. Web Techniques, Data bases, Graphics, PDF, Dates and Times.

7. MYSQL Installation, Accessing MySQL Using PHP, Form Handling, Cookies, Sessions, and Authentication, Tables, Inserting Data into Tables , Selecting Data from a Table, Updating Table Deleting data from Table, Webpage creation

Text Books

1. Web Programming, building internet applications, 2nd Ed., Chris Bates, Wiley Dreamtech

2. Web Technologies; by Uttam K. Roy

3. The complete Reference HTML and DHTML, Thomas A. Powey

Reference Books

1. Internet, World Wide Web , How to program, Dietel , Nieto, PHI/PEA

2. Web Tehnologies, Godbole, kahate, 2nd Ed., TMH

IT323 ELECTIVE-II DISTRIBUTED SYSTEMS

Instruction: 3Periods+1Tut/week, Univ.Exam:3Hours Credits: 3

Internal:30Marks University Exam: 70Marks Total:100Marks

Course Objectives

This course provides an introduction to the fundamentals of distributed computer systems, assuming the availability of facilities for data transmission.

Course Outcomes

By the end of the course, students should be able to build distributed systems that:

1. Scale as the number of entities in the system increase

2. Can sustain failures and recover from them

3. Work with distributed, fault tolerant file systems

4. Can handle and process large data volumes

5. Are secure and handle certain classes of distributed denial of service attacks

6. Are Loosely coupled, transactional and eventually stable

SYLLABUS

1. Introduction to Distributed Systems, What is a Distributed System?, Hard ware concepts, Software concepts, Design issues.

2. Communication in Distributed Systems, Lay red Protocols, ATM networks, The Client – server model, Remote Procedure call, and Group communication.

3. Synchronization in Distributed System, Clock Synchronization, Mutual Exclusion, Election algorithms, Atomic transactions, Deadlocks in Distributed Systems.

4. Process and processors in Distributed System threads, System Models, Processors allocation, Scheduling in Distributed System, Fault tolerance, Real time Distributed System.

5. Distributed File Systems, Distributed File System Design, Distributed File System implementation, Trends in Distributed File System.

6. Distributed Shared Memory, Introduction, What is Shared memory?, Consistency models, Page based Distributed Shared memory, Shared – variable Distributed Shared memory, Object based Distributed Shared Memory

Text Book

1.Distributed Operating Systems, Andrew S. Tanenbanm

Reference Book

1. Advanced Concepts in Operating Systems, Makes Singhal and NiranjnG.Shivaratri

IT323 ELECTIVE-II INFORMATIONRETRIEVAL

Instruction: 3Periods+1Tut/week, Univ. Exam:3Hours Credits:3

Internal:30Marks UniversityExam: 70Marks Total:100Marks

Course objectives

a. To provide an overview of Information Retrieval.

b. To introduce students about insights of the several topics of Information retrieval such as – Boolean retrieval model, Vector space model.

c. To provide comprehensive details about various Evaluation methods.

d. To provide implementation insight about the topics covered in the course.

Course outcomes

a. Students will get the understanding different Information retrieval model.

b. Students will get to know about evaluation methods of the information retrieval model.

c. Students will get to know the challenges associated with each topic.

SYLLABUS

1. Introduction to Information storage and retrieval systems: Domain Analysis of IR systems, IR and other types of Information Systems, IR System Evaluation, Introduction to Data structures and algorithms related to Information Retrieval: Basic Concepts, Data structures, Algorithms.

2. Inverted Files: Introduction, Structures used in Inverted Files, Building an Inverted files using a sorted array, Modifications to the Basic Techniques.

3. Signature Files: Introduction, Concepts of Signature files, Compression, Vertical Partitioning, Horizontal Partitioning.

4. New Indices for Text: PAT Trees and PAT Arrays: Introduction, PAT Tree structure, Algorithms on the PAT Trees, Building PAT Trees as PATRICA Trees, PAT representation as Arrays.

5. Lexical Analysis and Stop lists: Introduction, Lexical Analysis, Stop lists.

6. Stemming Algorithms: Introduction, Types of Stemming algorithms, Experimental Evaluations of Stemming, Stemming to Compress Inverted Files.

7. Thesaurus Construction: Introduction, Features of Thesauri, Thesaurus Construction, Thesaurus construction from Texts, Merging existing Thesauri.

8. String Searching Algorithms: Introduction, Preliminaries, The Naive Algorithm, The Knutt-Morris-Pratt Algorithm, The Boyer-Moore Algorithm, The Shift-Or Algorithm, The Karp-Rabin Algorithm

Reference Books

1. Modern Information Retrieval, Ricardo Baeza-Yates, Neto, PEA,2007.

2. Information Storage and Retrieval Systems: Theory and Implementation, Kowalski, Gerald, Mark Academic Press,2000.

3. Information Retrieval: Algorithms and Heuristics , Grossman, OphirFrieder,2/e, Springer,2004.

4. Information Retrieval Data Structures and Algorithms , Frakes, Ricardo Baeza-Yates, PEA

5. Information Storage and Retrieval, Robert Korfhage, John Wiley & Sons.

6. Introduction to Information Retrieval, Manning, Raghavan, Cambridge University Press

IT323 ELECTIVEII SOFTCOMPUTING

Instruction: 3Periods+1Tut/week, Univ. Exam:3Hours Credits: 3

Internal:30Marks UniversityExam: 70Marks Total:100Marks

Course Objectives

1. Understand Soft Computing concepts, technologies, and applications

2. Understand the underlying principle of soft computing with its usage in various application. .

3. Understand different soft computing tools to solve real life problems.

Course Outcomes

Upon successful completion of this course students should be able to:

1. Develop application on different soft computing techniques like Fuzzy, GA and Neural network

2. Implement Neuro-Fuzzy and Neuro-Fuzz-GA expert system.

SYLLABUS

1. Soft Computing: Introduction to Fuzzy Computing, Neural Computing, Genetic Algorithms, Associative Memory, Adaptive Resonance Theory, Different Tools and Techniques, Usefulness and Applications.

2. Fuzzy Sets and Fuzzy Logic: Introduction, Fuzzy Sets Versus Crisp Sets, Operations on Fuzzy Sets, Extension Principle, Fuzzy Relations and Relation Equations, Fuzzy Numbers, Linguistic Variables, Fuzzy Logic, Linguistic Hedges, Applications,

3. Interference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzifications and Defuzzifications, Fuzzy Controller, Fuzzy Controllers, Fuzzy Pattern Recognition, Fuzzy Image Processing, Fuzzy Database.

4. Artificial Neural Network: Introduction, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, re-current networks. Various learning techniques, perception and convergence rule, Auto-associative and hetro-associative memory , Hebb's Learning, Adaline, Perceptron

5. Multilayer Feed Forward Network, Back Propagation Algorithms, Different Issues Regarding Convergence of Multilayer Perceptron, Competitive Learning, Self- Organizing, Feature Maps, Adaptive Resonance Theory, Associative Memories, Applications.

6. Evolutionary and Stochastic Techniques: Genetic Algorithm (GA), Genetic Representations, (Encoding) Initialization and Selection, Different Operators of GA, Analysis of Selection Operations, Hypothesis of Building Blocks, Schema Theorem and Convergence of Genetic Algorithm, Simulated Annealing and Stochastic Models, Boltzmann Machine, Applications.

7. Rough Set: Introduction, Imprecise Categories Approximations and Rough Sets, Reduction of Knowledge, Decision Tables and Applications.

8. Hybrid Systems: Neural-Network-Based Fuzzy Systems, Fuzzy Logic-Based Neural Networks, Genetic Algorithm for Neural Network Design and Learning, Fuzzy Logic and Genetic Algorithm for Optimization, Applications

Text Books

1. Neural Networks, fuzzy Logic and Genetic Algorithm: Synthesis and Applications, S. Rajsekaran and G.A. Vijayalakshmi Pai, Prentice Hall of India.

2. Rough Sets, Z.Pawlak, Kluwer Academic Publisher,1991.

3. Intelligent Hybrid Systems, D. Ruan, Kluwer Academic Publisher,1997

References

1. Artificial Intelligence and Intelligent Systems, N.P.Padhy, Oxford University Press.

2. Neural Fuzzy Systems, Chin-Teng Lin & C. S. George Lee, Prentice Hall PTR. Addison-Wesley

3. Learning and Soft Computing, V. Kecman, MIT Press,2001

4. Fuzzy Sets and Fuzzy Logic, Klir& Yuan, PHI,1997

IT324 ELECTIVE-III ARTIFICIALINTELLIGENCE

Instruction: 3Periods+1Tut/week, Univ.Exam:3Hours Credits: 3

Internal:30Marks UniversityExam:70Marks Total:100Marks

Course Objectives

1. To learn about AI problem, Production Systems and their characteristics.

2. To understand the importance of search and the corresponding search strategies for solving AI problem.

3. To introduce to Planning, Natural Language Processing and Expert Systems

Course Outcomes

1. The Student understands AI problem characteristics, state space approach for solving AI problem, Production System framework.

2. The student learn several optimal search strategies and the use of heuristics.

3. The student learns relational, inferential, inheritable and procedural knowledge and the corresponding knowledge representation approaches.

4. The student is introduced to applying AI problem solving approaches to natural language processing, planning and expert systems

SYLLABUS

1. Introduction to Artificial Intelligence: Artificial Intelligence, AI Problems, AI Techniques, Defining the Problem as a State Space Search, Problem Characteristics, Production Systems.

2. Search Techniques: Issues in The Design of Search Programs, Un-Informed Search, BFS, DFS; Heuristic Search Techniques: Generate-And-Test, Hill Climbing, Best- First Search, A* Algorithm, Problem Reduction, AO*Algorithm, Constraint Satisfaction, Means-Ends Analysis.

3. Knowledge Representation using Rules: Procedural Vs Declarative Knowledge, Logic programming, Forward Vs Backward Reasoning, Matching Techniques, Partial Matching, RETE Matching Algorithm AI Programming languages: Overview of LISP and PROLOG, Production System in Prolog.

4. Symbolic Logic: Propositional Logic, First Order Predicate Logic: Representing Instance and is-a Relationships, Computable Functions and Predicates, Unification & Resolution, Natural Deduction;

a. Structured Representations of Knowledge: Semantic Nets, Partitioned Semantic Nets, Frames, Conceptual Dependency, Conceptual Graphs, Scripts.

5. Reasoning under Uncertainty: Introduction to Non-Monotonic Reasoning, Truth Maintenance Systems, Logics for Non-Monotonic Reasoning, Statistical Reasoning: Bayes Theorem, Certainty Factors and Rule-Based Systems, Bayesian Probabilistic Inference, Bayesian Networks, Dempster- Shafer Theory, Fuzzy Logic: Crisp Sets, Fuzzy Sets, Fuzzy Logic Control, Fuzzy Inferences & Fuzzy Systems.

6. Natural Language Processing: Steps in The Natural Language Processing, Syntactic Processing and Augmented Transition Nets, Semantic Analysis, NLP Understanding Systems;

7. Planning: Components of a Planning System, Goal Stack Planning, Non- linear Planning using Constraint Posting, Hierarchical Planning, Reactive Systems.

8. Experts Systems: Overview of an Expert System, Architecture of an Expert Systems, Different Types of Expert Systems- Rule Based, Frame Based, Decision Tree based, Case Based, Neural Network based, Black Board Architectures, Knowledge Acquisition and Validation Techniques, , Knowledge System Building Tools, Expert System Shells

Text Books

1. Artificial Intelligence, Elaine Rich and Kevin Knight, Tata Mcgraw-Hill Publications

2. Introduction To Artificial Intelligence & Expert Systems, Patterson, PHI publications

Reference Books

1. Artificial Intelligence, George F Luger, Pearson Education Publications
2. Artificial Intelligence : A modern Approach, Russell and Norvig, Printice Hall
3. Artificial Intelligence, Robert Schalkoff, Mcgraw-Hill Publications
4. Artificial Intelligence and Machine Learning, Vinod Chandra S.S., Anand HareendranS

IT324 ELECTIVEIII IMAGEPROCESSING

Instruction: 3Periods+1Tut/week, Univ.Exam:3Hours Credits: 3
Internal:30Marks UniversityExam: 70Marks Total:100Marks

Courseobjectives

1. To explain fundamentals of Image processing concepts.
2. To provide mathematical foundation of image enhancement, image compression and image segmentation.
3. To explain the students about Morphology and its applications in image processing.
4. To explain various methods and techniques for image transformation

Course outcomes

1. Ability to develop algorithms for fundamental concepts in Image processing.
2. Ability to perform image enhancement, image compression and image segmentation using various methods.
3. Ability to implement Image transformation techniques

SYLLABUS

1. Fundamentals of Image Processing: Image Acquisition, Image Model, Sampling, Quantization, Relationship between Pixels, Distance Measures, Connectivity, Image Geometry, Photographic Film. Histogram: Definition, Decision Of Contrast Basing On Histogram, Operations Basing on Histograms Like Image Stretching, Image Sliding, Image Classification. Definition and Algorithm of Histogram Equalization.

2. Image Enhancement in Spatial Domain : Arithmetic and Logical Operations, Pixel or Point Operations, Size Operations; Smoothing Filters-Mean, Median, Mode Filters – Comparative Study;

3. Edge enhancement in spatial domain: Edge enhancement filters, Directorial Filters, Sobel, Laplacian, Robert, KIRSCH Homogeneity & DIFF filters, PREWITT Filter, Contrast based edge enhancement techniques, Comparative study, Low pass filters, High pass filters, Sharpening filters, Comparative study, Color fundamentals and color model

4. Image Compression: Run Length Encoding, modified run length encoding, Contour Coding, Huffman Code, Compression Due to Change in Domain, Compression Due to Quantization Compression at the Time of Image Transmission. Brief Discussion on:- Image Compression Standards.

5. Image Segmentation: Definition of segmentation, Characteristics of Segmentation, Detection of Discontinuities, Thresholding. Pixel Based Segmentation Method. Region Based Segmentation Methods, Segmentation by Pixel Aggregation, Segmentation by Sub Region Aggregation, Histogram Based Segmentation, Spilt and Merge Technique, Segmentation of moving objects

6. Morphology: Dilation, Erosion, Opening, Closing, Hit-And-Miss Transform, Thinning, Thickening, Skeletons , Pruning Extensions to Gray – Scale Images Application of Morphology in I.P

7. Image Transforms: A Detail Discussion On Fourier Transform, DFT, FFT, Properties of Fourier transform, WALSH Trans Form, WFT, HADAMARD Transform, DCT Image Enhancement in Frequency Domain: Design of Low Pass, High Pass, EDGE Enhancement, Smoothing Filters in Frequency Domain. Butter Worth Filter, Homomorphic Filters in Frequency Domain Advantages of Filters in Frequency Domain, Comparative Study of Filters in Frequency, Domain and Spatial Domain.

Text Book

1. Digital Image Processing, Rafael C.Gonzalez And Richard E. Woods, Addison Wesley

Reference Books

1. Fundamentals Of Electronic Image Processing By Arthyr – R – Weeks,Jr.(PHI)
2. Image Processing, Analysis, And Machine Vision By Milan SonkaVaclanHalavac Roger Boyle, Vikas Publishing House.
3. Digital Image Processing, S. Jayaraman, S. Esakkirajan& T. Veera Kumar, TMH
4. Fundamentals of Digital Image Processing, Chris Solomon, Tobi Breckon, Wiley- Blackwell

IT324 ELECTIVEIII MOBILECOMPUTING

Instruction: 3Periods+1Tut/week, Univ.Exam:3Hours Credits: 3
Internal:30Marks UniversityExam: 70Marks Total:100Marks

Course objectives

1. To introduce the basic concepts and principles in mobile computing. This includes major techniques involved, and networks & systems issues for the design and implementation of mobile computing systems and applications.

2. To explore both theoretical and practical issues of mobile computing.

3. To provide an opportunity for students to understand the key components and technologies involved and to gain hands-on experiences in building mobile applications.

Course outcomes

On successful completion of course learner will be able:

1. To identify basic concepts and principles in mobile communication & computing, cellular architecture.

2. To describe the components and functioning of mobile networking.

3. To classify variety of security techniques in mobile network.

4. To describe and apply the concepts of mobility management

SYLLABUS

1. Basics of Android: Introduction to Android Operating System, Version of Android, Installing of software, Android example, Internal Details, Software Stack, Android Core Building Blocks, Android Emulator, AndroidManifest.xml, R.java file, Hide Title Bar, Screen Orientation.

2. User Interface Widgets: Working with Button, Toast, Custom Toast, Button, Toggle Button, Switch Button, Image Button, Check Box, Alert Dialog, Spinner, Spinner and other widgets, Auto Complete Text View, Rating Bar, Date Picker, Time Picker, Progress Bar, Activity life cycle and example, Intents-types, Fragment lifecycle and types.

3. Android Menu, Layouts and Views: Option Menu, Context Menu, Popup Menu, Types of layouts-Relative, Linear, Table, Grid. Types of views-Grid, Web, Scroll, Search, Tab Host, Dynamic List, Expanded List views.

4. Android services and Data storage: web service, Android services, Android Service API, lifecycle and examples. Shared preferences, Soap Vs Restful web service, , Internal storage, External storage, Sqlite Databases, Storing data into external oracle database.

5. Multimedia and Animation: Playing audio and video, creating audio player ,Alarm manager, gallery, Animation API, Drawable class, Rotate, Fade, Zoom animations, XML &JSON -XML Parsing SAX, XML Parsing DOM , XML Pull Parser , JSON Parsing.

6. Speech API and Telephony API, Web services: Text To Speech API, Example, managing speech and pitch, Speech to text. Telephony manager, Get calls state, call tracker, make phone call and send SMS,

Email. Web Service introduction, SOAP vs RESTFUL web services, external oracle database connections.

7. Content Providers and Notifications: Fundamentals of content providers, Content URI, Creation of custom content provider. Notification API, Notification Builder, Issuing notifications, Notification Compact builder, Examples

Text Book

1. Beginning Android 4 Application Development- WEI-MENG LEE, Wiley India Pvt.ltd

Reference Books

1. Introduction to Android Application Development: Android Essentials, 4/E, Joseph Annuzzi, Jr. Lauren Darcey, Shane Conder, Pearson Education publishers

2. Professional Android 4 Application Development, Reto Meier, Wiley India Pvt.ltd

3. Android Application Development, Pradeep Kothari, Dream tech publications <http://developer.android.com/guide/index.html>

CSE325 DATAWAREHOUSING&DATAMINING

Common with 6 years integrated B.Tech(CSE)+M.Tech and B.Tech(IT)

Instruction: 3 Periods + 1 Tut/week, Univ.Exam: 3 Hours Credits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives

1. To understand the evolution of data warehousing and data mining systems

2. To understand extracting, cleaning and transformation of data into a warehouse.

3. To learn the principles of statistics, information theory, machine learning and other areas AI and implementation of data mining techniques.

4. To understand pattern mining using classification and clustering methods

Course Outcomes

1. The student understands the differences between OLTP and OLAP.

2. The student learns how data cube technology supports summarization and querying high dimensional data.

3. The student is introduced to similarity, distance, information gain and other performance and error metrics used for evaluation of mining results.

4. The student is introduced to various approaches to association rule mining, supervised and unsupervised learning and the corresponding classification and clustering approaches involving decision trees, Bayesian approaches, model based and agglomerative approaches

SYLLABUS

1. Introduction to Data Mining: Importance of Data Warehousing and Data Mining, Kinds of Patterns, Technologies, Applications, Major Issues in Data Mining, Data Objects and Attributes Types, Statistical Descriptions of Data, Estimating Data Similarity and Dissimilarity.

2. Data exploration and pre-processing: Data Visualization, Quality data, Data Cleaning, Data Integration, Data Reduction, Data Transformation, Discretization and Concept Hierarchy Generation.

3. Data Warehouse and OLAP Technology: Basic Concepts of Data warehouse, Data Modeling using Cubes and OLAP, DWH Design and Usage, Implementation using Data Cubes and OLAPs, Data Generalization with AOI.

4. Data Cube Technology: Preliminary Concepts of Data Cube Computation, Data Cube Computation Methods: Multi-way Array Aggregation for Full Cube, BUC, Star-cubing, Pre-computing shell fragments for High dimensional OLAP.

5. Mining Frequent Patterns Based on Associations and Correlations: Basic Concepts, Frequent Itemset Mining Methods: Apriori Algorithm, Association Rule Generation, Improvements to A Priori, FP-Growth Approach, Pattern Evaluation Methods.

6. Classification & Prediction: Basic Concepts, Decision Tree Induction, Bayes Classification, Rule-Based Classification, Model Evaluation and Selection, Techniques to Improve Classification Accuracy, Classification by Back Propagation, K-nearest neighbor classifier.

7. Cluster Analysis: Basic Concepts and issues in clustering, Types of Data in Cluster Analysis, Partitioning Methods, Hierarchical Methods, DBSCAN, Grid Based Methods, Evaluation of Clustering Solutions

Text Books

1. Data Mining- Concepts and Techniques by Jiawei Han, Micheline Kamber and Jian Pei—Morgan Kaufmann publishers —3rd edition

2. Data Mining Techniques, A.K. Pujari, University Press

Reference Book

1. Data mining concepts by Tan, Steinbach, and Vipin Kumar - Pearson Education publishers

IT326 CRYPTOGRAPHY & NETWORK SECURITY

Instruction: 3 Periods + 1 Tut/week, Univ. Exam: 3 Hours Credits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives

1. Introduction of the issues in network security- its need and importance, taxonomy and terminology.

2. Discussion of various cryptographic techniques.

3. Exploration of different types of security threats and remedies.

4. Understanding of Internet security protocols and standards

Course Outcomes

1. Realize the need and importance of network and data security in the Internet and in the distributed environments.

2. Identify the different types of network security issues and their remedies.

3. Application various cryptographic tools and techniques in different contexts and as per need of security levels.

4. Implementation of some Internet security protocols and standards

SYLLABUS

1 Overview: Computer Security Concepts, Threats, Attacks, and Assets, Security Functional Requirements, A Security Architecture for Open Systems, Computer Security Trends, Computer Security Strategy. Cryptographic Tools: Confidentiality with Symmetric Encryption, Message Authentication and Hash Functions, Public-Key Encryption, Digital Signatures and Key Management, Random and Pseudorandom Numbers, Practical Application: Encryption of Stored Data. User Authentication: Means of Authentication, Password-Based Authentication, Token-Based Authentication, Biometric Authentication, Remote User Authentication, Security Issues for User Authentication, Practical Application: An Iris Biometric System, Case Study: Security Problems for ATM Systems.

2 Access Control: Access Control Principles, Subjects, Objects, and Access Rights, Discretionary Access Control, Example: UNIX File Access Control, Role-Based Access Control, Case Study: RBAC System for a Bank. Database Security: The Need for Database Security, Database Management Systems, Relational Databases, Database Access Control, Inference, Statistical Databases, Database Encryption, Cloud Security.

3 Malicious Software: Types of Malicious Software (Malware), Propagation—Infected Content—Viruses, Propagation—Vulnerability Exploit—Worms, Propagation—Social Engineering—SPAM E-mail, Trojans, Payload—System Corruption, Payload—Attack Agent—Zombie, Bots, Payload—Information Theft—Key loggers, Phishing, Spyware, Payload—Stealth—Backdoors, Root kits, Countermeasures. Denial-of-Service Attacks: Denial-of-Service Attacks, Flooding Attacks, Distributed Denial-of-Service Attacks, Application-Based Bandwidth Attacks, Reflector and Amplifier Attacks, Defenses Against Denial-of-Service Attacks, Responding to a Denial-of-Service Attack.

4. Intrusion Detection: Intruders, Intrusion Detection, Host-Based Intrusion Detection, Distributed Host-Based Intrusion Detection, Network-Based Intrusion Detection, Distributed Adaptive Intrusion Detection, Intrusion Detection Exchange Format, Honey pots, Example System: Snort. Firewalls and Intrusion Prevention Systems: The Need for Firewalls, Firewall Characteristics, Types of Firewalls, Firewall Basing, Firewall Location and Configurations, Intrusion Prevention Systems, Example: Unified Threat Management Products

5. Buffer Overflow: Stack Overflows, Defending Against Buffer Overflows, Other Forms of Overflow Attacks, Software Security: Software Security Issues, Handling Program Input, Writing Safe Program Code, Interacting with the Operating System and Other Programs, Handling Program Output. Operating System Security: Introduction to Operating System Security, System Security Planning, Operating Systems Hardening, Application Security, Security Maintenance, Linux/Unix Security, Windows Security, Virtualization Security..

6. Symmetric Encryption and Message Confidentiality: Symmetric Encryption Principles, Data Encryption Standard, Advanced Encryption Standard, Stream Ciphers and RC4, Cipher Block Modes of Operation, Location of Symmetric Encryption Devices, Key Distribution. Public-Key Cryptography and Message Authentication: Secure Hash Function, HMAC, The RSA Public-Key Encryption Algorithm, Diffie-Hellman and Other Asymmetric Algorithms

7. Internet Security Protocols and Standards: Secure E-mail and S/MIME, Domain Keys Identified Mail, Secure Socket Layer (SSL) and Transport Layer Security (TLS), HTTPS, IPv4 and IPv6 Security. Internet Authentication Applications: Kerberos, X.509, Public-Key Infrastructure, Federated Identity Management. Wireless Network Security: Wireless Security Overview, IEEE 802.11 Wireless LAN Overview, IEEE 802.11i Wireless LAN Security.

Text Book

1. Computer Security - Principles and Practices (Except the Chapters 13, 14, 15, 16, 17, 18, 19), 2nd Edition by William Stallings, Pearson Education, Inc.

Reference Books

1. Cryptography and Network Security by William Stallings, Pearson Education Asia, New Delhi.

2. Network Security Essentials Applications and Standards, by William Stallings, Pearson Education Asia, New Delhi

IT327 NETWORK PROGRAMMING LAB

Instruction: 3 Periods/week, Univ. Exam: 3 Hours Credits: 1.5

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

FIRST CYCLE OF EXPERIMENTS

1. PC-to-PC COMMUNICATIONS UNDER DOS WITH NULL MODEM
 - a) Using Serial Ports and RS-232C Cable Connection
 - b) Using Parallel Ports and Parallel Cable Connection
2. PC-to-PC COMMUNICATIONS UNDER DOS WITH MODEM and 4-LINE EXCHANGE Using Communication Software: COMIT or XTALK
3. PC-to-PC COMMUNICATIONS UNDER WIN98's DIRECT CABLE CONNECTION with NULL MODEM
 - a) Using Serial Ports and RS-232C Cable Connection
 - b) Using Parallel Ports and Parallel Cable Connection
4. PC-to-PC COMMUNICATIONS UNDER WIN98's DIAL-UP NET WORKING WITH MODEM and 4-LINE EXCHANGE.
5. PC-to-PC COMMUNICATIONS UNDER WIN98's HYPER TERMINAL WITH MODEM and 4-LINE EXCHANGE.
6. a) LAN WITH BUS TOPOLOGY with a minimum of two systems
 - a) Windows Peer-to-Peer Network
 - ii) Windows NT Client-Server Network
- b) LAN WITH STAR TOPOLOGY with a minimum of two systems
7. a) LAN WITH BUS TOPOLOGY with a minimum of two systems using NOVELL Netware
- LAN WITH STAR TOPOLOGY with a minimum of two systems using NOVELL Netware

SECOND CYCLE OF EXPERIMENTS

1. INTERNET CONNECTION SET-UP USING DIAL-UP NETWORKING
2. TERMINAL NETWORK WITH UNIX/LINUX SERVER and one or two Terminals
3. TERMINAL NETWORK WITH UNIX/LINUX SERVER, Terminal Server, and one or two terminals
4. NETWORK PROGRAMMING EXERCISE-I: USING A SIMPLIFIED API Echo software (Develop echoclient and echo server programs and run the two programs on separate computers and verify that they can communicate Chat software (Develop chatclient and chatserver programs and test to ensure they can communicate). Build a simple file transfer service that consists of client and server.
5. NETWORK PROGRAMMING EXERCISE-II : USING THE SOCKET API Write an echoclient and server using sockets build a web server using sockets.
6. CONCURRENT NETWORK PROGRAMMING EXERCISE-III: Build a Concurrent server (threads)–Create a server capable of handling

connections from multiple clients concurrently Build a Concurrent file transfer server (processes)–Create separate processes to allow a server to handle multiple clients concurrently.

7. NETWORK PROGRAMMING EXERCISE–IV: USING PROTOCOL DESIGN Design a reliable data transfer protocol (Devise, implement and test a protocol that providesreli able data transfer across a network that drops, delays or corrupts packets Designs to pand wait flow control protocol Design a sliding window protocol

8. NETWORK PROGRAMMING EXERCISE–V: WITH PROTOCOLS FROM TCP/IP SUITE Build a domain name system client program

CSE328 WEB TECHNOLOGIES LAB

Common with 6years integrated B.Tech (CSE)+M.Tech and B.Tech(IT)

Instruction:3Periods/week, Univ.Exam:3 Hours Credits:1.5

Internal:50Marks UniversityExam: 50Marks Total: 100Marks

Eachstudentsshoulddevelop twoprojects outofthislistusingJSP,JDBC,J2EE

1. Design Airlines Ticket Reservation System
2. Design ONLINE Banking system.
3. Design Library Information system
4. Design Gram Panchayat Information system for House tax, water tax, wealth tax, Library tax collection, phone bill, Electricity bill collection.
5. Design student information system portal which maintain attendance, marks etc.
6. Design online examination system

Electrical Engineering Scheme of Instruction & Examination

III/IV B.Tech

Common With Six Year Dual Degree Course II/VI (B.tech.+ M.Tech.)

(With effect from 2019-2020 admitted batch onwards)

B.Tech. (EEE) III Year I-semester Scheme of Instruction and Examination

Sub. Ref	Name of the Subject	Periods			Maximum Marks		Credits
		Theory	Tutorial	Lab	Sessionals	Exam Total	
EE031xx	OEC-5:	3	1	—	70	30 100	3
EEC3101	PCC-7: Power Electronics	3	1	—	70	30 100	3
EEC3102	PCC-8: ElectricalMeasurements	3	1	—	70	30 100	
3							
EEC3103	PCC-9:ElectricalMachines-II	3	1	—	70	30 100	3

EEC3104	PCC-10: Power Systems - I	3	1	—	70	30 100	3
EEE31XX	PEC-1:	3	1	—	70	30 100	3
EEL3101	Laboratory – V: Electrical Measurements Lab	—	—	3	50	50 100	1.5
EEL3102	Laboratory – VI: Electrical Machines Lab – II	—	—	3	50	50 100	1.5
EEM3101	MC-6: Indian Constitution	—	—	—	—	— —	—
TOTAL		18	6	6	520	280 800	21

Open Electives Courses (OEC) (Semester-V)

S.No.	Subject Code	Subject Name
1	EEO3101	Linear ICs and Applications
2	EEO3102	Communication Systems
3	EEO3103	Internet of Things (IoT)

Professional Electives Courses (PEC) (Semester-V)

S.No.	Subject Code	Subject Name
1	EEE3101	Computer Architecture and Organisation
2	EEE3102	Digital Signal Processing
3	EEE3103	Information Technology

OEC-5 : EEO3101 : Linear IC's and Applications

3L:1T:0P 3 Credits

Course Outcomes:

Upon successful completion of the course, the students will be able to

- ? Design different RC differentiator and integrator circuits.
- * Analyze the various multi-vibrator circuits.
- * Infer the DC and AC characteristics of operational amplifiers and its effect on output and their compensation techniques.
- * Elucidate and design linear and non-linear applications using op-amps.
- * Describe the concepts of filters, Timers and VCO.
- * Apply the concepts of A/D and D/A convertors in various applications.

UNIT: I : Operational Amplifiers: Design Aspects of Monolithic Op-Amps, Ideal Characteristics, AC and DC Characteristics, Data sheet Specifications, Offset Voltages and Currents, Frequency Compensation Techniques, Measurement of Op-Amp Parameters.

UNIT: II : Applications of Op-Amps: Inverting and Non-inverting Amplifiers, Integrator, Differentiator, Comparator, Logarithmic Amplifiers, Instrumentation Amplifiers, Op-Amp Phase Shift, Wein- bridge and Quadrature Oscillator, Voltage Controlled Oscillators, Voltage to Current and Current to Voltage Converters., Analog Multiplexers.

UNIT: III : Signal Conditioning Circuits: Rectifiers, Peak Detection and, Wave form Generators, Sample and Hold Circuits, Multivibrators, Square Wave Generators, Schmitttrigger.

UNIT: IV : Active Filters: LPF, HPF, BPF, BEF, All-pass Filters, Higher Order Filters and their Comparison, Switched Capacitance Filters.

UNIT: V : Special ICs: 555 Timers, 556 Function Generator ICs and their Applications, Three Terminal IC Regulators, IC 1496 (Balanced Modulator), IC 565 PLL and its Applications, Function Generators, Voltage to Frequency and Frequency to Voltage Converters.

UNIT: VI : Digital to Analog and Analog to Digital Converters: DAC techniques, Weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, Different types of ADCs-parallel Comparator type ADC, Counter type ADC, Successive approximation ADC and dual type ADC, DAC and ADC specifications, Integrated ADC and DACs.

Text Books:

1. Op-Amps and Linear ICs- Ramakanth Gayakwad, PHI, 1987.
2. Linear Integrated Circuits- D.Roy Chowdhury, New Age International(p) Ltd, 2nd Edition ,2003.

Reference Books:

1. Integrated Circuits- Botkar, Khanna Publications.
2. Applications of Linear ICs- Clayton.
3. Microelectronics- Jacob Millman.

OEC-5 : EEO3102 Communication Systems

3L:1T:0P 3 Credits

Course Outcomes:

At the end of this course, student will be able to

- * Explain the need of modulation.
- * Describe various types of modulation.
- * Describe the sampling theorem and spectra of pulse modulation.

Unit-I : Communication System: Elements of communication System and its Fundamental limitations Need of Modulation.

Random Processes: Random Process, Stationary Processes, Ergodic Processes, Transmission through LTI, Power spectral density, Gaussian process.

UNIT: II : Noise: External and internal sources of noise, Thermal noise, Calculation of thermal noise, Shot noise, Noise figure, Noise temperature, Equivalent noise bandwidth.

Unit-III : Amplitude (Linear Modulation): Generation and detection of DSB, SSB, VSB, Carrier Acquisition, Concept of FDM, AM transmitter and Receiver.

Unit-IV : Angle (Exponential Modulation): Types of Angle Modulation, Concepts of Instantaneous frequency, Wideband and Narrowband FM, Generation and detection of FM, Generation and detection of PM, FDM.

Unit-V : Noise performance of CW Modulation Systems, Noise in DSB-SC, SSB-SC and AM system, Noise in FM and PM FM threshold and its extension, Pre-emphasis and De-emphasis in FM.

Unit-VI : Sampling theory & pulse modulation Sampling process, sampling theorem, signal reconstruction, flat top sampling of band pass signals.

Analog Pulse Modulation: Types of analog pulse modulation, Method of generation and detection of PAM, PWM, PPM, Spectra of pulse modulation, concept of time division multiplexing.

Text books:

1. Communication Systems S. Haykin, John Wiley & Sons.
2. Communication Systems: A.B. Carlson, Mc-Graw-HW.
3. Modern Analog & Digital Communication Systems: B.P. Lathi; Oxford Univ. Press.
4. Analog Communication Systems: PchakrabartiDhanpatRai.

Reference Books:

1. Carlson, A. Bruce, Crilly, Paul B. & Rutledge, Janet C. / "Communication Systems an Introduction to Signals & Noise in Electrical Communication"/ Tata McGraw-Hill.
2. Kennedy, George & Davis, Bernard / "Electronic Communication Systems" / Tata McGraw-Hill / 4th Ed.

OEC-5 : EEO3103 : Internet of Things

3L:1T:0P 3 credits

Course Outcomes:

At the end of this course, student will be able to

- * Analyze structural aspects of IoT.
- * Describe the different applications of IoT.
- * Explain the concept of Raspberry - pi Interface.
- * Particular application of IoT for Smart Grid.

UNIT: I : Introduction and Fundamental IoT Mechanisms, History of IoT, Overview and Motivations, Examples of Applications, Internet of Things Definitions and Frameworks : IoT Definitions, IoT Architecture, Identification of IoT Objects and Services, Structural Aspects of the IoT, Environment Characteristics, Traffic Characteristics, Scalability, Interoperability, Security and Privacy. IOT paradigm - smart objects - Bits an atom - goal orientation - RTLS+ GPS - agents+ Multi agent system

UNIT: II : M2M to IoT A Market Perspective – Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT - An Architectural Overview – Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

UNIT: III : Introduction to Atmega 8 /16 microcontroller - Architecture of the AVR Microcontroller - Pin description of the microcontroller - I/O of the microcontroller - IR Sensors.

UNIT: IV : IoT Reference Architecture Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real - World Design Constraints - Introduction, Technical Design constraints hardware is popular again, Interaction and remote control.

UNIT: V : Industrial realizing the enterprise integrated Web of Things, IMC - AESOP: from the Web of Things to the Cloud of Things, Commercial Building Automation -Introduction, Case study: phase one - commercial building automation today, Case study. Specification - Domain Model Specification - Information Model Specification - Service Specifications - IoT Level Specification - Functional View

UNIT: VI : IoT for Business Applications Internet of Things Application: IoT for Smart Grid ,City Automation, Automotive Applications, Home Automation, Smart Cards , Process Monitoring / Automation, Sensor Technology, Raspberry - pi Interface, Smart Healthcare, Smart Transportation, M2M Communication, Smart Metering, Systems and Services Integration, Hands - on training, Smart Waste management System.

Text Books:

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, From Machine to - Machine to the Internet of Things: Introduction to a New Age of Intelligence, 1st Edition, Academic Press, 2014.

2. Daniel Minoli, Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications, ISBN: 9781 – 118 – 47347 - 4, Willy Publications, 2014

PCC-7 : EEC3101 : Power Electronics

3L:1T:0P

3 credits

Course Outcomes:

At the end of this course students will demonstrate the ability to

- * Understand the differences between signal level and power level devices.
- * Analyse controlled rectifier circuits.
- * Analyse the operation of DC-DC choppers.
- * Analyse the operation of voltage source inverters, Choppers & Cyclo Converters.

UNIT: I : Thyristors: Introduction, Principle of Operation, Two Transistor Model, Gate Characteristics, Turn On Methods, Turn Off Methods, Thyristor Ratings, Measurement of Thyristor Parameters, Protection Circuits.

UNIT: II : Gate Triggering Circuits: Firing of Thyristors, Pulse Transformers, Opto Isolators, Gate Triggering Circuits, Resistance Firing, Resistance-Capacitance Firing, UJT, Programmable UJT (PUT), UJT as an SCR Trigger, Synchronized UJT Triggering.

Series And Parallel Operation of Thyristors: Equalizing Networks, Triggering, String Efficiency, De-rating.

UNIT: III : Phase Controlled Rectifiers: Single Phase-Half wave Rectifier with R, RL & RLE Circuits, Single Phase Full wave & Bridge Controlled Rectifiers, Three-Phase Half Wave and Fully Controlled Rectifiers, Three-Phase Fully Controlled Bridge Rectifier.

UNIT: IV : Inverters: Classification, Series and Parallel Inverters, Self Commutated Inverters, The Mc Murray Inverter, The Mc Murray Bedford Inverter, Harmonic Reduction, Current Source Inverters, Voltage Source Inverters.

UNIT: V : Choppers: Principle of Operation, Step up, Step down Choppers, Jones Chopper, Morgan Chopper.

Cyclo-converters: Principle of Operation, Single Phase To Single Phase Cyclo-converters, Cyclo-converter Circuits for Three-Phase Output, Control Circuits

UNIT: VI : Modern Power Semiconductor Devices: Basic Structure and Characteristics of Diode, Transistor, MOSFET, IGBT, GTO, DIAC, TRIAC

Text Books:

1. Power Electronics by M.D.Singh, K.B.Khanchandani, Tata Mc Graw Hill Education (India) Private Limited.

Reference Books:

1. Power Electronic Circuits Devices and Applications by M.H.Rashid, Pearson India

2. Power Electronics by Dr. P S Bhimbra, Khanna Publishers.

PCC-8:EEC3102 : Electrical Measurements

3L:1T:0P 3 Credits

Course Outcomes:

Upon successful completion of the course, the students will be able to

- * Describe operation of electrical measuring instruments.
- * Select suitable instrument for measuring power and energy of electrical systems.
- * Determine the parameters of electrical circuits using suitable measuring instruments.

UNIT: I : Instruments: Objectives of Measurements, Analog versus Digital Measurements, Accuracy, Precision and Uncertainty, Sources of Measurement Error, Standard Cell And Standard Resistance.

UNIT: II : Characteristics of measuring instruments with a moving element instruments: Ammeter, Voltmeter, Expression for Torque of Moving Coil, Moving Iron, Dynamometer, Induction and Electrostatic Instruments.

UNIT: III : Extension of Range Of Instruments: Wattmeters, Torque Expression for Dynamometer Instruments. Reactive Power Measurement, Energy Meters Single Phase And Poly Phase, Driving Torque And Braking Torque Equations, Errors And Testing, Compensation, Maximum Demand Indicator, Power Factor Meters, Frequency Meters, Electrical Resonance And Weston Type of Synchro-Scope.

UNIT: IV : Bridge Methods: Measurement of Inductance, Capacitance & Resistance Using Bridges. Maxwell's, Anderson's, Wein's Heave-Side & Campbell's, Desauty's, Schering's Bridges, Kelvin's Double Bridge, Price Guard Wire Bridge, Loss Of Charge Method, Megger, Wagner's Earthing Device.

UNIT: V : Magnetic Measurements: Ballastic Galvanometer, Calibration of Hibbert's Magnetic Standard Flux Meter, Ioydfischer Square for Measuring Iron Loss. Testing Of Ring and Bar Specimens, Determination Of B-H Curve And Hysteresis Loop Using CRO, Determination Of Leakage Factor.

UNIT: VI : Potentiometers & Instrument Transformers: Crompton's D.C. Potentiometer, A.C. Polar and Co-Ordinate Type Potentio Meters. Applications measurement Of Impedance, Calibration of Ammeters, Voltmeters and Wattmeters. Use of Oscilloscope in Frequency, Phase and Amplitude Measurements, Indian Standard Specifications for Voltmeters,

Ammeters, Energy Meters, Instrument Transformers –Ration and Phase Angle Errors and Their Reduction.

Text Book:

1. Electric and Electronic Instrumentation By A.K. Sawhney, Dhanpat Rai & Sons, Delhi, 11th Edition, 1995.

References:

1. Electrical & Electronic Instrumentation by Umesh Sinha, Satya Prakashan, Newdelhi,1998

2. Electrical Measurements by E.W.Golding. & Widdis, 5th Edition, Wheeler Publishing.

PCC-9: EEC3103 : Electrical Machines – II

3L:1T:0P 3 Credits

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Understand the concepts of rotating magnetic fields.
- Understand the operation of ac machines.
- Analyze performance characteristics of ac machines.

UNIT: I : Induction Motors - I: Principle of operation, Constructional details, Rotating Magnetic field, Types of rotors, Slip, Stator and Rotor current frequencies, Development of torque and torque calculations, Torque-Speed Characteristics, Power flow and performance calculations, Equivalent circuit, Calculation of equivalent circuit parameters from No-load and Rotor-blocked tests.

UNIT: II : Induction Motors - II: Predetermination of performance characteristics using circle diagram and load test, Starting of Induction motors using Rheostat/reactor starter, Auto-transformer starter, Star-Delta starter, and Rotor Resistance starter, Crawling and cogging, Brief description of the induction motor speed control using Voltage control, frequency control, pole changing, rotor resistance control, cascading, and rotor emf injection, Induction generator and principle of operation, Double-cage rotors.

UNIT: III : Synchronous Generators: Basic requirements, Constructional details, EMF equation, Effect of chording and distribution of winding, Armature reaction, Phasor diagram, Regulation of Synchronous Generators using EMF, MMF and ZPF method.

UNIT: IV : Synchronization of alternators, Parallel operation of two-alternators, Parallel operation of Synchronous Generator to infinite bus, Sharing of real and reactive powers, Capability curve, Salient-pole synchronous machine, Two-reaction theory, Determination of direct axis and

quadrature axis reactances of salient-pole machines, Power-Angle characteristics of cylindrical and salient-pole machines.

UNIT: V : Synchronous Motors: Principle of operation, starting methods, phasor diagram, effect of changing load and changing excitation on machine performance, V and Inverter 'V' curves, Hunting, Damper winding, power developed by synchronous motor.

UNIT: VI : Special Machines: Single phase Induction motors: Double-field revolving theory, Principle of operation of Split-phase, capacitor start, capacitor start and run, shaded pole machines. Principle of operation of hysteresis motor, Reluctance motor, BLDC motor and Doubly-fed Induction generator.

Text books:

1. M G Say, The performance and Design of Alternating Current Machines, 3rd edition, CBS Publishers & Distributors, New Delhi, 2002.
2. P S Bhimbhra, Electrical Machinery, 7th edition, Khanna Publishers, New Delhi, 2011.

References:

1. A E Fitzferald, Chrls Kingsley, Jr., and Stephen D Umans, Electric Machinery, 6th edition, Mc. Graw-Hill, New Delhi, 2003.
2. B L Theraja, and A K Theraja, A textbook of Electrical Technology, Vol. 2, AC & DC Machines, S Chand Publications.
3. Gonzalo Abad, *et al*, Doubly Fed Induction Machine: Modelling and Control for Wind Energy Generation, John. Wiley & Sons, Inc., USA, 2011.

PCC-10:EEC3104 : Power Systems-I

3L:1T:0P 3 Credits

Course Outcomes:

Upon successful completion of the course, the students will be able to

- * Identify different components of a thermal power station.
- * Describe the operation of various components of a nuclear power station.
- * Distinguish between the operation of hydro and gas power plants.
- * Analyze the significance of various factors for economic analysis of power generation.
- * Select the suitable tariff method for various consumers.

UNIT: I : **Introduction:** Basic Structure of power system, Power Generation, Comparison of different Sources of Energy.

Hydro Electric Plants: Choice of Site, Hydrology, Classification of Plants, General Arrangement, Functions of Different Components of a Hydro Plant, Advantages & Disadvantages

UNIT: II : Thermal Power Stations(TPS): Line Diagram and location of thermal power plant, TPS components, Boilers – Fire tube and Water tube, Super heaters, Economizers, Condensers, Draught, Cooling Water Systems.

Nuclear Power Plants: Schematic Arrangement, Components of Nuclear Reactor, Classification and working of Nuclear reactors, Different Power Reactors.

UNIT: III : Diesel Power Plant: Understand the Working Principle, Site Selection, Plant Layout, Components, Merits and Demerits.

Gas Turbine Plants: Layout, Components of a Gas Turbine Plant, Open Cycle and Closed Cycle Plants.

UNIT: IV : Magneto Hydro Dynamic (MHD) Power Generation: Basic Concepts, Principle, Classification, Coal Burning MHD Steam Power Plant, Gas Cooled Nuclear MHD Power, Liquid Metal MHD Generator.

UNIT: V : Operational Aspects of Generating Stations: Load Curves and Associated Definitions – Connected load, Maximum demand, Demand factor, Load factor, Diversity factor, Capacity factor, Utilization factor, Capacity, utilization and plant use factors-Numerical Problems, Selection of Units, and Load Duration Curves.

UNIT: VI : Economic Considerations: Capital and Running Costs of Generating Stations, Different Tariffs - Simple Rate Tariff, Flat Rate Tariff, Block-Rate Tariff, Two-part Tariff, Three-part tariff and power factor tariff, Comparison of Costs.

Text Book:

1. A Text Book on Power System Engineering by Soni, Gupta, Bhatnagar & Chakrabarti, Dhanpat rai & Co.

Reference Books:

1. Generation & Utilization by C.L.Wadhwa
2. Electrical Power by S. L. Uppal, Khanna Publishers

PEC-1:EEE3101 : Computer Architecture and Organisation

3L:1T:0P 3 Credits

Course Outcomes:

At the end of this course, student will be able to

- * Explain about the concept of arithmetic micro operations.
- * Describe the vector and pipeline processing.
- * Explain the addressing modes of CPU.

UNIT: I : Register Transfer and Micro operations: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Micro operations, Logic Micro operations, Shift Micro operations, Arithmetic Logic Shift Unit.

UNIT: II : Basic Computer Organization and Design: Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instructions, Input- Output and Interrupt, Complete Computer Description, Design of Basic Computer, Design of Accumulator Logic.

UNIT: III : Micro programmed Control: Control Memory, Address Sequencing, Micro program Example, Design of Control Unit.

UNIT: IV : Central Processing Unit: Introduction, General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer(RISC)

Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processors.

UNIT: V : Input/output Organization: Peripheral Devices, I/O interface, Asynchronous data transfer, Modes of transfer, priority Interrupt, Direct memory access, Input-Output Processor (IOP), Serial Communication.

UNIT: VI : Memory Organization: Memory Hierarchy, Main memory, Auxiliary memory, Associate Memory, Cache Memory, and Virtual memory, Memory Management Hardware.

Text Book:

1. Computer System Architecture, M. Morris Mano, Prentice Hall of India Pvt. Ltd., Third Edition, Sept. 2008.

References:

1. Computer Architecture and Organization, William Stallings, PHI Pvt. Ltd., Eastern Economy Edition, Sixth Edition, 2003.

2. Computer Organization and Architecture, Linda Null, Julia Lobur, Narosa Publications ISBN 81- 7319-609-5

3. Computer System Architecture", John. P. Hayes.

PEC-1:EEE3102 : Digital Signal Processing

3L:1T:0P 3 Credits

Course Outcomes:

At the end of this course, students will demonstrate the ability to

* Represent signals mathematically in continuous and discrete-time, and in the frequency domain.

* Analyse discrete-time systems using z-transform.

* Understand the Discrete-Fourier Transform (DFT) and the FFT algorithms.

* Design digital filters for various applications.

* Apply digital signal processing for the analysis of real-life signals.

Unit-I: Discrete - Time Signals and Systems: Discrete - Time Signals – Sequences, Linear Shift – Invariant Systems, Stability and Casuality, Linear Constants – Coefficient Difference Equations, Frequency Domain Representation of Discrete – Time Signals and Systems.

Unit- II : Applications of Z – Transforms: System Functions H(z) of Digital Systems, Stability Analysis, Structure and Realization of Digital Filters, Finite Word Length Effects.

Unit- III : Discrete Fourier Transform (DFT): Properties of the DFS, DFS Representation of Periodic Sequences, Properties of DFT, Convolution of Sequences.

Unit -IV : Fast – Fourier Transforms (FFT): Radix – 2 Decimation – In – Time (DIT) and Decimation – In – Frequency (DIF), FFT Algorithms, Inverse FFT.

Unit-V : IIR Digital Filter Design Techniques: Design of IIR Filters from Analog Filters, Analog Filters Approximations (Butterworth and Chebyshev Approximations), Frequency Transformations, General Considerations in Digital Filter Design, Bilinear Transformation Method, Step and Impulse Invariance Technique.

Unit-VI : Design of FIR Filters: Fourier Series Method, Window Function Techniques, Comparison of IIR and FIR Filters.

Text Book:

1. Alan V. Oppenheim and Ronald W. Schaffer: Digital Signal Processing, PHI.

References:

1. Sanjit K. Mitra, Digital Signal Processing “A – Computer Based Approach”, Tata McGraw Hill.

2. Raddar and Rabiner, Application of Digital Signal Processing.

3. S. P. Eugene Xavier, Signals, Systems and Signal Processing, S. Chand and Co. Ltd.

4. Antonio, Analysis and Design of Digital Filters, Tata McGraw Hill.

PEC-1:EEE3103 : Information Technology

3L:1T:0P 3 Credits

Course Outcomes:

At the end of this course student will be able to

* Understand the concept of different data transmission modes.

* Explain the concept of internetworking protocol and wireless networking.

* Describe Security system of computer.

UNIT: I : Introduction to Computer and Computer System Hardware: Characteristics of Computer, History and generations of computers, micro, mini, mainframe and computers, applications, CPU, Instruction execution, microprocessors, interconnecting the units of Computer system, components of computer cabinet

UNIT: II : Memory, Storage Devices and I/O devices: Memory hierarchy, Primary memory, secondary memories, types of storage devices and technologies, role of I/O devices, Manual and automatic Data entry devices, output devices, I.O ports

UNIT: III : Data Representation: Number systems, conversion of Binary, Octal, Hexadecimal, Decimal numbers from one form to the other, Binary arithmetic, signed number representation, fixed and floating point numbers, coding schemes.

Operating systems: Objectives of OS, types of OS, Functions of OS, Process management, memory management, file management, device management, protection and security, User interface, case studies

UNIT: IV : Data communication and Computer Networking: Importance of networking, Various Data transmission media, transmission modes, analog and digital signals, modulation and demodulation, multiplexing, asynchronous and synchronous transmission, types of switching, Types of networks, LAN technologies, communication protocols, Network devices, wireless networking.

UNIT: V : Internet and Internet Services: History of Internet, Internetworking Protocol, Internet Architecture, Managing the Internet, types of internet connections, Internet services - www, e- mail, FTP, Telnet, IRC, News etc.

UNIT: VI : Computer Security: Security Threat and Attack, Malicious software, Hacking, Security services, security mechanisms, cryptography, digital signatures, firewalls, user identification and authentication, security awareness, security policy.

Text book:

1. "Computer Fundamentals", Anita Goel, Pearson Education India.

References:

1. "Fundamentals of Computers", V.Raja Raman and Neeharika Adabala, Prentice Hall India Publishers.
2. "Fundamentals of Information Technology", V.Rajaraman, Prentice Hall India publishers.

EEL3101 : Laboratory-V: ElectricalMeasurements Lab

0L:0T:3P 1.5 Credits

EEL3102 : Laboratory-VI: ElectricalMachines Lab-II

0L:0T:3P 1.5 Credits

MC-6: EEM3101 Indian Constitution

*** Common to all Branches

Electrical Engineering Scheme of Instruction & Examination

III/IV B.TECH

Common with SIX YEAR DUAL DEGREE COURSE II/VI (B.TECH.+ M.TECH.)

(With effect from 2019-2020 admitted batch onwards)

B.Tech. (EEE) III Year II-semester Scheme of Instruction and Examination

Sub. Ref	Name of the Subject	Periods			Maximum Marks		Credits	
		Theory	Tutorial	Lab	Sessionals	Exam	Total	
EEC3201	PCC-11:PowerSystems-II	3	1	—	70	30	100	3
EEC3202	PCC-12: Control Systems	3	1	—	70	30	100	3
EEC3203	PCC-13: Microprocessors & Micro-controllers	3	1	—	70	30	100	3
EEC3204	PCC-14: Power System Analysis & Stability	3	1	—	70	30	100	3
EEE32XX	PEC-2:	3	1	—	70	30	100	3
EEE32XX	PEC-3:	3	1	—	70	30	100	3
EEE32XX	OEC-6	3	1	—	70	30	100	3
EEL3201	Laboratory – VII: Power Electronics Laboratory	—	—	3	50	50	100	1.5
EEL3202 1.5	Laboratory – VIII:Microprocessor and Microcontroller Laboratory	—	—	3	50	50	100	
TOTAL		21	7	06	590	310	900	24

Professional Electives Courses (PEC) (Semester-VI)

S.No.	Subject Code	Subject Name
1	EEE3201	Utilization of Electrical Energy
2	EEE3202	Renewable Energy Sources
3	EEE3203	Energy Management and Auditing
4	EEE3204	Power Station Practice

5	EEE3205	Digital Control Systems
6	EEE3206	High Voltage Engineering

Open Electives Courses (OEC) (Semester-VIII)

S.No.	Subject Code	Subject Name
1	EEO3201	Industrial Management and Entrepreneurship
2	EEO3202	Organisational Behaviour
3	EEO3203	Financial Accounting

PCC-11: EEC3201 Power Systems – II

3L:1T:0P 3 Credits

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- * Estimate the inductance and capacitance for different conductor configurations.
- * Analyze the performance of short, medium & long transmission lines.
- * Select a suitable insulator for a particular operating voltage, configuration and best method to improve string efficiency.
- * Analyze the effect of various factors on corona.
- * Evaluate the sag and tension of transmission line for various configurations under the effect of wind and ice.

UNIT: I : Transmission Line Constants: Transmission line components, Types of conductors, Inductance and Capacitance of Single Phase and Three Phase Lines, Concept of GMDR Mutual GMD Double Circuit Line, Inductance of Composite Conductors, Transposition, Skin Effect and Proximity Effect.

UNIT: II : Transmission Line Modeling: Generalized Network Constants, Modeling of Short Transmission line, Modeling of Medium transmission line: Nominal-T and Nominal- δ methods and Long Transmission Lines, Rigorous Line Modeling, Circle Diagrams.

UNIT: III : Mechanical Design of Transmission Lines: Sag and Tension Calculations with equal and unequal heights of towers, effect of Wind and Ice on weight of conductor. Line Supports, Conductor Materials, Overhead Lines Vs Underground Cables.

UNIT: IV : Over Head Line Insulators: Types of Insulators, String efficiency and Methods for improvement–Numerical Problems, Voltage distribution, Calculation of string efficiency, Capacitance grading and Static Shielding.

UNIT: V : Under-Ground Cables: Types of Cables, Insulation in Cables, Armoring & Covering of Cable, Insulation Resistance OFR Cables, Stress

in Insulation, Sheathing in Cable, Use of Inter Sheaths, Capacitance Grading, Capacitance in 3-Core Cables.

UNIT: VI : **Corona**: Phenomenon of Corona, Critical Voltages, Power Loss due to Corona, Factors Affecting Corona Loss, Radio Interference.

Text Books:

1. A Text Book on Power Systems Engineering by Sony, Gupta, Bhatnagar and Chakrabarti, Dhanapatrai & Co.
2. Electrical Power Systems by C. L. Wadhwa.

References:

1. Electrical Power by S. L. Uppal.
2. A Course in Power Systems by J. B. Gupta.
3. Electrical Power Transmission and Distribution by S. Siva Nagaraju and S. Satyanarayana.

PCC-12:EEC3202 Control Systems

3L:1T:0P 3 Credits

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- * Understand the modeling of linear-time-invariant systems using transfer function and state-space representations.
- * Develop mathematical models for physical systems.
- * Employ the time domain analysis to quantify the performance of linear control systems and specify suitable controllers.
- * Understand the concept of stability and its assessment for linear-time invariant systems.
- * Quantify time and frequency domain specifications to determine stability margins.
- * Apply state variable theory to determine the dynamic behavior of linear control systems.

UNIT: I : Basic Structure of a Feedback Control System: Introduction to Mathematical Modeling of Physical Systems – Equations of Electrical Networks – Modeling of Mechanical Systems – Equations of Mechanical Systems, Analogous Systems.

UNIT: II : Transfer Functions of Linear Systems: Impulse Response of Linear Systems – Block Diagrams of Control Systems – Signal Flow Graphs (Simple Problems) – Reduction Techniques for Complex Block Diagrams and Signal Flow Graphs (Simple Examples). Feedback Characteristics of Control Systems.

UNIT: III : Time Domain Analysis of Control Systems: Time Response of First and Second Order Systems with Standard Input Signals – Steady

State Error Constants – Effect of Derivative and Integral Control on Transient and Steady State Performance of Feedback Control Systems.

UNIT: IV : Stability: Concept of Stability and Necessary Conditions for Stability – Routh-Hurwitz Criterion, Relative Stability Analysis, the Concept and Construction of Root Loci, Analysis of Control Systems with Root Locus (Simple Problems to understand theory).

UNIT: V : Frequency Domain Analysis of Control Systems: Correlation between Time and Frequency Responses – Polar Plots – Bode Plots – Log Magnitude versus Phase Plots – All Pass and Minimum Phase Systems – Nyquist Stability Criterion – Assessment of Relative Stability – Constant M and N Circles-The Nichols Chart.

Text Books:

1. Automatic Control Systems, Benjamin C. Kuo, PHI Publication (5th Edition).

Reference Books:

1. Modern Control Engineering, Ogata, PHI.
2. Control Systems Engineering, I. J. Nagrath and M. Gopal, Wiley Eastern Ltd.
3. Control Systems Principles and Design M.Gopal, McGrawHill

PCC-13: EEC3203 Microprocessors & Micro-controllers

3L:1T:0P 3 Credits

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- * Do assembly language programming.
- * Do interfacing design of peripherals like I/O, A/D, D/A, timer etc.
- * Develop systems using different microcontrollers.

UNIT: I : 8085 Microprocessor: Introduction to microprocessors, microcomputers – Architecture of 8085 microprocessor – pin-out diagram of 8085 – Detailed description of the 8085 pins – addressing modes – Memory structure and its requirements – Basic concepts in memory interfacing – Address decoding – Memory mapping – Machine cycles and bus timings for memory read, memory write, I/O read, I/O write operations – Memory mapped I/O and I/O mapped I/O.

UNIT: II : 8085 Instructions and programming: Difference between Machine language, Assembly language and High level language – Brief description of the 8085 instruction set – 8085 programming using data transfer group, arithmetic group, logical group, branch transfer group, stack and subroutines – counters and delay - code conversions.

UNIT: III : Interfacing peripherals to 8085: Function of D/A and A/D converters – Interfacing D/A and A/D converters and necessary

programming – Detailed description and interfacing of 8251 USART, 8253/8254 programmable timer, 8255 PPI, 8257 DMA controller, 8259 programmable interrupt controller, 8279 programmable keyboard/display interface

UNIT: IV : 8051 Microcontroller: Introduction to microcontrollers – Comparison between microprocessors and microcontrollers – Functional block diagram of 8051 microcontroller and its description – 8051 pin-out diagram and description of 8051 pins – Interfacing external memory to 8051 – implementing counters and timers in 8051 – Serial data transfer using 8051 – Various interrupts and its programming in 8051.

UNIT: V : Advanced topics in Microprocessors: Architecture of 8086 microprocessor – Addressing modes – RS232 communication standard – Interfacing Stepper motor, elevator, traffic controller to 8085 microprocessor.

Text books:

1. Ramesh S. Gaonkar, Microprocessor Architecture, Programming, and Applications, New Age International Publishers, New Delhi, 2nd edition, 1996.

2. Kenneth J. Ayala, The 8051 Microcontroller : Architecture, Programming, & Applications, Penram International Publishing (I) Pvt. Ltd., Mumbai, 2nd edition, 2006.

3. Douglas V. Hall, Microprocessor and Interfacing : Programming and hardware, Tata McGraw-Hill Publishing Company Limited, New Delhi, 1997.

Reference Books:

1. B. Ram, Fundamentals of Microprocessors and Microcomputers, Dhanpat Rai & sons, New Delhi, 4th edition, 1998.

2. Muhammad Ali Mazidi and Janice Gillispie Mazidi, The 8051 Microcontroller and Embedded Systems, Pearson Education (Singapore) Pte. Ltd., New Delhi, 2003.

3. A K Ray and K M Bhurchandi, Advanced Microprocessors and Peripherals : Architecture, Programming and Interfacing, Tata McGraw Hill Publishing Company Limited, New Delhi, 2002.

PCC-14:EEC3204 Power System Analysis & Stability

3L:1T:0P 3 Credits

Course Outcomes:

Upon successful completion of the course, the students will be able to

- * Describe the per unit system of power system.
- * Apply the concepts of addition or removal of element in the power system for determining the impedance matrix.
- * Formulate and solve the power flow problem of power system.

- * Develop and solve the positive, negative, and zero sequence networks for systems consisting of machines, transmission lines and transformers.

- * Determine the fault voltages and currents for various faults.

- * Analyze the stability of power system under various disturbances.

UNIT: I : Per Unit Representation & Topology: Per Unit Quantities– Single line diagram– Impedance diagram of a power system – Graph theory definition – Formation of element node incidence and bus incidence matrices – Primitive network representation – Formation of Y– bus matrix by singular transformation and direct inspection methods.

UNIT: II : Power Flow Studies: Necessity of power flow studies – Derivation of static power flow equations – Power flow solution using Gauss-Seidel Method – Newton Raphson Method (Rectangular and polar coordinates form) –Decoupled and Fast Decoupled methods

UNIT: III : Symmetrical Fault Analysis: Formation of Z_{bus} : Partial network– Algorithm for the Modification of Z_{bus} Matrix for addition element for the following cases: Addition of element from a new bus to reference– Addition of element from a new bus to an old bus– Addition of element between an old bus to reference and Addition of element between two old busses (Derivations and Numerical Problems) – Modification of Z_{bus} for the changes in network (Problems). 3–Phase short circuit currents and reactances of synchronous machine–Short circuit MVA calculations.

UNIT: IV : Symmetrical Components: Synthesis of unsymmetrical phasor from their symmetrical components– Symmetrical components of unsymmetrical phasor–Phase–shift of symmetrical components in Y– Δ – Power in terms of symmetrical components – Sequence networks – Positive, negative and zero sequence networks

UNIT: V : Unsymmetrical Faults: Various types of faults LG– LL– LLG and LLL on unloaded alternator– unsymmetrical faults on power system.

UNIT: VI : Power System Stability Analysis: Elementary concepts of Steady state– Dynamic and Transient Stabilities– Description of Steady State Stability Power Limit–Transfer Reactance Synchronizing Power Coefficient –Power Angle Curve and Determination of Steady State Stability –Derivation of Swing Equation–Determination of Transient Stability by Equal Area Criterion–Application of Equal Area Criterion–Methods to improve steady state and transient stability.

Text Books:

1. Power System Analysis by Grainger and Stevenson, Tata McGraw Hill.
2. Modern Power system Analysis – by I.J.Nagrath & D.P.Kothari: Tata Mc Graw–Hill Publishing Company, 2nd edition.

Reference Books:

1. Power System Analysis by Hadi Saadat – TMH Edition.

PEC-2:EEE3201 : Utilization of Electrical Energy

3L:1T:0P

3 Credits

Course Outcomes:

At the end of this course, student will be able to,

- * Describe various electric heating and welding methods.
- * Design illumination systems for residential, commercial and industrial environments.
- * Design an illumination system.
- * Calculate the required tonnage capacity for a given air-conditioning system.
- * Evaluate domestic wiring connection and debug any faults occurred.

UNIT: I : Electric Heating & Welding: Electric Heating: Advantages and methods of electric heating, resistance heating induction heating and dielectric heating. Electric welding: resistance and arc welding, electric welding equipment, comparison between A.C. and D.C. Welding.

UNIT: II : Illumination-I: Introduction terms used in illumination, laws of illumination, polar curves, photometry, integrating sphere, sources of light.

UNIT: III : Illumination-II: Discharge lamps, MV and SV lamps - comparison between tungsten filament lamps and fluorescent tubes, Basic principles of light control, Types and design of lighting and flood lighting.

UNIT: IV : Electrical Circuits used in Refrigeration Air Conditioning and Water Coolers: Principle of air conditioning, vapour pressure, refrigeration cycle, eco-friendly refrigerants Description of Electrical circuit used in refrigerator, air conditioner, Lift wiring and Automobile wiring.

UNIT: V : Electrolytic Processes: Need of electro-deposition, Laws of electrolysis, process of electrode position – clearing, operation, deposition of metals, polishing, buffing, Equipment and accessories for electroplating, Factors affecting electrode position, Principle of galvanizing and its applications, Principle of anodising and its applications, Electroplating on non- conducting materials, Manufacture of chemicals by electrolytic process and electrolysis process.

UNIT: VI : Electrical Safety, Wiring & Introduction to Power System: Safety measures in electrical system- types of wiring- wiring accessories- staircase, fluorescent lamps & corridor wiring- Basic principles of earthing- Types of earthing- Simple layout of generation, transmission & distribution of power.

Text Books:

1. C.L. Wadhwa, 'Generation, Distribution and Utilization of Electrical Energy', New Age International Pvt. Ltd, 2003.

2. B.R. Gupta, 'Generation of Electrical Energy', Eurasia Publishing House (P) Ltd, New Delhi, 2003.

Reference Books:

1. H. Partab, 'Art and Science of Utilization of Electrical Energy', Dhanpat Rai and Co, New Delhi, 2004.

2. E. Openshaw Taylor, 'Utilization of Electrical Energy in SI Units', Orient Longman Pvt. Ltd, 2003

3. Dash.S.S, Subramani.C,Vijayakumar.K,"BasicElectrical Engineering", First edition, Vijay Nicole Imprints Pvt.Ltd,2013

PEC-2:EEE3202 : Renewable Energy Sources

3L:1T:0P 3 Credits

Course Outcomes: At the end of this course, students will demonstrate the ability to

- * Understand the energy scenario and the consequent growth of the power generation from renewable energy sources.
- * Understand the basic physics of wind and solar power generation.
- * Understand the power electronic interfaces for wind and solar generation.
- * Understand the issues related to the grid-integration of solar and wind energy systems.

UNIT: I : Energy Sources: Classification, Indian energy scenario, prediction regarding fossil fuels, generation of non-conventional and renewable energy resources, Description of renewable energy sources, Achievements of renewable energy in India, Use of renewable energy in agriculture in India.

UNIT: II : Solar Energy: Environmental impact of solar power, principles of solar radiation, solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on tilted surfaces, solar radiation data, instruments for measuring solar radiation, sun shine.

Solar Energy Collectors: Principles of solar energy conversion, Flat plate and Concentrating type collectors, energy balance and collector efficiency, solar thermal plants, thermal energy storage for solar heating and cooling, limitations and applications.

UNIT: III : Photovoltaic Technology: Present status, solar cells, cell technology, characteristics of PV systems, equivalent circuit, array design, Integrated PV systems, components, sizing and economics, peak power operation, MPPT, Standalone and grid integrated systems.

UNIT: IV Wind Energy: Wind power sources, wind characteristics, site selection, criterion, momentum theory, Components of wind energy systems, performance and limitations, classification of wind energy collectors, aerodynamic forces acting on blades, applications and environmental impacts.

UNIT: V Nonconventional Energy: Detailed description of nonconventional energy sources of bio energy, chemical energy, MHD, geothermal energy, ocean energy systems, General features, Basic principles of operation, classification, applications and environmental impacts.

UNIT: VI Renewable Energy Generation in Power Systems: Distributed Generation, Renewable energy penetration, Point of common coupling (PCC), Connection voltage, Voltage Effects, Steady state voltage rise, Thermal Limits, Other Embedded Generation Issues, Islanding.

Text Books:

1. Non-Conventional Energy Sources by GD Rai, Khanna Publishers.
2. Renewable Energy in Power Systems by Leon Freris and David Infield, John Wiley & Sons, Ltd.

References:

1. Advanced renewable energy systems; Part 1 by S. C. Bhatia, Woodhead Publishing India Pvt Ltd.
2. Renewable Energy Sources and Methods by Anne Maczulak, Green technology info print publication.

PEC-2:EEE3203 : Energy Management and Auditing

3L:1T:0P 3 Credits

Course Outcomes: At the end of this course, students will demonstrate the ability to

- * Understand the current energy scenario and importance of energy conservation.
- * Understand the concepts of energy management.
- * Understand the methods of improving energy efficiency in different electrical systems.
- * Understand the concepts of different energy efficient devices.

UNIT-I: Basic Principles of Energy Audit: Energy audit- definitions, concept , types of audit, energy index, cost index ,pie charts, Sankey diagrams, load profiles, Energy conservation schemes- Energy audit of industries- energy saving potential, energy audit of process industry, thermal power station, building energy audit.

UNIT-II: Energy Management: Principles of energy management, organizing energy management program, initiating, planning, controlling,

promoting, monitoring, reporting- Energy manager, Qualities and functions, language.

UNIT-III: Energy Efficient Motors: Energy efficient motors, factors affecting efficiency, loss distribution, constructional details, characteristics - variable speed , variable duty cycle systems, RMS hp- voltage variation-voltage unbalance- over motoring- motor energy audit.

UNIT-IV: Power Factor Improvement, Lighting and Energy Instruments: Power factor – methods of improvement, location of capacitors, Pf with non-linear loads, effect of harmonics on power factor, power factor motor controllers - Good lighting system design and practice, lighting control ,lighting energy audit - Energy Instruments- wattmeter, data loggers, thermocouples, pyrometers, lux meters, tongue testers ,application of PLC's.

UNIT-V : Economic Aspects and Analysis: Economics Analysis- Depreciation Methods, time value of money, rate of return, present worth method , replacement analysis, life cycle costing analysis- Energy efficient motors- calculation of simple payback method, net present worth method- Power factor correction, lighting - Applications of life cycle costing analysis, return on investment .

Text Books:

1. Energy Management by W.R. Murphy & G. McKay Butter worth, Elsevier publications. 2012
2. Energy Efficient Electric Motors by John. C. Andres, Marcel Dekker Inc. Ltd – 2nd Edition, 1995
3. Electric Energy Utilization and Conservation by S C Tripathy, Tata McGraw hill Publishing Company Ltd, New Delhi.

Reference Books:

1. Energy management by Paulo' Callaghan, Mc – Graw Hill Book company – 1st edition, 1998
2. Energy management hand book by W.C. Turner, John wiley and son, 2001. Energy management and good lighting practice: fuel efficiency booklet12

PEC-3:EEE3204 : Power Station Practice

3L:1T:0P 3 Credits

Course Outcomes:

At the end of this course student will be able to

- * Selection of locating generating stations
- * Explain the concept of Lightning Arrestor
- * Describe the Operation and control of HVDC Transmission system.
- * Applications of HVDC System.

UNIT: I : Design of Power Station: Introduction, selection of sizes and location of generating stations, interconnections issues with wind and Solar PV.

UNIT: II : Substation Design: Determination of voltage regulation and losses in power system, shifting of distribution transformer centre, Substation layout, sizes and locations of sub stations, Substation equipments specifications ratings and its operation from design view point, Cathodic Protection, Gas Insulated Substation (GIS).

UNIT: III : Power System Earthing – Power Station and Sub Station Earthing: Objectives, definitions, tolerable limits of body currents, soil resistivity, measurement of soil resistivity, earth resistance, measurement of earth resistance, tolerable step and touch voltage, actual step and touch voltage, design of earthing grid, impulse behaviour of earthing system.

UNIT: IV : Insulation Coordination and Location of Lightning Arrestor: Introduction, definitions, insulation-co-ordination curves, determination of line insulation, Basic Insulation level (BIL), Insulation levels of substation equipments, Lightning arrestor selection and location, Selection of arrestor voltage rating, arrestor discharge voltage and arrestor discharge current, protective margin.

UNIT: V : HVDC Transmission: Merits and demerits of HVDC transmission, one line diagram, types of DC link, necessary equipments, operation and control, applications, recent advances of HVDC in India.

UNIT: VI : EHV Transmission: Introduction, Need of EHV Transmission Lines, Advantages and Disadvantages of EHV Lines

Note: It is suggested that based on the above syllabus, visits for LT/HT Electrification and 220KV/ 400 KV substations should be carried out.

Text Books:

1. Electrical Power System Design – M. V. Deshpande, TMH publication
2. Electrical Power System Design – B. R. Gupta, S. CHAND
3. Electrical Power System Planning – A. S. Pabla, TMH publication
4. Substation Design – Satnam & Gupta, Dhanpat Rai and Co.
5. A course in Electrical Power- Soni, Gupta and Bhatnagar, Dhanpat Rai & Sons

PEC-3:EEE3205 Digital Control Systems

3L:1T:0P 3 Credits

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Obtain discrete representation of LTI systems.

- Analyze stability of open loop and closed loop discrete-time systems.

- Design and analyze digital controllers.
- Design state feedback and output feedback controllers.

UNIT: I : Discrete –Time Systems: The Structure of a Digital Control System, Analog Systems with Piecewise Constant Inputs, Difference Equations, The Z Transform, Z Transform Solution of Difference Equation, The Time Response of a Discrete Time System, Frequency Response of Discrete Time Systems.

UNIT: II : Modeling of Digital Control Systems: ADC Model, DAC Model, Transfer Function of the ZOH, Effect of Sampler on Transfer Function of a Cascade, Transfer Function for the DAC, Analog Subsystem, ADC Combination, Closed Loop Transfer Function, Analog Disturbances in a Digital System, Steady State Error and Error Constants.

UNIT: III : Stability of Digital Control Systems: Definitions of Stability, Stable Z Domain Pole Locations, Stability Conditions, Stability Determination, Jury Test.

UNIT: IV : State Space Representation: Discrete Time State Space Equations, Solution of Discrete Time State Space Equations, Z Transfer from State Space Equations, Similarity Transformation, Stability of State Space Realizations, Controllability and Stabilizability, Observability and Detectability.

UNIT: V : State Feedback Control: On State and Output Feedback, Pole Placement, Servo Problem, Principles of Observer, State Feedback and Pole Assignment Using Transfer Functions.

Text Book:

1. Digital control systems by B.C.Kuo, Oxford University Press.

Reference Books:

1. Digital Control Engineering: Analysis and Design, By M. Sami Fadali, Antonio Visioli, Academic Press; 1edition (February 16, 2009)
2. Digital control systems by K.Ogata

PEC-3:EEE3206 : High Voltage Engineering

3L:1T:0P 3 Credits

Course Outcomes:

At the end of the course, the student will demonstrate

- Understand the basic physics related to various breakdown processes in solid, liquid and gaseous insulating materials.
- Knowledge of generation and measurement of D. C., A.C., & Impulse voltages.

- Knowledge of tests on H. V. equipment and on insulating materials, as per the standards.

- Knowledge of how over-voltages arise in a power system, and protection against these over-voltages.

UNIT: I : Breakdown in Gases: Ionization processes and de-ionization processes, Types of Discharge, Gases as insulating materials, Breakdown in Uniform gap, non-uniform gaps, Townsend's theory, Streamer mechanism, Corona discharge

UNIT: II : Breakdown in liquid and solid Insulating materials: Breakdown in pure and commercial liquids, Solid dielectrics and composite dielectrics, intrinsic breakdown, electromechanical breakdown and thermal breakdown, Partial discharge, applications of insulating materials.

UNIT: III : Generation of High Voltages: Generation of high voltages, generation of high D. C. and A.C. voltages, generation of impulse voltages, generation of impulse currents, tripping and control of impulse generators.

UNIT: IV : Measurements of High Voltages and Current: Peak voltage, impulse voltage and high direct current measurement method, cathode ray oscillographs for impulse voltage and current measurement, measurement of dielectric constant and loss factor, partial discharge measurements.

UNIT: V : Lightning and Switching Over-voltages: Charge formation in clouds, Stepped leader, Dart leader, Lightning Surges. Switching over voltages, Protection against over-voltages, Surge diverters, Surge modifiers.

UNIT: VI : High Voltage Testing of Electrical Apparatus and High Voltage Laboratories: Various standards for HV Testing of electrical apparatus, IS, IEC standards, Testing of insulators and bushings, testing of isolators and circuit breakers, testing of cables, power transformers and some high voltage equipment, High voltage laboratory layout, indoor and outdoor laboratories, testing facility requirements, safety precautions in H. V. Labs.

Text/Reference Books:

1. M. S. Naidu and V. Kamaraju, "High Voltage Engineering", McGraw Hill Education, 2013.
2. C. L. Wadhwa, "High Voltage Engineering", New Age International Publishers, 2007.

OEC-6:EEO3201 : Industrial Management and Entrepreneurship

3L:1T:0P 3 Credits

COURSE OUTCOMES:

At the end of the course the student should be able to

- Differentiate between Micro and Macro Economics and apprise the nitty gritty of demand function.

- Identify various kinds of markets, the pricing methods used and solve the basic problems using BEP analysis.
- Comprehend the basic concepts of Management and Human Resource Management.
- Apply the basic concepts of Production Management and Marketing Management in planning the production and distribution of products.
- Evaluate the basic forms of organization best suited for entrepreneurship and appreciate the importance of Financial Management in a firm.

UNIT I: Introduction to Economics: Concept, Nature & Scope of Economics-Macro and Micro Economics Demand Analysis: Demand Determinants- Law of Demand& its exceptions- Elasticity of Demand Types –Demand Forecasting-Methods.

UNIT II: Market Structures: Types of Markets-Price output determination in Perfect Competition, Monopoly, Monopolistic Competition, Oligopoly - Pricing methods - Break – Even Analysis (simple problems).

UNIT III: Introduction to Management: Concept - Functions of Management - Scientific Management Principles of Management-Leadership Styles - Functional areas of Management. Human Resource Management: Definition, Significance and Functions - PM Vs HRM – Recruitment, Selection, Training and Development -Job Analysis - Role and position of HR department – Performance Appraisal.

UNIT IV: Marketing Management : Needs- Wants - Products - Market-Marketing- Production Concept, Product Concept, Sales Concept, Marketing Concept, Societal Marketing Concept- Organizing the Marketing Department - Marketing Mix: Product, Price, Place, Promotion (in brief)Production Management: Concept of production management-Types of Production processes Plant Location & Layout, Statistical Quality Control.

UNIT V: Financial Management: Financial Statements – Contents of Trading Account, Profit and Loss Account – Balance Sheet (Theory only) - Analysis of Financial statements : Ratio analysis (simple problems) -Concept of Finance - Objectives of Finance-Wealth Maximization Vs. Profit Maximization - Functions of Finance - Role of financial manager - Organization of finance function.

UNIT VI: Forms of Business Organizations: Sole Proprietorship, Partnership, Joint Stock Company – Private limited and Public limited Companies, Public enterprises and their types, Business Cycles .Entrepreneur ship- Entrepreneur – Qualities of good entrepreneur - Entrepreneurial Functions ,Entrepreneurial Development: Objectives, Training, Benefits - Phases of Installing a Project.

Text/Reference Books:

1. M.Y.Khan & P.K.Jain, Financial Management, TATA McGraw-Hill, New Delhi.
2. Koontz O Donnel, Management, TATA McGraw-Hill, New Delhi.
3. K. Aswathappa, Production Management, Himalaya Publishing House, Mumbai.
4. P.Subba Rao, Human Resource Management, Himalaya Publishing House, Mumbai.
5. Philip Kotler, Marketing Management, Pearson Prentice Hall, New Delhi.
6. Vasant Desai, Entrepreneurship, Himalaya Publishing House, Mumbai.
7. Varshini &Maheswari, Managerial Economics, SChand & Co, New Delhi.

OEC-6:EEO3202 : Organizational Behavior

3L:1T:0P

3 Credits

Course Outcomes:

At the end of this course student will be able to

- Explain the role of entrepreneur in economic development
- Demonstrate methods of generating ideas
- Develop the business plan to start their own enterprise
- Manage various production aspects such as manufacturing costs control, marketing management and waste reduction
- Make financial plan for enterprise
- Find the institutional support entrepreneurship

UNIT: I : Planning and Decision Making: Planning and goal setting – Organizational planning – Vision, Mission and goals, Types of plans, steps in planning process, Approaches to planning, Planning in Dynamic Environment. Decision making process, types of decisions, decision making styles, Vroom's Participative decision making model.

UNIT: II : Organizing: Organizational Structure, Principles of Organizing, Authority, Power and Influence, designing organizational structure, Mechanistic and organic structures, contemporary organizational design and its challenges.

UNIT: III : Controlling: The control process, controlling for organizational performance, types of control, financial controls, Balanced Scorecard, Bench Marking, Contemporary issues in controlling.

UNIT: IV : Organizational Behavior: Individual and Group Behavior, Importance of organizational Behavior, Culture and diversity, personality

theories, perception, formation of group behavior, classification of groups, group properties, group cohesiveness.

UNIT: V : Leadership: Leadership traits, Leadership styles, Leadership theories, Power and Politics.

UNIT: VI : Motivation: Approaches to Motivation, Maslow's needs hierarchy theory, two factor theory of motivation, McGregor's theory, ERG theory, McClelland's needs theory, Valance Theory.

TEXTBOOKS:

1. Richard L.Daft, New Era of Management, Cengage Learning, 11e, 2017.
2. Afsaneh Nahavandi, Robert B.Denhardt, Janet V. Denhardt, Maris P. Aristigueta, Organizational Behaviour, Sage Publications, 2015.
3. Laurie J. Mullins, Management, and Organizational Behaviour, Pearson publications, 9e.
4. Stephen P. Robbins, Timothy A.Judge, NeharikaVohra, Organizational Behaviour, Pearson, 16e, 2017.
5. Ramesh B.Rudani, Management and Organizational Behaviour Tata McGraw hill, 2011.

OEC-6:EEO3203 : Financial Accounting

3L:1T:0P 3 Credits

Course Outcomes:

At the end of this course student will be able to

- Explain basic principles of Financial Accounts.
- Apply cost – volume - profit (CVP) analysis in their business decision making.
- Evaluate investment proposals through various Accounting transactions.
- Apply the knowledge to prepare the simple financial statements for measuring performance of business firm.
- Analyse key issues of organization, management and administration

Unit: I : Meaning and Scope of Accounting: Need, development, and definition of accounting; Bookkeeping and accounting; Persons interested in accounting; Disclosures; Branches of accounting; Objectives of accounting.

Unit: II : Accounting Principles: International Accounting Standards (only outlines); Accounting principles; Accounting Standards in India.

Unit: III : Accounting transactions: Accounting Cycle; Journal; Rules of debit and credit; Compound journal entry; Opening entry; Relationships

between Journal and Ledger; Rules regarding posting; Trial balance; Sub divisions of journal.

Unit: IV : Capital and Revenue: Classification of income; Classification of expenditure; Classification of receipts Accounting concepts of income; Accounting concepts and income measurement; Expired costs and income measurement Final Accounts; Manufacturing account; Trading account ;Profit and loss account; Balance Sheet; Adjustment entries, Rectification of errors; Classification of errors; Location of errors; Suspense accounts; Effects on profit.

Unit: V : **Depreciation Provisions and Reserves:** Concept of depreciation; Causes of depreciation ; Depreciation, depletion, amortization, and dilapidation ;Depreciation accounting; Methods of recording depreciation; Methods for providing depreciation; Depreciation of different assets; Depreciation of replacement cost ;Depreciation accounting as per accounting standard; Depreciation accounting.

Text Books:

1. Anthony, RN. and Reece. J.S.: Accounting Principles: Richard Irwin Inc.
2. Gupta. R.L.and Radhaswamy. M: Financial Accounting; Sultan Chand and Sons, New Delhi.
3. Monga J.R., Ahuja Girish, and Sehgal Ashok: Financial Accounting; Mayur Paper Back.Nokia.
4. Shukla. M.C., Grewal T.S., and Gupta, S.C.: Advanced Accounts: S. Chand & Co. New Delhi.
5. Compendium of Statement and Standards of Accounting : The Institute of Chartered Accountants of India, New Delhi.

EEL3201 : Laboratory-VII: PowerElectronics Lab

0L:0T:3P 1.5 Credits

EEL3202 : Laboratory-VIII:Microprocessor and Microcontroller Laboratory

0L:0T:3P 1.5 Credits

Electrical Engineering Scheme of Instruction & Examination

IV/IV B.Tech

Common with SIX YEAR DUAL DEGREE COURSE II/VI (B.TECH.+ M.TECH.)

(With effect from **2019-2020** admitted batch onwards)

B.Tech. (EEE) IV Year I-semester Scheme of Instruction and Examination

Sub. Ref	Name of the Subject	Periods	Maximum Marks	Credits

		Theory	Tutorial	Lab	Sessionals	Exam	Total	
EEH4101	HSMC-3: Managerial Economics	3	1	—	70	30	100	3
EEC4101	PCC-15: Electrical Drives & Traction	3	1	—	70	30	100	3
EEC4102	PCC-16: Power System Operation & Control	3	1	—	70	30	100	3
EEE41XX	PEC-4:	3	1	—	70	30	100	3
EEE41XX	PEC-5:	3	1	—	70	30	100	3
EEE41XX	PEC-6	3	1	—	70	30	100	3
EEL4101	Laboratory – IX: Control Systems Laboratory	—	—	3	50	50	100	1.5
EEL4102	Laboratory – X: Power System Simulation Lab	—	—	3	50	50	100	1.5
EEL4103	Laboratory – XI: Power System protection lab	—	—	3	50	50	100	1.5
EEL4104	Seminar(based on Internship experience)	—	—	4	50	50	100	1.5
TOTAL		18	6	13	620	380	1000	24.0

Professional Electives Courses (PEC) (Semester-VII)

S.No.	Subject Code	Subject Name
1	EEE4101	Operations Research
2	EEE4102	Electrical Machine Design
3	EEE4103	Flexible AC Transmission Systems
4	EEE4104	Electrical Distribution Systems
5	EEE4105	Advanced Control Systems
6	EEE4106	Advanced Power Electronics
7	EEE4107	HVDC Transmission
8	EEE4108	Power System Protection
9	EEE4109	Electrical Gas Insulated Substations

HSMC-3: EEH4101 : Managerial Economics

3L:1T:0P 3 Credits

Course Outcomes:

At the end of this course student will be able to

- Explain basic principles of engineering economics
- Apply cost – volume -profit (CVP) analysis in their business decision making

· Evaluate investment proposals through various capital budgeting methods

· Apply the knowledge to prepare the simple financial statements for measuring performance of business firm

· Analyse key issues of organization, management and administration

· Evaluate project for accurate cost estimates and plan future activities

Unit: I : Introduction to Engineering Economics - Concept of Engineering Economics – Types of efficiency – Managerial Economics - Nature and Scope – Law of Demand – Types of Elasticity of demand.

UNIT: II : Demand Forecasting & Cost Analysis: Demand Forecasting: Meaning, Factors Governing Demand Forecasting, Methods of Demand Forecasting (Survey and Statistical Methods) – Cost Analysis: Basic Cost Concepts, Break Even Analysis. Factors affecting the elasticity of demand – Supply and law of Supply.

Unit: III : Investment Decisions & Market Structures: Financial Statements & Ratio Analysis Time Value of Money – Capital Budgeting: Meaning, Need and Techniques of Capital Budgeting – Types of Markets Structures – Features – Price Out - put determination under Perfect Competition and Monopoly.

UNIT: IV Financial Statements & Ratio Analysis: Introduction to Financial Accounting –Double entry system – Journal - Ledger – Trail Balance – Final Accounts (with simple adjustments) – Financial Analysis through Ratios: Interpretation of Liquidity Ratios (Current Ratio and quick ratio), Activity Ratios (Inventory turnover ratio and Debtor Turnover ratio, Creditors Turnover Ratio, Capital Turnover Ratio), Solvency Ratios (Debt - Equity ratio, Interest Coverage ratio), and Profitability ratios (Gross Profit Ratio, Net Profit ratio, Operating Ratio, P/E Ratio and EPS).Price output determination under Monopolistic markets, Accounting concepts and conventions.

Unit: V : Introduction to Management & Strategic Management: Introduction to management: Nature – Importance – Classical Theories of Management: F.W.Taylor's and Henri Fayol's Theory – Functions and Levels of Management – Decision Making Process. Methods of Production (Job, Batch and Mass production) - Inventory Control, Objectives, Functions – Analysis of Inventory –EOQ. Maslow & Douglas Mc. Gregor theories of Management, ABC Analysis.

Unit: VI : Project Management: Introduction – Project Life Cycle and its Phases – Project Selection Methods and Criteria – Technical Feasibility – Project Control and Scheduling through Networks – Probabilistic Models of Networks – Time - Cost Relationship (Crashing) –Human Aspects in Project Management: Form of Project Organization – Role & Traits of Project Manager.

Textbooks:

1. Chan S. Park, "Fundamentals of Engineering Economics", Pearson, 2013, 3 Edition, New Delhi, 2015
2. Rajeev M Gupta, "Project Management", 2nd Ed., PHI Learning Pvt. Ltd. New Delhi, 2014

References:

1. Panneer Selvam. R, "Engineering economics", 3rd Edition., Prentice Hall of India, New Delhi, 2013
2. R.B.Khanna, "Project Management", PHI Learning Pvt. Ltd. New Delhi, 2011

PCC-15:EEC4101 : Electrical Drives & Traction

3L:1T:0P 3 Credits

Course Outcomes:

Upon successful completion of the course, the students will be able to

- Analyze the appropriate type of traction system.
- Select a suitable drive for speed control of AC motors.
- Select a suitable drive for speed control of DC motors.
- Determine the tractive effort, power and specific energy consumption of electric traction.

UNIT: I : Electric Drive: Definition, Components of electric drive system, Advantages and applications of drives, factors governing the selection of motors, classification of drives, Drive characteristics and nature of load conditions, selection of motor for particular drive, Dynamics of motor load combination, Multi quadrant operation, Nature, classification and components of load torques.

UNIT: II : Speed Control of DC Motor Drives: Speed Control methods, Single phase rectifier fed uncontrolled and controlled drives, chopper fed drives, closed loop control and Phase locked loop control of DC drives.

UNIT: III : Speed Control of AC Motor Drives: Speed control methods of induction motors, phase controlled drives; frequency controlled drives, slip power recovery schemes, voltage current and frequency control and closed

loop control. Variable frequency control of synchronous motor drives, self-controlled synchronous motor drives.

UNIT: IV : Electric Traction I: Definition and features of traction, Classification of traction systems, Types and choice of track electrification systems, Review of characteristics and suitability of traction motors. Transmission of drive and auxiliary equipment, Loco wheel arrangement and riding qualities, Train lighting system.

UNIT: V : Electric Traction II: Speed time curves and speed distance curves, Tractive effort, specific energy consumption, mechanics of train movement, coefficient of adhesion.

UNIT: VI : Control of Traction Motors: Control of traction motors, rheostatic control, series parallel control, drum controllers, constant current systems, multiple unit control, thyristor and feedback controls. Magnetic levitation suspension systems.

Text Books:

1. Fundamentals of Electrical Drives by GK Dubey
2. Power Electronics: Circuits, Systems and Applications by MH Rashid
3. A First Course on Electric Drives by SK Pillai
4. Utilization of Electrical Energy by E. Open Shaw Taylor and VVL Rao

Reference Books:

1. Electrical Drives and Traction by N. Prema Kumar
2. Electrical Drives by Vedam Subramanyam
3. Modern Electric Traction by H. Partab

PCC-16:EEC4102 Power System Operation & Control

3L:1T:0P 3 Credits

Course Outcomes:

Upon successful completion of the course, the students will be able to

- Evaluate optimal generation schedule with and without losses.
- Compute loss coefficients and transmission losses.
- Find the solution for short term hydrothermal scheduling problems.
- Determine the steady state changes in frequency in single area and two area load frequency control.
- Suggest suitable voltage control method for different applications.

UNIT: I : Optimal System Operation: Characteristics of various steam units, combined cycle plants, cogeneration plants, Hydro-electric units, Steam units economic dispatch problem with and without considering losses and solution using Lagrange multiplier method only.

Hydro-Thermal Coordination: Hydro-electric plant models, Scheduling energy, Short-term hydrothermal scheduling.

UNIT: II : Unit Commitment: Constraints in unit commitment, Generation of state, optimizing the states using Priority-list method, Unit commitment problem solution using Priority-list method and Dynamic Programming.

Optimal Power Flow: Optimal power flow problem formulation for loss and cost minimization, Solution of optimal power flow problem using Newton's method and Linear Programming technique.

UNIT: III : Automatic Generation Control: Control System structure, Automatic Load-frequency control of single area system with and without control, Steady state and dynamic responses of single area ALFC loop, Automatic Load-frequency control of two area system, Tie-line bias control of two area and multi-area system.

Voltage Control: Automatic voltage regulator, Exciter types, Exciter modelling, Generator modelling, Static and Dynamic response of AVR loop.

UNIT: IV : Power System Security: Introduction, Factors affecting the power system security, Contingency analysis procedure, Linear sensitivity factors: Line outage distribution factors and Generation shift factors, and its derivation; AC power flow method, contingency selection.

UNIT: V : **State Estimation:** Weighted Least Square State Estimation, Basic concepts about network observability, Pseudo-measurements, Bad data detection and identification.

Text Books:

1. Power Generation, Operation and Control, Allen J. Wood and Bruce F. Wollenberg, John Wiley & Sons, Inc., New York, 2nd edition, 1996.
2. Electric Energy Systems Theory: An Introduction, Olle I. Elgerd, TMH Publishing Company Ltd., New Delhi, 2nd edition, 1983.

PEC-4:EEE4101 : Operations Research

3L:1T:0P 3 Credits

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Analyse any real life system with limited constraints and depict it in a model form.
- Convert the problem into a mathematical model.
- Solve the mathematical model manually as well as using soft resources/software such as solver, TORA etc.
- Understand variety of problems such as assignment, transportation, travelling salesman etc.
- Solve the problems mentioned in point 4 using linear programming approach using software.

· Understand different queuing situations and find the optimal solutions using models for different situations.

UNIT-I : Introduction to Optimization: Engineering Applications of Optimization, Statement of Problem, Classification of Optimization Problem Techniques.

UNIT-II : Linear Programming : Introduction, Requirements For a LP Problem, Examples on The Application of LP, Graphical Solution of 2-Variable LP Problems, Some Exceptional Cases, General Mathematical Formulation For LPP, Canonical And Standard Forms of LP Problem, Simplex Method, Examples on The Application of Simplex Techniques.

Artificial Variable Techniques: Big-M Method and Two Phase Techniques.

UNIT-III : Transportation Problem: Matrix Terminology, Definition and Mathematical Representation of Transportation Model, Formulation and Solution of Transportation Models (Basic Feasible Solution by North-West Corner Method, Inspection Method, Vogell's Approximation Method).

UNIT-IV : Assignment Problem: Matrix Terminology, Definition of Assignment Model, Comparison with Transportation Model, Mathematical Representation of Assignment Model, Formulation and Solution of Assignment Models.

UNIT-V : Pert Network: Introduction, Phases of Project Scheduling, Network Logic, Numbering the Events (Fulkerson's Rule), Measure of Activity.

Pert Network Computations: Forward Pass And Backward Pass Computations, Slack Critical Path, Probability of Meeting the Scheduled Dates.

UNIT-VI : Inventory Models: Introduction, Necessity For Maintaining Inventory, Classification of Inventory Models, Inventory Models With Deterministic Demand, Demand Rate Uniform Production Rate Infinite, Demand Rate Non-Uniform Production Rate Finite, Demand Rate Uniform-Production Rate Finite. Game Theory: Useful Terminology, Rules For Game Theory, Saddle Point, Pure Strategy, Reduce Game By Dominance, Mixed Strategies, 2x2 Games Without Saddle Point.

TEXT BOOKS:

1. "Operations Research-An Introduction" By H.Taha, Prentice Hall Of India Pvt. Ltd.
2. "Engineering Optimization-Theory & Practice" By S.S. Rao, New Age International (P) Ltd.

3. "Operations Research – An Introduction" By P.K.Gupta & D.S.Hira, S. Chand & Co. Ltd.

PEC-4:EEE4102 : Electrical Machine Design

3L:1T:0P 3 Credits

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Understand the construction and performance characteristics of electrical machines.
- Understand the various factors which influence the design: electrical, magnetic and thermal loading of electrical machines.
- Understand the principles of electrical machine design and carry out a basic design of an ac machine.
- Use software tools to do design calculations.

UNIT: I : Introduction to Design: Introduction, Design factors, Limitations in Design.

Electrical Engineering Materials: (a) Conducting Materials – High conductivity materials (Copper, Aluminum, Copper alloys only); High resistivity materials, Carbon materials, Super- conductivity; (b) Magnetic Materials – types of magnetic materials; (c) Insulating Materials – Electrical characteristics, temperature characteristics, and classification of insulating materials.

UNIT: II : Heating and Cooling: Theory of solid body heating, Heating time constant and estimation, Selection of motor power rating, types of duties and ratings (Description only), Selection of motor capacity for continuous, short-time and Intermittent periodic duty ratings, Concept of the methods used for determination of motor rating for variable load drives.

UNIT: III : Design of Transformers: Output of transformer, Design of core, Selection of type of winding, Design of insulation, Overall design, No-load current estimation, Design of tank with tubes. Design of DC machines: Output equation and main dimensions, choice of flux density, choice of ampere-conductors, Selection of number of poles, Length of air gap, Design of field winding.

UNIT: IV : Design of AC machines (Induction motor): Output equation and main dimensions, Selection of stator and rotor slots, Length of air gap, Reduction of harmonic torques.

UNIT: V : Design of AC machines (Synchronous machines): Output equation, Main dimensions for cylindrical and salient pole machines, Choice of specific magnetic and electric loadings, Effect of SCR on machine

performance, Length of air gap, Selection of stator slots, Elimination of harmonics.

UNIT: VI : Windings: DC machines: Simplex Lap and Wave windings. AC machines: Hemitropic, whole coil and Mush windings.

Text books:

1. A K Sawhney and Chakrabarti, A course on Electrical Machine Design, 6th edition, Dhanpat Rai & Co Pvt. Ltd., 2014.
2. M G Say, The performance and Design of Alternating Current Machines, 3rd edition, CBS Publishers & Distributors, New Delhi, 2002.
3. A E Clayton and N N Hancock, Performance and Design of Direct Current Machines, 3rd edition, CBS Publication, 2004.

PEC-4:EEE4103 Flexible AC Transmission Systems

3L:1T:0P 3 Credits

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Understand the characteristics of ac transmission and the effect of shunt and series reactive compensation.
- Understand the working principles of FACTS devices and their operating characteristics.
- Understand the basic concepts of power quality.
- Understand the working principles of devices to improve power quality.

UNIT: I : Introduction: Electrical Transmission Networks, Conventional Control Mechanisms- Automatic Generation Control, Excitation Control, Transformer Tap-Changer Control, Phase- Shifting Transformers; Advances in Power-Electronic Switching Devices, Principles and Applications of Semiconductor Switches; Limitations of Conventional Transmission Systems, Emerging Transmission Networks, HVDC and FACTS options.

UNIT: II : Flexible AC Transmission Systems (FACTS): Transmission Interconnections, Power Flow in AC System, Factors Limiting the Loading Capability of Transmission Lines, Power Flow and Dynamic Stability Considerations, Importance of Controllable Parameters, Types of FACTS Controllers.

UNIT: III : FACTS Converters: Types of converter, Concept and operation of Voltage sourced converters, Current Sourced converters, Operation of Single-Phase and Three-Phase Bridge Converters, Description of Three-Level VSC and PWM Converters, Transformer Connections for 12-pulse, 24-pulse and 48-pulse operation.

UNIT: IV : Shunt, Series Type FACTS Controllers (Operation and Theoretical Descriptions only): Objective of Shunt Compensation, Methods of Controllable Shunt VAR Generation (Variable Impedance type, Switching Converter type and Hybrid type), Objective of Series Compensation, Methods of Controllable Series VAR Generation (Variable Impedance type, Switching Converter type and Hybrid type).

UNIT: V : UPFC and IPFC : Unified Power Flow Controller (UPFC) – Principle of operation, Transmission Control Capabilities, Independent Real and Reactive Power Flow Control; Principle of operation and Characteristics of Interline Power Flow Controller (IPFC), UPFC and IPFC control structures (only block diagram description).

Text Books:

1. Narain G. Hingorani and Laszlo Gyugyi, Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems, IEEE Press, Wiley-Interscience, New Jersey, 2000.

2. R Mohan Mathur and Rajiv K Varma, Thyristor-Based FACTS Controllers for Electrical Transmission Systems, IEEE Press, Wiley-Interscience, New Jersey, 2002.

Reference Books:

1. K R Padiyar, FACTS Controllers in Power Transmission and Distribution, New Age International Publishers, New Delhi, 2007.

2. Anrique Acha, Claudio R. Fuerte-Esquivel, Hugo Ambriz-Pérez and César Angeles- Camacho, FACTS: Modelling and Simulation in Power Networks, John Wiley & Sons, West Sussex, 2004.

PEC-5:EEE4104 : Electrical Distribution Systems

3L:1T:0P 3 Credits

Course Outcomes:

Upon successful completion of the course, the students will be able to

- Distinguish various load models in the distribution system
- Describe the primary feeder ratings and voltage levels.
- Design an optimum location of the substation.
- Analyze the distribution system and its associated coordination procedures
- Select appropriate voltage control method in the distribution systems

UNIT: I : Distribution System Basics: Brief description about electrical power transmission and distribution systems, Factors effecting the system planning, Distribution system planning methods, Planning models, Factors for future planning, Distribution system loading characteristics – demand, demand interval, Maximum demand, diversified demand, Non- coincident

demand, demand factor, connected load, utilization factor, plant factor, load factor, diversity factor, coincidence factor, load diversity, contribution factor, loss factor; relation between load and loss factors, Tariff structures (As per text book and practically existing at the institution location are to be covered).

UNIT: II : Distribution Systems: Types of distribution sub-transmission, Substation bus schemes and comparison, Factors effecting the substation location, Rating of a distribution substation for square and hexagonal shaped distribution substation service area, Factors effecting the primary feeder rating, types of primary feeders, Factors affecting the primary feeder voltage level, Factors affecting the primary feeder loading, Tie-lines, Radial feeder with uniformly and non-uniformly distributed loading.

UNIT: III : Distribution System Components: Approximate line segment model, Various types of loads, Definitions of various terms related to system loading, Detailed description of distribution transformer loading, feeder loading, Modelling of star and delta connected loads, two-phase and single-phase loads, shunt capacitors, Voltage regulators, Line-drop compensator.

UNIT: IV : Modern Distribution Systems: Distribution system automation, Architecture and implementation strategies for distribution automation, Distribution management system functions, Real-time control system, Outage management, Decision support applications, Concepts of distributed generation, Various types of distributed generators.

UNIT: V : Advanced topics in Distribution Systems: Basic reliability indices, Calculation of SAIDI, SAIFI and MAIFI, Distribution automation communication protocols: MODBUS, DNP 3.0, IEC 60870-5-101, UCA 2.0, IEC 61850; Brief description of Smart-grid, Micro-grid, and Nano-grid with simple examples.

Text Books:

1. Distribution System Modelling and Analysis, William H. Kersting, CRC Press, Newyork, 2002.

2. Electric Power Distribution System Engineering, Turan Gonen, McGraw-Hill Inc., New Delhi, 1986.

3. Control and Automation of Electrical Power Distribution Systems, James Northcote- Green and Robert Wilson, CRC Taylor & Francis, New York, 2007.

PEC-5:EEE4105 : Advanced Control System

3L:1T:0P 3 Credits

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Understand various design specifications.
- Design controllers using the state-space approach.

- Design a compensator for continuous time systems.
- Apply the concepts of controllability and observability in evaluating the performance of control system.
- Design an appropriate feedback controller and/or observer for physical plants.

UNIT: I : Control Systems Components: DC & AC Tachometers - Synchros, AC AND DC Servo Motors - Stepper Motors and its use in Control Systems, Amplidyne Metadyne - Magnetic Amplifier – Principle, Operation and Characteristics Ward - Leonard Systems.

UNIT: II : State Variable Analysis: concept of State Variables & State Models, State model for Linear Continuous Time Systems, State-Space Representation Using Physical Variables, State-Space Representation Using Phase Variables.

UNIT: III : Diagonalization, Jordan Canonical Form, Solution of State Equations, Properties of State Transition Matrix, Computation of State-Transition Matrix (Using Laplace Transformation, Cayley-Hamilton Theorem).

UNIT: IV : Controllability & Observability: Concept of Controllability & Observability, Controllable Companion Form, Observable Companion Form (For SISO and MIMO Systems), Pole Placement By State Feedback.

UNIT: V : Introduction to Design: Introduction-Preliminary Considerations of Classical Design - Lead Compensation, Lag Compensation, Realization of Compensating Networks, Cascade Compensation in Time Domain and Frequency Domain (Root Locus And Bode Plot Techniques).

Text Books:

1. Control Systems Engineering, Ij Nagrath, M.Gopal, New Age International Publishers.
2. Modern Control System Theory, M. Gopal, New Age International Publishers.

References:

1. R. T. Stefani and G. H. Hostetter, "Design of feedback Control Systems", Saunders College Pub, 1994.

PEC-5:EEE4106 Advanced Power Electronics

3L:1T:0P 3 Credits

Course outcomes:

At the end of this course, student will be able to

- Employ suitable switching converter for a particular industrial applications.
- Realize various compensators for power quality issues.
- Select suitable drive for electric vehicle.

UNIT: I : Static Switches: Single Phase AC Switches, Three Phase AC Switches, Three Phase Reversing Switches, AC Switches for Bus Transfer, DC Switches and Solid State Relays.

UNIT: II : Soft Switching and resonant converters: Switching mechanism of semiconductor devices, resonant switch topologies, concepts of Zero Voltage Switching (ZVS) and Zero Current Switching (ZCS), L – type and M – type ZCS resonant converters, ZVS resonant converters.

UNIT: III : Power Quality Mitigation Devices: Passive Filters, Active Filters, Hybrid Filters. Distribution Static Compensator (DSTATCOM), Dynamic Voltage Restorer (DVR) and Unified Power Quality Conditioner (UPQC). (Theoretical Approach Only)

UNIT: IV : Power Supplies: Power Line Disturbances – Types And Sources, Effect on Sensitive Equipment, Power Conditioners, Uninterruptible Power Supplies (UPS), DC Power Supplies – Switched Mode, Resonant and Bidirectional DC Power Supplies, AC Power Supplies – Switched Mode, Resonant and Bidirectional AC Power Supplies.

UNIT: V : Power Electronics Application: Residential Applications, Industrial Applications, Solar and Battery Powered Drives, Motors Suitable for Pump Drives, Solar Power Pump Drives, Battery Powered Vehicles, Solar Powered Electric Vehicles and Boats.

Text Books:

1. MH Rashid, "Power Electronics: Circuits, Systems and Applications", 2nd edition. Prentice Hall, Eaglewood Cliffs, NJ, 1996.
2. R. W. Erickson, "Fundamentals of Power Electronics", First Edition. Chapman and Hall, New York, 1997.
3. Ned Mohan, Tore M. Undeland and William P. Robbins, "Power Electronics – Converters, Applications, and Design", Third Edition. John Wiley & Sons, Inc. 2003.

Reference Books:

1. Narain G. Hingorani and Laszlo Gyugyi, Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems, IEEE Press, Wiley-Interscience, New Jersey, 2000.
2. Gopal K Dubey, "Fundamentals of Electrical Drives".1st edition, Narosa Publishing House, New Delhi, 1995.
3. R.S. Ramshaw, "Power Electronics Semiconductor Switches", 2nd edition, Chapman & Hall, UK. 1993.

PEC-6:EEE4107 : HVDC Transmission

3L:1T:0P 3 Credits

Course Outcomes: At the end of this course, students will demonstrate the ability to

- Understand the advantages of dc transmission over ac transmission.
- Understand the operation of Line Commutated Converters and Voltage Source Converters.
- Understand the control strategies used in HVDC transmission system.
- Understand the improvement of power system stability using an HVDC system.

UNIT: I : General aspects of DC transmission and comparison of it with AC transmission: Introduction, General aspects of transmission, Transmission links, types - Monopolar, Homopolar, Bipolar and Back-to-Back, Constitution of dc and ac links. Technical aspects, Economic aspects, Reliability aspects and Environmental aspects of HVDC Transmission (HVDCT), Advantages and disadvantages of HVDCT, Applications of DC Transmission, HVDC light.

UNIT: II : Converters: Definition, Thyristor system, Valves, Valve characteristics, Components of circuits, Properties of converter circuits, Pulse number, Single phase and three phase converters, Assumptions in converter circuit, Graetz circuit, Bridge converter with grid control without overlap, Bridge converter with grid control with overlap less than 60°

UNIT: III : HVDC Links and Converters: Characteristics of converter circuits – Rectifier and inverter characteristics, complete characteristics of rectifier and inverter, Equivalent circuit of HVDC Link, Brief description of 12-pulse, 24-pulse and 48-pulse converters transformer configurations, Choice of converter circuit for HVDC transmission.

UNIT: IV : HVDC Converter control: Desired features and means of control, control of the direct current transmission link, Constant current control, Constant extinction angle control, Constant ignition angle control, Converter firing-angle control-IPC and EPC, frequency control and Tap changer control, Starting, Stopping and Reversal of power flow in HVDC links.

UNIT: V : **Misoperation and Protection of DC links:** Malfunction of converter valves, Arc-back, Arc- through, Misfire, Quenching, Commutation failure, Valve blocking and bypass, Short circuits within the converter station. DC reactors, valve dampers, line dampers, circuit breakers.

Text Books:

1. E.W. Kimbark, Direct current transmission, Vol. I, Wiley Interscience, New York, 1971.

2. P Kundur, Power System Stability and Control, McGraw Hill Inc., New York, 1994.

Reference Books:

1. K. R. Padiyar, HVDC Power Transmission Systems: Theory and System Interactions, New Age International Publishers, New Delhi, 2009.
2. Erich Uhlmann, Power Transmission by Direct Current, Springer-Verlag, Berlin/Heidelberg, 1975.

PEC-6:EEE4107 : HVDC Transmission

3L:1T:0P 3 Credits

Course Outcomes: At the end of this course, students will demonstrate the ability to

- Understand the advantages of dc transmission over ac transmission.
- Understand the operation of Line Commutated Converters and Voltage Source Converters.
- Understand the control strategies used in HVDC transmission system.
- Understand the improvement of power system stability using an HVDC system.

UNIT: I : General aspects of DC transmission and comparison of it with AC transmission: Introduction, General aspects of transmission, Transmission links, types - Monopolar, Homopolar, Bipolar and Back-to-Back, Constitution of dc and ac links. Technical aspects, Economic aspects, Reliability aspects and Environmental aspects of HVDC Transmission (HVDCT), Advantages and disadvantages of HVDCT, Applications of DC Transmission, HVDC light.

UNIT: II : Converters: Definition, Thyristor system, Valves, Valve characteristics, Components of circuits, Properties of converter circuits, Pulse number, Single phase and three phase converters, Assumptions in converter circuit, Graetz circuit, Bridge converter with grid control without overlap, Bridge converter with grid control with overlap less than 60°

UNIT: III : HVDC Links and Converters: Characteristics of converter circuits – Rectifier and inverter characteristics, complete characteristics of rectifier and inverter, Equivalent circuit of HVDC Link, Brief description of 12-pulse, 24-pulse and 48-pulse converters transformer configurations, Choice of converter circuit for HVDC transmission.

UNIT: IV : HVDC Converter control: Desired features and means of control, control of the direct current transmission link, Constant current control, Constant ignition angle control, Constant extinction angle control, Converter firing-angle control-IPC and EPC, frequency control and Tap changer control, Starting, Stopping and Reversal of power flow in HVDC links.

UNIT: V : Misoperation and Protection of DC links: Malfunction of converter valves, Arc-back, Arc- through, Misfire, Quenching, Commutation failure, Valve blocking and bypass, Short circuits within the converter station. DC reactors, valve dampers, line dampers, circuit breakers.

Text Books:

1. E.W. Kimbark, Direct current transmission, Vol. I, Wiley Interscience, New York, 1971.
2. P Kundur, Power System Stability and Control, McGraw Hill Inc., New York, 1994.

Reference Books:

1. K. R. Padiyar, HVDC Power Transmission Systems: Theory and System Interactions, New Age International Publishers, New Delhi, 2009.
2. Erich Uhlmann, Power Transmission by Direct Current, Springer - Verlag, Berlin/ Heidelberg, 1975.

PEC-6:EEE4108 : Power System Protection

3L:1T:0P

3 Credits

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Understand the different components of a protection system.
- Evaluate fault current due to different types of fault in a network.
- Understand the protection schemes for different power system components.
- Understand the basic principles of digital protection.
- Understand system protection schemes, and the use of wide-area measurements.

UNIT: I : Introduction to Protection Scheme: Need for Protective systems - Nature and causes of Faults -Types of faults - Effect of faults - fault statistics - Evolution of protective relays - Zones of protection - Primary and Back -up Protection - Essential qualities of Protection - Classification of Protective schemes -Automatic reclosing - current transformer for Protection - potential transformer - basic relay terminology.

UNIT: II : Relays: General considerations - sensing of faults - construction of electro-magnetic attraction and induction types relays - Buchholz and negative sequence relay -concept of reset, pick up, inverse time and definite time characteristics, over current, over voltage, directional, differential and distance relays on R-X diagram

UNIT: III : Static Relays: Introduction, advantage and limitation of static relays, static over current, directional, distance and differential relays. Electronic relays - static relays functional circuits: comparators, level detectors, logic and training circuits, microprocessor and computer based protection schemes.

UNIT: IV : Protection: Types & detection of faults and their effects, alternator protection scheme - Power transformer protection , generator-transformer unit protection scheme, bus bar protection - Transmission line protection, Pilot relaying schemes, power line carrier protection.

UNIT: V : Switchgear: Theory of current interruption- energy balance and recovery rate theory, arc quenching, recovery and restriking voltages - Types of circuit breakers - Rating selection and testing of circuit breakers/operating mechanisms - LT switchgear, HRC fuses, types construction and applications.

Text Books:

1. Badrinarayana & Vishwakarma, "Power System Protection", Tata McGraw-Hill Education, 2011.
2. Paithankar Y. G., S. R. Bhade, "Fundamentals of power system protection", PHI Learning Pvt. Ltd., 2004.

Reference Books:

1. Ravindra Nath.B, and Chandar.M, "Power systems protection and switchgear", New age international (P) Ltd. 2005.
2. Rao Sunil.S, "Switchgear and protection". Khanna Publishers, 1999.
3. Paithankar.Y.G, "Transmission Network Protection: Theory and Practice", Marcel Dekker, Inc.1998.

PEC-6:EEE4109 : Electrical GIS

3L:1T:0P

3 Credits

Course outcomes:

At the end of this course student will be able to,

- Distinguish between the operation of air and gas insulated sub-stations.
- Develop the layout of a GIS sub-station.
- Analyze the significance of various factors like fast transient phenomenon, insulation diagnostics & problems in GIS sub-station.

UNIT-I : Introduction to GIS, Properties of SF₆ and Layout of GIS Stations: Characteristics of GIS - Introduction to SF₆ - Properties of SF₆ Gas - Specifications of SF₆ Gas for GIS applications - Handling of SF₆ Gas before use - Safe handling of SF₆ Gas in Electrical Equipment - Equipment for handling the SF₆ Gas - SF₆ and Environment, advantage of GIS Stations - Comparison with Air Insulated Substations - Economics of GIS - User Requirements for GIS - Main features of a GIS - Planning and Installation - Components of a GIS Station.

UNIT-II : Design and Construction of GIS Station: Introduction - Rating of GIS components - Design Features - Estimation of different types of Electrical Stresses -Design Aspects of GIS components - Insulation Design for Components - Insulation Design for GIS - Thermal Considerations in the Design of GIS - Effect of very Fast Transient Over-voltages (VFTO) on the GIS design - Insulation Coordination systems - Gas handling and Monitoring System Design.

UNIT-III : Testing of GIS and Special Problems in GIS: Introduction – Various Tests on GIS – Design Approach for manufacturing and Type Tests – Quality Assurance in Manufacturing, Shipping and Erection – On-site Testing of GIS – Dielectric Tests – Commonly Used On-site Test Methods - Experience during On-site Testing – Condition Monitoring and Diagnostic Methods. Introduction - particles their effects and their control- Insulating Spacers and their Reliability - SF6 Gas Decomposition.

UNIT-IV : GIS Diagnostics, GIS Service Experience and Maintenance Procedures: Introduction - Characteristics of imperfections in insulation - Insulation Diagnostic methods - PD Measurement and UHF Method.

UNIT-V : Fast Transient Phenomena in GIS and Future Trends in GIS Technology: Introduction - Disconnecter Switching in Relation to Very fast Transients - Origin of VFTO Propagation and Mechanism of VFTO - VFTO Characteristics - Effects of VFTO - Testing of GIS for VFTO.

TEXT BOOK:

1. M. S. Naidu, "Gas Insulated Substations"- IK International Publishing House.

References:

1. G.F. Montillet, E. Mikes et al. "Underground transmission and distribution GIS solutions" IEEE/PES T&D Exposition and Conference, Dallas USA, 2003.

2. E. Mikes, Ch. Tschannen, et al. "GIS substation extensions and upgrades" CEPSE Paper T1-068, 2000, Manila, Philippines.

3. CIGRE WG 23.10; Paper 23-102, 1998, Report on the Second International Survey on High-Voltage Gas Insulated Substations (GIS) Service Experience, Paris, France 1998.

4. E. Mikes, H. Aeschbach et al. "Innovative GIS based solutions for substations" CIGRE SC23 Colloquium Venezuela, Paper 3.1, 2001.

5. D. Dufournet, C. Lindner et al. "Technical Trends in Circuit Breaker Switching Technologies" CIGRE SC A3 Colloquium paper, Sarajevo, Bosnia, 2003.

EEL4101 Laboratory- IX: Control Systems Laboratory

OL:0T:3P 1.5 Credits

EEL4102 Laboratory X: Power System Simulation Lab

OL:0T:3P 1.5 Credits

EEL4103 Power system protection lab

OL:0T:3P 1.5 Credits

EEL4103 Power system protection lab

OL:0T:3P 1.5 Credits

SCHEME OF INSTRUCTION & SYLLABUS FOR B.Tech. (CIVIL ENGINEERING), B.Tech.+M.Tech. Dual degree (CIVIL ENGINEERING)

(Effective from 2019-20 Admitted Batch)

III Year - I Semester

S.No	Sub Code	Category	Subject Name	L	T	P	C	I	E	TM
1	CE3101	PCC	Structural Analysis - II	3	1	-	3	30	70	100
2	CE3102	PCC	Environmental Engineering-II	3	1	-	3	30	70	100
3	CE3103	PCC	Reinforced Concrete Structures - I	4	1	-	3	30	70	100
4	CE3104	PCC	Steel Structures - I	4	1	-	3	30	70	100
5			Professional Elective - I							
	CE3105A	PEC	Concrete Technology							
	CE3105B	PEC	Remote Sensing and GIS Applications	3	-	-	3	30	70	100
	CE3105C	PEC	Geo-Environmental Engineering							
6	CE3106	OEC	Open Elective - II Building Services and Maintenance	3	-	-	2	30	70	100
7	CE3107	PCC	Geotechnical Engineering Lab - I	-	-	3	1.5	50	50	100
8	CE3108	PCC	Environmental Engineering Lab	-	-	3	1.5	50	50	100
Total				20	4	6	20.0	280	520	800

III Year - II Semester

S.No	Sub Code	Category	Subject Name	L	T	P	C	I	E	TM
1	CE3201	PCC	Estimation, Specifications and Contracts	3	1	-	3	30	70	100
2	CE3202	PCC	Fluid Mechanics -II	4	1	-	3	30	70	100
3	CE3203	PCC	Reinforced Concrete Structures-II	3	1	-	3	30	70	100
4	CE3204	PCC	Transportation Engineering	4	1	-	3	30	70	100
5	CE3205	PCC	Water Resources Engineering-I	3	1	-	3	30	70	100
6			Professional Elective - II							
	CE3206A	PEC	Steel Structures- II							

	CE3206B	PEC	Ground Improvement Techniques	3	-	-	3	30	70	100
	CE3206C	PEC	Irrigation Engineering							
7	CE3207	PCC	Highway Material Lab	-	-	3	1.5	50	50	100
8	CE3208	PCC	Concrete Lab	-	-	3	1.5	50	50	100
9	CE3209	PCC	Computer Applications in Civil Engineering Lab	-	1	2	1.5	50	50	100
Total				20	6	8	22.5	330	570	900

IV Year - I Semester

S.No	Sub Code	Category	Subject Name	L	T	P	C	I	E	TM
1	CE4101	PCC	Geotechnical Engineering - II	3	1	-	3	30	70	100
2	CE4102	PCC	Fluid Mechanics - III	3	1	-	3	30	70	100
3	CE4103	PCC	Water Resources Engineering-II	3	-	-	3	30	70	100
4	CE4104	PCC	Construction Management	3	-	-	3	30	70	100
Professional Elective - III										
	CE4105A	PEC	Prestressed Concrete Structures							
5	CE4105B	PEC	Elements of Coastal Engineering	3	-	-	3	30	70	100
	CE4105C	PEC	Introduction to Rock Mechanics							
	CE4105D	PEC	Solid Waste Management							
6	Professional Elective - IV									
	CE4106A	PEC	Environmental Impact Assessment							
	CE4106B	PEC	Earth Retaining Structures	3	-	-	3	30	70	100
	CE4106C	PEC	Airport Planning and Design							
	CE4106D	PEC	Finite Element Method of Analysis							
7	CE4107	PCC	Geotechnical Engineering Lab - II -	-	-	3	1.5	50	50	100
8	CE4108	PCC	Fluid Mechanics Lab-II	-	-	3	1.5	50	50	100
Total				18	2	6	21.0	280	520	800

IV Year - II Semester

S.No	Sub Code	Category	Subject Name	L	T	P	C	I	E	TM
1	CE4201	PW	Project Work	-	-	12	12.5	100	100	200
Total				-	-	12	12.5	100	100	200

B.Tech. (CIVIL ENGINEERING), B.Tech.+M.Tech. Dual degree (CIVIL ENGINEERING)

(Effective from 2019-20 Admitted Batch)

Summary of Credits Semester Wise

I B. Tech. I Semester 19.0

I	B. Tech. II Semester	20.0
II	B. Tech. I Semester	23.0
II	B. Tech. II Semester	22.0
III	B. Tech. I Semester	20.0
III	B. Tech. II Semester	22.5
IV	B. Tech. I Semester	21.0
IV	B. Tech. II Semester	12.5
TOTAL CREDITS		160.0

B.Tech. (CIVIL ENGINEERING), B.Tech.+M.Tech. Dual degree (CIVIL ENGINEERING)

(Effective from 2019-20 Admitted Batch)

III Year – I Semester

CE3101: STRUCTURAL ANALYSIS – II

Analysis of Statically Indeterminate Trusses (having not more than 7 members and 3 supports) containing (a) External Redundant Supports (b) Internal Redundant Members using (i) Method of Consistent Deformation of Unit Load Method (ii) Castigliano's Theorem – II.

Analysis of Three Span Continuous Beams using Kani's Method, Analysis of Statically Indeterminate Frames (Single Storey, Single Bay Portal Frames only) using (i) Slope-deflection method (ii) Moment Distribution Method (iii) Kani's Method.

Arches: Normal Thrust, Radial Shear and Bending Moment in Three Hinged and Two Hinged Parabolic and Segmental Arches. Effects of Rib-shortening and Temperature Change.

Suspension Bridges: Stresses in Loaded Cables with Supports at the Same and Different Levels. Length of Cable; Two and Three Hinged Stiffening Girders.

Introduction to Matrix Methods of Structural Analysis (Very elementary treatment only), Static Indeterminacy, Kinematic Indeterminacy, Stiffness and Flexibility Method for Two Span Continuous Beams only– Truss with 3 supports and 7 members.

Text books

1. Theory of Structures by S.Ramamrutham, R.Narayan, Dhanpat Rai, Publishing Company.

2. Theory of Structures by B.C.Punmia, Ashok K Jain, Arun K Jain, Laxmi Publications.

3. Mechanics of Structures Vol II by S.B.Junnarkar, H.J.Shah, Charotar Publishing House.

Reference Books

1. Statically Indeterminate Structures by C.K. Wang, McGraw-Hill.
2. Structural Analysis – A Matrix Approach by G.S. Pandit and S.P. Gupta, McGraw-Hill Education.
3. Indeterminate Structures by R.I. Jindal, S. Chand Publishers.

CE3102 : ENVIRONMENTAL ENGINEERING – II

Introduction to Sanitation – Systems of Sanitation – Relative Merits and Demerits – Collection and Conveyance of Wastewater – Sewerage – Classification of Sewerage Systems– Estimation of Sewage Flow and Storm Water Drainage – Fluctuations – Types of Sewers – Hydraulics of Sewers and Storm Drains – Design of Sewers – Materials for Sewers – Appurtenances in Sewerage – Cleaning and Ventilation of Sewers – Safety of Sewer Workers .

Storm Sewers – Design: Pumping of Wastewater – Pumping Stations – Location – Components Parts – Types of Pumps and their Suitability with regard to Wastewaters. House Plumbing: Plumbing Systems of Drainage – Sanitary Fittings and other Accessories – Single Stack System – One Pipe and Two Pipe Systems – Design of Building Drainage.

Bacteriology of Sewage: Sewage Characteristics – Physical, Chemical and Biological Examination – Decomposition – Cycles of Decomposition – Sampling and Analysis of Wastewater – BOD-COD –Treatment of Sewage – Primary Treatment: Screens–grit Chambers – Grease Traps – Flootation – Sedimentation – Design of Primary and Pretreatment Units.

Secondary Treatment: Aerobic and Anaerobic Treatment Process B–Comparison.

Suspended Growth Process: Activated Sludge Process, Principles, Designs and Operational Problems, Modifications of Activated Sludge Processes, Miscellaneous Methods, Oxidation Ponds, Oxidation Ditches, Aerated Lagoons.

Attached Growth Process: Trickling Filters – Mechanism of Impurities Removal – Classification – Filter Problems, Design and Recirculation. RBCs, Fluidized Bed Reactors, Sewage Disposal Methods.

Anaerobic Processes: Septic Tanks and Imhoff tanks – Principles and Design – Sludge Treatment and Disposal-Fundamentals of UASB. Biosolids (Sludge): Characteristics – Thickening – Digestion, Drying and Sludge Disposal.

Text Books

1. Wastewater Engineering Treatment and Reuse by Metcalf & Eddy, Tata McGraw-Hill edition.
2. Environmental Engineering by Peavy, H.S., Rowe, D.R., and Tchobanoglous, G. McGraw-Hill international edition

3. Environmental Engineering. II: Sewage Disposal and Air Pollution Engineering, Khanna Publishers.

Reference Books

1. Environmental Engineering –II: Sewage disposal and Air Pollution Engineering, by S.K.Garg, Khanna Publishers
2. Water Supply and Sanitary Engineering by G.S.Birdie and J.S.Birdie, Dhanpat Rai Publishing Company.
3. Water Supply Engineering by P.N.Modi, Standard Book House.
4. Water Supply Engineering by B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Laxmi Publications (P) Ltd.

CE3103 : REINFORCED CONCRETE STRUCTURES – I

(IS-456 code book is allowed for examination)

General: Loading Standards as per IS 875, Grades of Steel and Cement, Stress-Strain Characteristics of Concrete and Steel, Introduction to Working Stress Method and Limit State Method (L.S.D.) of Design.

Limit State of Collapse of in Flexure: Central Value measures, Measures of Distribution, Normal Distribution Curve. Introduction and Principles of L.S.D., Characteristic Load and Strengths, Design Values, Partial Safety Factors, Factored Loads.

Limit State of Collapse: Flexure of R.C.C. Beams of Rectangular section. Under Reinforced, Balanced and Over Reinforced Sections. Compression Stress Block, Estimation of Ultimate Moment by Strain Compatibility. Guide Lines for choosing Width, Depth and Percentage of Reinforcements in Beams. Analysis and Design of Singly Reinforced Rectangular Beams and Doubly Reinforced Beams, Design of Flanged Beams (T and L), Effective Flange Width, Basis of Analysis and Design, Minimum and Maximum Steel in Flanged Beams.

Design of One way and Two way Slabs: Simply Supported Slabs on all Four Sides, Moment in Two way Slabs with Corners held down. Choosing Slab Thickness. Design of Restrained Slabs (with Torsion at corners) I.S. Code Provisions. Detailing of Reinforcement.

Shear, Torsion and Bond: Limit State of Collapse in Shear, Types of Shear Failures. Truss Analogy, Shear Span/Depth Ratio. Calculation of Shear Stress, Types of Shear Reinforcement. General Procedure for Design of Beams for Shear. Enhanced Shear near Supports. Shear in Slabs, Steel detailing. Analysis for Torsional Moment in a Member. Torsional Shear Stress in Rectangular and Flanged Sections. Reinforcement for Torsion in RC Beams. Principles of Design for Combined Bending Shear and Torsion. Detailing of Torsion Reinforcement – Concept of Bond, Development Length, Anchorage, Bond, Flexural Bond.

Columns: Short and Long Columns, Minimum Eccentricity, Short Column under Axial Compression, Column with Helical and Tie Reinforcement.

Footings: Analysis and Design of Isolated Square and Rectangular Footings.

Text Books

1. Limit State of Design of Reinforced Concrete by P. C. Vergheese, Prentice Hall India Learning.
2. Reinforced Concrete Limit state Design by A.K. Jain, Nem Chand & Brothers.
3. R.C.C Design by Unnikrishna Pillai and Devadas Menon, McGraw-Hill

Reference Books

1. Limit State Design of Reinforced Concrete Structures by P. Dayaratnam, P.Sarah, Oxford and IBH Publishers.
2. Reinforced Concrete Structures by R.Park and T.Paulay, Wiley Publishers.

CE3104: STEEL STRUCTURES – I

Note: All the designs should be taught in the limit state design method as per IS 800-2007

Fundamental Concepts of Limit State Design of Structures, Different types of Rolled Steel Sections available to be used in Steel Structures. Stress – Strain relationship for Mild Steel

Bolted Connections: Behavior of Bolted Joints, Design Strength of Ordinary Black Bolts, High Strength Friction Grip Bolts, Simple Connections, Moment Resistant Connections

Welded Connections: Advantages of Welding, Types and Properties of Welds, Types of Joints, Weld Specifications Design of Welded Joints subjected to Axial Load, Eccentric Welded Connections

Tension Members: Types of Tension Members, Design of Strands, Slenderness Ratio, Displacement of Tension Members, Behavior of Tension Members, Modes of Failure, Factors affecting Strength of Tension Members, Angles under Tension, Design of Tension Members, Lug Angles, Splices

Compression Members: Possible Failure Modes, Classification of Cross-section, Behavior of Compression Members, Effective Length, Radius of Gyration and Slenderness of Compression Members, Allowable Stresses in Compression, Design of Axially Loaded Compression Members, Built up Compression Members, Laced and Battened Columns, Eccentrically Loaded Columns, Column Splices.

Beams: Beam Types, Section Classifications, Lateral Stability of Beams, Allowable Stress in Bending, Shear and Bearing Stresses, Effective Length of Compression Flange, Laterally Supported and Unsupported beams, Design of Built up Beams.

Roof Trusses: Types of Trusses, Economical Spacing of Roof Trusses, Loads on Roof Trusses, Estimation of Wind Load on Roof Trusses as per IS: 875. Design of Members of Roof Truss and Joints, Design of Purlins.

Column Bases and Foundations: Allowable Stress in Bearing, Slab Base, Gusset Base and Grillage Foundations. Introduction to Pre-engineered Structures, Concepts, Advantages and Disadvantages.

Text Books

1. Limit State Design of steel structures by S.K.Duggal, McGraw-Hill Education Private Ltd.
2. Design of steel structures by K.S.Sai Ram, Pearson Education India.
3. Limit State Design of steel structures by Ramchandra and Virendra Gehlot, Scientific Publishers (India).

Reference Books

1. Design of Steel structures by N. Subramanian, Oxford University Press.
2. Design of steel structures by Limit State Method as per IS: 800-2007 – S.S. Bhavikatti, IK International Publishing House.

PE-I: CE3105A : CONCRETE TECHNOLOGY

Chemical and Mineral Admixtures: Water Reducers, Air Entrainers, Set Controllers, Special Admixtures – Structure, Properties and effects on Concrete Properties. Introduction to Supplementary Cementing Materials and Pozzolans – Fly ash, Blast Furnace Slag, Silica Fume, and Metakaolin – their Production, Properties, and Effects on Concrete Properties; Other Mineral Additives – Reactive and Inert.

Dimensional Stability and Durability: Creep and Relaxation – Parameters Affecting; Shrinkage of Concrete – Types and Significance. Parameters affecting Shrinkage; Measurement of Creep and Shrinkage.

Durability of Concrete: Introduction to Durability; Relation between Durability and Permeability – Chemical Attack of Concrete; Corrosion of Steel Rebars; other Durability Issues.

Mix Design: Review of Methods and Philosophies of IS, BS and ACI Methods, Mix Design for Special Purposes. Acceptance Criteria for Compressive Strength of Concrete

Special Concretes: Properties and Applications of High Strength – High Performance Concrete, Reactive Powder Concrete, Lightweight,

Heavyweight and Mass Concrete; Fibre Reinforced Concrete; Self-compacting Concrete; Shotcrete.

Text Book

1. Concrete Technology Theory and Practice by M.S.Shetty, S.Chand & Company Ltd, New Delhi.

Reference Books

1. Properties of Concrete by A.M.Neville, Longman 1995.
2. Concrete micro-structure, Properties and Materials by P.K.Mehta, J.M.Monteiro, Printice Hall INC & McGraw-Hill, USA.

PE I: CE3105B: REMOTE SENSING AND GIS APPLICATIONS

Remote Sensing: Introduction, Basic Components of Remote Sensing, Electromagnetic Radiation, Electromagnetic Spectrum, Interaction with Atmosphere, Energy Interaction with the Earth Surfaces, Sensors – Types and Characteristics, Passive Sensor, Active Sensor, Platforms –Airborne Remote Sensing, Space Borne Remote Sensing, Data Pre-processing, Important Remote Sensing Programmes.

Geographic Information System: Introduction, Key Components, Spatial Data, Raster Data Models, Vector Data Models, Raster Versus Vector, Data Input Methods and Editing, Non-Spatial Data, Map Projections.

Image Analysis: Introduction, Elements of Visual Interpretations, Digital Image Processing – Digital Image Data Formats – Band Interleaved by pixel, Band Interleaved by line, Band Sequential, Image Preprocessing, Image Rectification, Image Enhancement, Image Classification, Supervised Classification, Unsupervised Classification.

GIS Analysis: Introduction, Digital Elevation Models, RS and GIS Data Integration, Overlay Function – Vector Overlay Operations, Raster Overlay Operations, Arithmetic Operators, Comparison and Logical Operators, Conditional Expressions, Overlay using a Decision Table, Some Neighbourhood Operations.

RS and GIS Applications in Civil Engineering: Land Cover and Land Use, Urban Applications, Hydrological Studies, Runoff Modeling, Flood Zone Delineation and Mapping, Groundwater Prospects and Recharge, Reservoir Storage Estimation, Water Management, Irrigation Planning, Drought Monitoring, Environmental Impact Assessment and other Watershed Studies.

Text Books

1. Remote Sensing and Image Interpretation by Thomas M. Lilles and Ralph W. Kiefer, John Wiley and Sons Inc.
2. Introduction to Geographical Information Systems by Kang-tsung Chang, TMH Publications & Co.

Reference Books

1. Fundamentals of Remote Sensing and its Applications by Dr George Joseph, Universities Press.

2. Concepts & Techniques of GIS by C.P. Lo Albert, K.W.Young, Prentice Hall (India) Publications.

3. Principles of Geographical Information Systems by Peter A. Burrough and Rachael A. Mc Donnell, Oxford Publishers.

PE-I: CE3105C : GEO-ENVIRONMENTAL ENGINEERING

Wastes: Source, Production and Classification of Wastes, Soil Pollution Processes, Waste Characterization, Physical Characterization, Problems due to Improper Disposal of Wastes, Waste Management Strategies.

Soil Pollution, Sources of Soil Pollution, Control of Soil Pollution.

Waste Disposal Facilities such as Landfills, Configuration or Types of Landfill, Components of Landfill, Layout of a Landfill Site, Stages of Decomposition of Waste in a Landfill, Landfill Planning and Design. Barrier Systems – Active Systems, Passive Systems, Vertical Barriers and their Types, Bottom Barriers, Reuse of Waste Materials, Contaminated Site Remediation.

Text Book

1. Geoenvironmental Engineering – Principles and Applications by Reddi, L. N., and Inyang, H. F., Marcel Dekker.

Reference Books

1. Geotechnical Practice for Waste Disposal by Daniel, D. E., Chapman and Hall, London.

2. Clay Barrier Systems for Waste Disposal Facilities by Rowe, R. K., Quigley, R. M. and Booker, J.R., E & FN Spon, London.

OP II: CE3106 : BUILDING SERVICES AND MAINTENANCE

Ventilation and Air conditioning: Ventilation–Necessity of Ventilation – Functional Requirements– Systems of Ventilation – Types – Natural Ventilation – Artificial Ventilation –Air Conditioning – Systems of Air Conditioning – Essentials of Air Conditioning systems –Protection against fire caused by Air Conditioning Systems.

Thermal Insulation: Heat Transfer – Thermal Insulating Materials – General Methods of Thermal Insulation – Economics of Thermal Insulation – Thermal Insulation of Exposed Walls, Doors, Windows and Roofs.

Fire Safety: Fire Hazards, Causes of Fire in Buildings, Fire Load – Safety Regulations –Characteristics of Fire Resisting Materials – General Fire Safety Requirements for Buildings –NBC – Planning Considerations in Buildings like Non-combustible Materials, Fire Resistant Construction, Staircases and Lift Lobbies, Fire Escapes and A.C. Systems – Building Types –Heat and Smoke Detectors – Fire Alarms, Snorkel Ladder – Fire

Fighting Pump and Water Storage –Dry and Wet Rises – Automatic Sprinklers.

Plumbing Services: Water Supply System –Fixing the Pipe in Building – Maintenance of Building Pipe Line – Water Meters – Sanitary Fittings – Principles Governing Design of Building Drainage – Gas Supply Systems.

Machineries in Buildings: Lifts – Definitions – Essential Requirements – Design Considerations – Maintenance Escalators – Essential Requirements, Pumps – Types of Pumps, Pumps for Household, Flats and Pumps for Dewatering

Electrical Installation in Buildings: Lighting for Office Buildings – School Buildings –Residential Buildings – Fannage – Air Conditioning/Heating – Reception and Distribution of Main Supply – Fittings and Accessories – Method of Internal Wiring – Earthing – Planning of Electrical Installations – Lightening Arrestors – Earthing

Anti–termite Treatment: Types of Termites, Internal and External Anti-termite Treatments – Pre-construction Treatment – Post-construction Treatment – Preventive Measures.

Text Books

1. Building Construction by B.C.Punmia, Er. Ashok K Jain, Arun K Jain, Laxmi Publications (P) Ltd., New Delhi.
2. Building Construction by Janardhan Jha, S K Sinha, Khanna Publishers.
3. Building construction by Rangwala, Charotar Publishibg House.

Reference Books

1. National Building Code, Bureau of Indian Standards.
2. Building Services Engineering by David V.Chadderton, Routledge
3. Building Construction by P.C.Varghese, Prentice Hall India Learning.

CE3107 : GEOTECHNICAL ENGINEERING LABORATORY – I

1. Determination of Specific Gravity of Coarse Grained and Fine Grained Soils
2. Determination of Atterberg Limits of Clay
3. Determination of Field Density by Core Cutter and Sand Replacement Methods
4. Determination of Grain Size Distribution of Coarse Grained Soil by Sieve Analysis
5. Determination of Grain Size Distribution of Fines Fraction of Soil by Hydrometer/pipette Analysis.
6. Determination of Coefficient Permeability of Coarse Grained Soil by Constant Head Permeability Test

7. Determination of Coefficient Permeability of Fine Grained Soil by Variable (Falling) Head Permeability Test

8. Determination of Compaction Characteristics of Soil by IS Light / Heavy Compaction Test.

Demonstration Experiments:

1. Rapid Moisture Meter Test for Quick Determination of Water Content
2. Determination of Water Content of Compacted Soil in Field by Proctor's Plasticity Needle

Reference Books

1. Relevant IS Codes of Practice

CE3108 : ENVIRONMENTAL ENGINEERING LABORATORY

1. Determination of p^H and Conductivity of a given water and wastewater sample
2. Measurement of Turbidity using Nephelometric Turbid meter and Determination of optimum coagulant dosage (Jar Test).
3. Determination of Hardness in a given water sample
4. Estimation of Acidity of a water sample
5. Estimation of Alkalinity of a waste and wastewater sample
3. Determination of Available Chlorine in a given Bleaching power sample and residual Chlorine in a water sample
4. Estimation of Fluorides in a given water sample.
5. Estimation Iron in a water sample
6. Estimation of Total Solids: Settleable Solids: Suspended solids, dissolved solids.
7. Measurement of D.O. by volumetric analysis
8. Estimate the B. O. D. of a wastewater sample.
9. Estimate the C. O. D. of a wastewater sample.
10. Estimation of Chlorides in a water sample
11. Estimation of Nitrates in a given sample

Text Books

1. Environmental Engineering Laboratory Manual by Kotaiah, B. and Kumara Swamy, N. Charotar Pub. House.
2. Chemical Analysis of Water and Soil: A laboratory Manual by Muralikrishan K.V.S.G., Envir. Prot. Society.

III Year – II Semester

CE3201 : ESTIMATION, SPECIFICATIONS AND CONTRACTS

Introduction: Standard Units, Units of Measurement of Different items of Work. Meaning of Estimate, Tender, Contract, Price Escalation. Errors in Estimation, Different types of Estimates. Contingencies and Related Terms in the Estimate, Different types of Approvals. Plinth Area and Related Terms used in the Estimation of various Structures, Rules and Methods of Measurements of different Works.

Specifications: Meaning, Purpose, types of Specifications, Method of preparation of Specification, General Specification, Detailed Specifications of different items of Buildings and other Structures – Rate Analysis – Data Sheet for Materials and various items of work in Buildings and other Structures, Schedule of Rates, Abstract Estimate of Buildings.

Detailed Estimate of Buildings. Different items of work in Building; Principles of taking out Quantities, Detailed Measurement Form; Long Walls and Short Walls method of Building Estimate, Centre Line Method of Building Estimate. Estimate of RCC Building, Slope Roof Buildings; G.I. and A.C. Sheet, Detailed Estimate of different types of Doors and Windows, Electricity and Water Supply, Sanitation Works etc.

Estimate of Earthwork; Different Formulae for Calculations, Estimate of Metalled Road, Tar Road, Concrete Road, Railway Track, Estimate of Culverts and Bridges etc. Valuation of Buildings; Purpose, Different Method of Building Valuation; Different Terms used in Valuation and their Meaning.

Text Books

1. Estimating and Costing in Civil Engineering by B.N. Dutta, Sangam Books.
2. Textbook of estimating and costing by G.S. Birdie, Dhanpat Rai Publishing Company Private Limited.

Reference Books

1. Estimation, Costing, Specifications and Valuation in Civil Engineering by M.Chakraborti.
2. Textbook on Estimating, Costing and Accounts by D.D. Kohli and R.C. Kohli, S Chand & Company Pvt. Ltd.

CE3202 : FLUID MECHANICS – II

Navier-Stokes Equations (No Derivation), Boundary Layer Theory: Theory of Boundary Layer – Characteristics of Laminar Boundary Layer – Boundary Layer growth over a Flat Plate (without pressure gradient) – Boundary Layer Thickness and its Characteristics – Displacement, Momentum and Energy Thicknesses; Stability Parameter; Laminar and Turbulent boundary layers.

Boundary Layer Separation – Mechanism of Separation, Control of B.L. Separation; Boundary Layer on Rough Surfaces – Laminar Sublayer, Shear Friction Velocity; Friction Drag.

Turbulent Flow: Critical Reynolds Number – Characteristics of Turbulent Flow – Mean and Fluctuating Components of Velocity. Analysis of Turbulent Flows – Shear Stress due to Turbulence – Velocity distribution for Hydrodynamically Smooth and Rough Pipes; Variation of Friction Factor in Turbulent Flow; Friction Factor for Commercial Pipes – Moody diagram.

Flow through Pipes: Introduction to Pipe Flow and Laws of Friction – Reynolds Experiment; Steady Turbulent Flow through Pipes; Laws of Friction; Darcy-Weisbach Equation.

Total Energy and Hydraulic Gradient – Energy and Hydraulic Gradient Lines; Minor Losses in Pipes; Pipes in Series and Parallel – Equivalent Length of Pipe.

Flow Between Two Reservoirs; Three Reservoir Problems; Distribution Mains; Working Pressures, Design Pressure And Test Procedures; Choice Of Pipe Material; Siphon; Pipe Network Analysis By Hardy-Cross Method; Hydraulic Power Transmission Through Pipes And Nozzles, Water Hammer (Only Concept).

Drag, Lift & Propulsion: Concepts of Drag and Pressure Distribution over Immersed Bodies – Drag and Lift – Deformation Drag, Friction Drag, Form Drag – Drag coefficient.

Distribution of Fluid Pressure on Immersed Bodies – Pressure Distribution for Flow Past a Circular Disk, Sphere; Effects of Eddy Pattern in Two Dimensional Flow – Distribution of Pressure for Two Dimensional Flow Past a Cylinder – von Kármán Vortex Trail, Eddy Shedding; Drag of Immersed Bodies – Variation of Drag Coefficient with Reynolds Number – Drag on Cylinder – Resistance Diagram for Bodies of Revolution; Drag Coefficient of Practical Bodies.

Lift and Propulsion – Effect of Circulation in Irrotational Flow, Generation of Lift around a Cylinder, Magnus Effect.

Open Channel Flows: Basic Concepts – Introduction, Classification of Open Channels – Classification of Flow; Channel Geometry – Geometric Elements of a Channel Section; Velocity Distribution in a Channel Section; Wide Open Channel; Measurement of Velocity; Velocity Distribution Coefficients; Pressure Distribution in a Channel Section – Effect of Slope on Pressure Distribution; Basic Equations – Chezy's Equation, Manning's Equation.

Uniform Flow Computation; Conveyance of a Channel Section – Section Factor and Hydraulic Exponent. Flow Characteristics in a Closed Conduit with Open Channel Flow; Determination of Normal Depth and Velocity; Design of Channels for Uniform Flow; Design of Non-erodible

Channels; Best Hydraulic Section; Determination of Section Dimensions for Uniform Flow; Most Economical Channel Sections – Rectangular, Trapezoidal, Circular and Triangular Channel Sections; Critical Flow – Computation of Critical Flow, Section Factor for Critical Flow.

Application of Energy Principle in Open channels – Definition of Specific Energy, Specific Energy Diagram, Critical depth, Critical Velocity, Conjugate or Alternate Depths, Sub-critical, Critical and Super-critical Flows, Froude Number, Relationship between Critical depth and Specific Energy for Rectangular, Trapezoidal Sections; Application of Momentum Principle in Open channels – Specific Force; Canal Transitions – Change of Depth in Channels with Change in Cross-section and Hump in the Bed; Control Sections; Venturi Flume and Parshall Flume.

Varied Flow in Open Channels: Analysis & computation of G.V.F. Definition of G.V.F. and Derivation of Governing Equation – Mild, Steep, Critical, Horizontal and Adverse Slopes – Backwater and Drawdown Curves – G.V.F. Profiles for Channels with Changing Slopes; Computation of G.V.F. Profiles – Method of Direct Integration (Procedures only), Direct Step Method – Computation of G.V.F. Profiles in rectangular channels using Direct and Single Step methods (Simple Slope cases only). Rapidly Varied Flow – Hydraulic Jump, Types of Jumps, Hydraulic Jump in Horizontal Rectangular Channels; Surges.

Text Books

1. Fluid Mechanics and Hydraulic Machinery by P.N.Modi and S.M. Seth, Standard Book House.
2. Flow in Open Channels by K.Subramanya, Tata McGraw-Hill Publishing Co. Ltd.

Reference Books

1. Fluid Mechanics by A.K.Jain, Khanna Publishers.
2. Engineering Fluid Mechanics by K.L.Kumar, S. Chand & Co. Ltd.
3. Flow through Open Channels by K.G.Ranga Raju, Tata McGraw-Hill Publishing Co.Ltd.
4. Open Channel Hydraulics by V.T.Chow, McGraw-Hill Ltd.

CE3203 : REINFORCED CONCRETE STRUCTURES – II

Retaining Walls: Types of Retaining Walls, Forces on Retaining Walls, Rankine and Coloumb Earth Pressure Theories (c and f soils). Passive Earth Pressure, Drainage of Retaining Walls. Stability Requirements. Preliminary Proportioning of Cantilever Retaining Walls. Design of Cantilever and Counterfort Retaining Walls.

Water Tanks: Stress in Concrete and Steel in Water Tanks, Modular Ratio, Impermeability Requirements, Tanks resting on Ground and below Ground of Circular and Rectangular shapes; Elevated Circular and

Rectangular Tanks resting on Maximum of 8 Columns; Design of Staging of Rectangular tanks.

Bridges: Components of a Bridge in Sub Structure and Super Structure. Classification of Bridges. Highway Loading Standards, Kerbs, Footpaths, Railings, Parapet Loadings, Impact, Wind, Longitudinal Forces.

Design of Solid Slabs, Design of T-beam Bridge Deck Slab, Longitudinal and Cross Beams (Design any one component for exam), Courbon's Theory.

Piles and Pile Caps: Design of Bored Cast-in-situ Piles (Bearing and Friction types), Under Reamed Piles. Pile Caps Design; Bending and Truss Methods.

Prestressed Concrete – Reinforced Concrete versus Prestressed Concrete – Prestressing Systems (Freyssinet, Gifford Udal, Magnel-Blatten) – Prestressing Losses – Steel and Concrete for Prestressing – Homogeneous Beam Concept, Limiting Eccentricities, Pressure Line, Elastic Stress Distribution across the Depth due to D.L., Eccentric Prestress and L.L.

Text Books

1. Reinforced Concrete structures Limit State by B. C. Punmia, Laxmi Publications.
2. Design of Reinforced Concrete Structures by M.L.Gambhir, PHI Publications
3. R.C.C Design by Unnikrishna Pillai and Devadas Menon, McGraw-Hill

Reference Books

1. Limit State of Design of Reinforced Concrete by P. C. Vergheese, Prentice Hall India Learning.
2. Reinforced Concrete Limit state Design by P. Dayaratnam and P.Sarah, Oxford and IBH Publishers.
3. Reinforced Concrete Structures by N.Subramanyan, Oxford University Press.

CE 3204 : TRANSPORTATION ENGINEERING

Highway Engineering-1: Highway Development and Planning, Classification of Roads, Highway Alignment, Highway Geometrics – Design of Cross-Sectional Elements, Sight Distance, Horizontal and Vertical Alignment.

Highway Engineering-2: Traffic Engineering – Traffic Characteristics, Traffic Studies (Surveys), Traffic Control Devices – Design of Intersections. Design of Pavements – Design Factors, Design of Flexible Pavements – Group Index Method, CBR Methods, Design of Rigid Pavements –

Westergaard Equations, I.R.C. Recommendations for Design of Concrete Roads.

Highway Engineering-3: Construction of Roads – Earthen Roads – W.B.M. Roads – Bitumen Roads – Cement Concrete Roads – Highway Materials and their Properties and Tests. Maintenance of all types of Roads – Highway Drainage.

Railway Engineering-1: Historical Development of Railways in India – Advantages of Railways – Classification of Indian Railways – Permanent Way – Components and their Functions – Rail Joints – Creep of Rails – Rail Fixtures and Fastenings.

Railway Engineering-2: Track Geometric Design–Track Drainage

Text Books

1. Highway Engineering by S.K. Khanna, C.E.G. Justo and A. Veeraragavan, Nem Chand

2. Railway Engineering by S.C. Saxena and S. Arora, Dhanpat Rai Publications Pvt. Ltd.

Reference Books

1. Principle and Practice of Highway Engineering by R.C.Sharma and S.K.Sharma, Asia Publishing House.

2. Transportation Engineering by L.R. Kadiyali, Khanna Publications.

3. *Principles of Transportation Engineering* by Partha Chakraborty, PHI Learning.

CE3205 : WATER RESOURCES ENGINEERING – I

Introduction to Hydrological Aspects: Water Resources in India, Hydrology in Water Resources Planning – Hydrologic Planning –Water Budget Equation;

Climate and Weather – Importance of Monsoon Rains, Clouds, Storms and Precipitation – Precipitation – Types, Measurement of Rainfall; Influence and Feedbacks of Hydrological Changes Due to Climate Change; Average Depth of Rainfall over an Area, Mean Annual Rainfall, Analysis of Rainfall Data – Consistency of Rainfall Record, Double Mass Curve, Depth – Intensity, Depth-Area-Duration Curves, Frequency of Point Rainfall – Intensity-Duration-Frequency (IDF) Curves, Probable Maximum Precipitation (PMP) Curves; Infiltration – Factors affecting and its Determination, Infiltrometers; Evaporation and Evapo-Transpiration – Pan Evaporation; Runoff – Factors Affecting Runoff, Methods of Determination of Runoff, Hydrograph Analysis, Base Flow Separation, Unit Hydrographs, Hydrograph of Different Durations, Applications of Unit Hydrograph; S-Hydrograph, Synthetic Unit Hydrograph; Stream Flow Measurement – Gauge Discharge Curves.

Groundwater Flow: Mechanics of Interstitial Flow, Definitions, Subsurface Distribution of Water, Ground Water Movement; Darcy's Law; Permeability – Intrinsic Permeability; Well Hydraulics – Steady Flow in Different Types of Aquifers and Wells; Determination of Hydraulic Properties of Aquifer; Well Losses; Specific Capacity of Well; Well Efficiency – Pumping Tests – Recuperation Test Method for Determination of Well Yield.

Rain Water Harvesting and Recharging of Underground Storage – Methods of Recharging – Infiltration Galleries, Infiltration Wells, Springs.

Methods of Construction of Open Well–Yield of an Open Well – Methods of Construction of Tube Wells, Well Shrouding and Well Development, Spacing of Tube Wells, Design of Tube Well; Pumping Requirements, Centrifugal and Bore Hole Type Pumps; Collector Wells.

Reservoir Planning and Flood Routing: Types of Reservoir – Investigations for Reservoir Planning, Selection of Site for a Reservoir, Zones of Storage in a Reservoir; Purpose of Reservoir, Design Studies, Reservoir Regulation, Reservoir Yield, Mass Curve and Demand Curve, Determination of Reservoir Capacity, Yield From a Reservoir of given Capacity; Operating Schedules – Rule Curve for Reservoir Operation; Economics of Water Resources Projects – Apportionment of Total Cost of a Multi Purpose Project, Benefit – Cost Ratio; Reservoir Losses – Measures To Reduce Evaporation Loss in Reservoirs Sedimentation, Control of Reservoir Sedimentation. Flood Routing – Hydrologic Reservoir Routing by Puls Method of Routing, Channel Routing by Muskingum Method.

Irrigation: Definition of Irrigation, Types of Irrigation Systems – Direct and Indirect, Lift and Inundation Irrigation Systems, Methods of Irrigation – Surface and Sprinkler Methods, Trickle or Drip Irrigation, Soil Moisture Constants, Depth of Water Held By Soil In Different Zones, Water Extraction – Quality of Irrigation Water, Irrigation Efficiencies – Soil Moisture – Irrigation Relationship – Estimating Depth and Frequency of Irrigation on the Basis of Soil Moisture Regime Concept; Water Requirements of Crops, Duty, Delta and Base Period – Their Relationship, Crops – Seasons, Factors Affecting Duty and Methods of Improving Duty, Consumptive Use of Water – Determination of Evapotranspiration – Blaney-Criddle and Penman Equations and Hargreaves Method; Determination of Canal Capacities for Cropping Patterns, Size of Reservoir, Assessment of Irrigation Water Charges.

Canal Systems: Classification of Irrigation Canals – Canal Alignment, Design of Unlined Canals, Regime Theories – Kennedy's and Lacey's Theories, Critical Tractive Force Method, Design Problems – Balancing Depth – L.S. of a Channel – Design According to I.S: 7112, 1975; Schedule of Area Statistics, Cross Section of an Irrigation Channel – Maintenance of Irrigation Channel. Regulation of Channel System – Canal Outlets, Requirements of a Good Outlet – Types of Outlets; Water Logging – Causes

and Control – Land Drainage; Canal Lining – Methods, Design of Lined Canals, Canal Navigation – Requirements, Methods to make Navigability Feasible.

Text Books

1. Irrigation and Water Power Engineering by B.C.Punmia and P.B.B. Lal, Laxmi Publications Pvt. Ltd.
2. Irrigation and Water Resources & Water Power by P.N.Modi, Standard Book House.

Reference Books

1. Irrigation and Hydraulic Structures by S.K.Garg, Khanna Publishers.
2. Engineering Hydrology by K.Subramanya, Tata McGraw-Hill Education Private Limited.
3. Hand Book of Applied Hydrology by V.T.Chow, McGraw-Hill Book Co.
4. Impacts of Climate Change and Climate Variability on Hydrological Regimes by Jan C. van Dam, Cambridge University Press.
5. Hydrology: Principles, Analysis and Design by H.M.Raghunath, New Age International.
6. Ground Water by H.M.Raghunath, New Age International.

PE-II: CE3206A : STEEL STRUCTURES – II

Note: All the designs should be taught in the limit state design method as per IS 800-2007.

Plate Girders (Bolted and Welded): Components of a Plate Girder, Economical Depth, Proportioning of Web and Flanges, Shear Buckling resistance of Web by Simple Post Critical and Tension Field Methods, Curtailment of Flange Plates, Connection of Flange Angles to Web and Flange Angles to Flange Plates.

Web Stiffeners: Design of Bearing Stiffeners. End Panel Design, Design of Intermediate Stiffeners, Connections.

Bridges: Classification, Loadings, Deck type Plate Girder Bridges.

Bearings: Types of Bearings, Plate Bearing, Rocker Bearing, Roller Bearing, Knuckle Pin Bearing.

Water Tanks: Introduction, Design of Elevated Circular and Rectangular Water Tanks.

Plastic Analysis: Introduction, Upper and Lower Bound Theorems, Uniqueness Theorem, Shape Factor, Load Factor; Beams: Collapse Load for Fixed and Continuous Beams, Design of Beams; Frames: Collapse Load for a Frame of Single Bay Single Storey Frame.

Text Books

1. Limit State Design of steel structures by S.K.Duggal, McGraw-Hill Education Private Ltd.

2. Design of steel structures by K.S.Sai Ram, Pearson Education India.

3. Limit State Design of steel structures by Ramchandra and Virendra Gehlot, Scientific Publishers (India)

Reference Books

1. Design of Steel structures by N. Subramanian, Oxford University Press.

PE II: CE3206B : GROUND IMPROVEMENT TECHNIQUES

In-situ Densification Methods in Granular Soils: Introduction of Vibration at the Ground Surface, Impact at the Ground Surface, Vibration at Depth, Impact at Depth.

In-situ Densification Methods in Cohesive Soils: Introduction, Preconsolidation Preloading using Sand Drains, Sand Wicks, Geodrains/Band drains, Forced Vacuum Preconsolidation, Stone and Lime Columns, Thermal Methods.

Grouting: Objectives, Suspension, Emulsion and Solution Grouts, Categories of Grouting, Grouting Equipment, Stage Grouting in Soils by Tube-a-Manchette, Ascending and Descending Stage Grouting, Hydrofracture, Grout Control

Reinforced Earth: Principles, Components of Reinforced Earth – Fill, Reinforcing Material and Facing, Evaluation of Interfacial Friction of Fill and Reinforcing Material, Applications of Reinforced Earth, Design Principles of Reinforced Earth Walls

Geotextiles: Introduction, Types of Geotextiles; Functions and their Application, Tests for Geotextiles

Soil Stabilization: Objectives, Methods of Stabilisation, Mechanical Stabilization: Proportioning of Materials by Rothfutch's Method, Factors affecting Mechanical Stabilization, Cement and Lime Stabilization: Mechanisms, Engineering Benefits, Factors affecting Cement and Lime Stabilization, Construction Techniques, Bituminous Stabilization: Types of Soil – Bitumen, Factors affecting Bituminous Stabilization of Soils, Construction Methods.

Deep Mixing of Soils with Lime/Cement: Lime-soil Columns, Soil-Cement Columns, Construction Methods, Applications.

Stone Columns: Introduction, Construction Methods – Vibroflotation Technique and Rammed Stone Column, Functions and limitations.

Text Book

1. Ground Improvement Techniques, P.Purushothama Raj, Lakshmi Publications (P) Ltd.

Reference Books

1. Engineering Principles of Ground Modification, Monfred R Hausmann, Mc Graw-Hill Publishing Co.
2. Highway Engineering, Khanna S.K. and Justo C.E., Nem chand Publications.

PE II: CE3206C : IRRIGATION ENGINEERING

Development of Irrigation: Water Resources of India – Importance of Irrigation in Agriculture – Historical Evolution of Irrigation In India – Irrigation Development During Pre-Colonization – Colonization and Post-Colonization – National Water Policy – Inadequacy of Irrigation Management – Criteria for Good Irrigation Management.

Soil Water Plant Relationship: Soil Physical Properties Influencing Soil – Water Relationship–Forms and Occurrence of Soil Water – Classification of Soil Water – Soil Water Constants – Energy Concept of Soil Water – Forces acting on Soil Water – Soil Water Potential Concept – Soil Water Retention – Soil Moisture Measurement.

Crop Water Requirement: Water Requirement of Crops– Evapotranspiration and Consumptive Use – Methods of Estimating Evapotranspiration – Effective Rainfall – Irrigation Requirement–Duty of Water – Irrigation Efficiencies – Irrigation Scheduling – Irrigation Measurement.

Surface Irrigation Methods: Canal Network and Canal Design – Surface Irrigation Methods – Types – Border Irrigation, Furrow Irrigation and Strip Irrigation– Specifications, Hydraulics and Design. Drip and Sprinkler Irrigation Method: Sprinkler and Drip – History and Development, Types, Components, Design and Layout, Performance Evaluation, Operation and Maintenance.

Drainage Principles and Criteria: Factors to be considered in Land Drainage – Combined Irrigation and Drainage Systems – Water Balance – Equations for Water Balance – Drainage Surveys – Agricultural Drainage Criteria – Effect of Field Drainage Systems on Agriculture.

Irrigation Water Quality: Water Quality for Irrigation – Salinity and Permeability Problem – Root Zone Salinity – Irrigation Practices for Poor Quality Water – Saline Water Irrigation – Future Strategies

Text Books

1. Irrigation Engineering by G.L. Asawa, New Age International Publishers.
2. Irrigation and Water Power Engineering by B.C.Punmia and Pande B.B. Lal, Laxmi Publishing.
3. Irrigation Theory and Practices by A.M.Michael, A.M, Vikas Publishing Pvt Ltd,

4. Irrigation Engineering by Gupta, B.L, and Amir Gupta, Satya Praheshan.
- #### Reference Books

1. Irrigation Water Management (Principles & Practices) by Dilip Kumar Majumdar, Prentice Hall of India (P), Ltd
2. Irrigation Engineering by N,N,Basak, Tata McGraw-Hill Publishing Co. Ltd.
3. Irrigation Engineering by R.K.Sharma, S. Chand & Company Pvt. Ltd.

CE3207 : HIGHWAY MATERIAL LABORATORY

Testing of Aggregates: Specific gravity – Sieve Analysis – Shape test – Flakiness Index – Elongation Index – Angularity Number – Aggregate Crushing value – Impact Value – Abrasion value – Stripping Value and Soundness.

Testing of Bituminous Material: Specific Gravity – Penetration Value – Viscosity Value – Softening Point – Ductility Value – Flash and Fire Point.

Testing on Soils: C.B.R. Test (IS 2720 – Part-XVI) – N.D.C. Penetration Test (IS 2720 Part-XXXII) – Group Index.

Testing on Bituminous Mixes: Bitumen Extraction Test, Marshal Stability Test (Demonstration)

Reference Book

1. Highway material testing by S.K. Khanna, C.E.G. Justo and A. Veeraragavan, Nem Chand & Brothers

CE3208 : CONCRETE LABORATORY

- 1) Determination of Specific Gravity and Unit Weight of Cement
- 2) Determination of Specific Gravity and Unit Weight of Coarse and Fine Aggregates
- 3) Determination of Normal Consistency of Cement
- 4) Determination of Initial and Final Setting Time
- 5) Determination of Fineness of Cement.
- 6) Determination of Compressive Strength of Cement (for different grades of cement).
- 7) Determination of Bulking Characteristics of Sand.
- 8) Sieve Analysis of Coarse and Fine Aggregates and Classification as per IS 383.
- 9) Workability Tests on Green Concrete by using: Slump Cone, Compaction Factor Apparatus, Flow Table, Vee-Bee Consistometer.
- 10) Tests on Hardened Concrete.
 - a. Determination of Compressive Strength
 - b. Determination of Split tensile strength

c. Determination of Modulus of rupture

11) Design of Concrete Mix by using IS Code Method (for class work only)

CE3209 : COMPUTER APPLICATIONS IN CIVIL ENGINEERING LABORATORY

Determination of Shear Force, Bending Moment, Deflection for Different Loading Conditions for a Simply Supported Beam and Cantilever Beam. Determination of Fixed End Moments for Different Loading Conditions of a Fixed Beam. Analysis and Design of Singly and Doubly Reinforced Beams. Analysis and Design of Columns, Footings.

Estimation of Runoff for a Catchment. Estimation of Friction Factor for Laminar and Turbulent Flows, Minor Losses in Pipe Flow. Conversion of Angles from WCB to RB.

Classification of Soils Determination of Coefficient of Permeability, Degree of Consolidation and Shear Strength.

Computation of Water Surface Profiles in Open Channel Flows. Estimation of Settlement of Foundations in Cohesive soil, Stability Analysis of Slopes. Estimation of Earth Pressure in Cohesive and Cohesionless Soils.

Basic AUTO CAD Commands Application of Drafting Tools and Modifying Tools Creation of 3 Dimensional Solids. Application of STAAD Pro/ETABS for the Analysis and Design of various Structural Components of Civil Engineering and Building Frames.

Text Books

1. Computer aided design-Software and Analytical tools by C.S. Krishnamoorthy and S. Rajesh, Alpha Science
2. Computer Aided Design in Reinforced Concrete, V.L.Shah, Standard publishers distributors

IV Year – I Semester

CE4101: GEOTECHNICAL ENGINEERING – II

Subsoil Exploration: Objectives, Methods of Subsoil Exploration Direct, Semi direct and Indirect Methods, Soundings by Standard, Dynamic Cone and Static Cone Penetration Tests, Types of Boring, Types of Samples, Criteria for Undisturbed Samples, Transport and Preservation of Samples, Borelogs, Planning of Exploration Programmes, Report Writing.

Bearing Capacity: Safe Bearing Capacity and Allowable Bearing Pressure, General and Local Shear Failures, Terzaghi's Bearing Capacity Equations its modifications for Square, Rectangular and Circular Foundations, Factors affecting Bearing Capacity of Soil, Effect of Water Table on Bearing Capacity, IS Code Method for Bearing Capacity of

Footings, Allowable Bearing Pressure based on N-values. Bearing Capacity from Plate Load Tests.

Shallow Foundations: Factors effecting locations of Foundation and Design considerations of Shallow Foundations, Types of Shallow Foundations and Choice of Type of Foundations, Foundations on Expansive Soils.

Settlement Analysis: Types of Settlement, Causes of Settlement, Computation of Settlement of Footings in Saturated Clay and Granular Soils, Allowable Settlement. Measures to Reduce Settlement.

Pile Foundations: Classification, Load carrying capacity of Pile – Dynamic Formula, Static Formula, Pile Load Tests; Efficiency of Pile Group, Load Carrying Capacity and Settlement of Pile Groups in Cohesive and Cohesionless soils, Negative Skin Friction, Under Reamed Pile.

Caissons: Types of Caissons, Pneumatic Caissons, Different Shapes of Well Foundations, Relative Advantages and Disadvantages, Different Components of Well and their Functions, Bearing Capacity of Well Foundation, Grip Length, Problems in Well Sinking and Remedial Measures.

Stability Analysis of Slopes: Infinite and Finite Slopes, Stability Analysis of Infinite Slopes, Different Factors of Safety, Types of Slope Failures – Toe, Slope and Base Failure, Stability Analysis of Finite slopes – Swedish Circle Method, Friction Circle Method, Fellenius Method for Location of Critical Slip Circle, Taylor's Stability Number.

Earth Pressure: Types of Earth Pressure, Rankine's Active and Passive Earth Pressure on Smooth Vertical Wall with Horizontal and Inclined Backfills. Coulomb's Wedge Theory, Culmann's and Rebhann's Graphical Methods for Active Earth Pressure of Cohesionless Backfills, Stability Analysis of Retaining Walls. Bulkheads: Classification, Analysis of Cantilever Sheet Piles in Sand and Saturated Clay, Analysis of Anchored Bulkhead by Free Earth Support Method in Granular Soil.

Text Books

1. Basic and Applied Soil Mechanics by Gopal Ranjan and A.S.R. Rao, New Age International Publishers
2. Soil Mechanics and Foundation Engineering by K.R. Arora, Standard Publishers.

Reference Books

1. Foundation Engineering by P.C. Varghese, Prentice Hall of India
2. Foundation Analysis and Design by J. E. Bowles, Mc Graw-Hill Publishing Co.

CE4102 : FLUID MECHANICS – III

Dimensional Analysis and Similitude: Fundamental Concepts of Dimensional Analysis – Importance of Dimensional Analysis & Model Study;

Units and Dimensional Formulae for Various Engineering Quantities; Fourier Concept of Dimensional Homogeneity.

Methods of Arriving at Dimensionless Groups – Non-dimensional Parameters; Rayleigh's Method; Buckingham π method – Buckingham modified method; Omitted and Superfluous variables.

Examples in Dimensional Analysis – Capillary Rise, Drag on Cylinder, Resistance of a Ship, Discharge over a Sharp Crested Weir, Fall Velocity of a Sphere, Head Characteristics of a Pump, Thrust on a Propeller,

Similarity and Similarity Laws – Concepts of Similarity – Geometric, Kinematic and Dynamic Similarities; Modeling Criteria; Similarity Laws – Important Dimensionless Numbers – Reynolds Number, Froude Number, Mach Number, Euler Number, Weber Number.

Application of Similarity Laws to Practical Problems – Bodies Completely Submerged in Fluids, Bodies Subjected to Gravity and Viscous Forces, River Models – Manning's Law; Distorted Models – Depth Distortion and Slope Distortion; Problems Related to Modeling of Spillways, Ships, Pumps and Turbines.

Impact of Jets: Force Exerted by Fluid Jet on Stationary and Moving Flat and Curved Vanes, Torque and Work Done by Series of Moving Vanes.

Hydraulic Machines– Turbines: Introduction and Classification of Turbines – Function of Prime Movers and Pumps, Hydraulic Turbines, Classification Based on Head, Discharge, Hydraulic Action – Impulse and Reaction Turbines, Differences Between Impulse and Reaction Turbines; Choice of Type of Turbine – Specific Speed.

Working of Impulse Turbines and Design Principles – Components and Working Principles of A Pelton Turbine – Work Done; Hydraulic and overall Efficiencies; Design of Pelton Turbine – Working Proportions; Governing Mechanism for a Pelton Turbine.

Working of Reaction Turbines and Design Principles – Components and Working Principles of a Francis Turbine – Work Done; Hydraulic and overall Efficiencies; Design of Francis Turbine – Working Proportions; Governing Mechanism for a Francis Turbine. Draft Tube Theory – Functions and Types of Draft Tubes in Reaction Turbines, Efficiency of Draft Tube; Kaplan Turbine and Working Proportions of Kaplan Turbine.

Performance and Characteristics of Turbines: Unit Quantities, Specific Speed and its Importance; Model Relationships; Operating Characteristic Curves; Cavitation Problem in Turbines – Thoma's Cavitation Factor.

Hydraulic Machines – Centrifugal Pumps Functions of a Pump – Types of Pumps – Selection Criterion – Rotodynamic and Positive Displacement Pumps – Comparison between Centrifugal & Reciprocating Pumps.

Centrifugal Pumps – Components & Working principles of Centrifugal Pumps; Classification of Centrifugal Pumps – Impellers based on Shape and

Type of Casing, Pump with Volute Casing, Pump with Vortex Chamber & Pump with Guide vanes, Closed, Semi-closed & Open Impellers, Axial, Radial & Mixed Flow Impellers; Working Head and Number of Stages, Single & Double Suction. Work done by Centrifugal Pumps – Pressure Change in a Pump, Manometric and Static Head – Velocity triangles – Effect of Vane Shape; Pump Losses and Efficiency – Pressure Rise in the Impeller – Minimum Starting Speed of pump – Multistage Pumps; Pumps in Parallel and Series; Cavitation – Limitation of Suction Lift, NPSH and its importance in Selection of Pumps. Performance Characteristics of Pumps – Similarity Relations and Specific speed of Pumps – Dimensionless characteristics – Constant Efficiency Curves of Centrifugal Pumps.

Hydraulic Machines – Reciprocating Pump & Hydraulic Ram: Reciprocating Pumps – Fundamental concepts, Component Parts and Working principle of Single Acting and Double Acting Reciprocating Pumps – Discharge Coefficient, Volumetric Efficiency and Slip; Work done by Reciprocating pumps – Work Done and Power Input – Indicator Diagram – Effect of Acceleration and Friction on Indicator Diagram – Maximum Speed of Rotation of Crank; Air Vessels and their principles – Modified Indicator Diagram in the presence of Air Vessels, Work Saved due to Presence of Air Vessel, Flow into and from Air Vessel.

Hydraulic Ram – Working Principle of Hydraulic Ram.

Text Books

1. Fluid Mechanics and Hydraulic Machinery by P.N.Modi and S.M. Seth, Standard Book House.
2. Fluid Mechanics by Jain, A.K., Khanna Publishers.

Reference Books

1. Engineering Fluid Mechanics by K.L.Kumar, S. Chand & Co. Ltd.
2. Hydraulic Machines by Jagadish Lal, Metropolitan Book Company.

CE4103 : WATER RESOURCES ENGINEERING – II

Storage Works: Classification of Dams, Factors Governing Selection of Types of Dam, Selection of Site, Preliminary Investigation.

Gravity Dams: Forces acting on a Gravity Dam, Stability Criteria, Modes of Failure – Elementary and Practical Profiles, Stability Analysis, Principal and Shear Stress – Construction Joints, Openings in Dams – Galleries, Foundation Treatment of Gravity Dam.

Earth Dams: Types, Foundation for Earth Dams, Design of Earth Dams, Causes for Failure of Earth Dams, Criteria for Safe Design, Phreatic Line, Seepage Analysis – Seepage Control Through Body and Foundation.

Spillways: Essential Requirements, Spillway Capacity, Components, Types of Spillways and Their Working, Design of Ogee Spillway, Energy Dissipation Below Spill Way, Scour Protection, Use of Hydraulic Jump as

Energy Dissipater – Design of Stilling Basins – USBR and IS Standard Basins; Spillway Crest Gates – Different Types.

Diversion Head Works: Types, Location and Components, Effects of Construction of Weirs on Permeable Foundation, Bligh's, Lanes and Khosla's Theories, Method of Independent Variables, Design Principles of Weirs and Barrages, Design of Weirs on Permeable Foundations, Design of Vertical Drop Weir, Silt Control Devices.

Regulation Works: Canal Falls – Definition, Necessity and Location, Classification of Falls, Design Principles of Syphon Well Drop, Notch Fall, Sarada Fall, Straight Glacis Fall; Offtake Alignment; Cross Regulator and Distributary Head Regulator – Design of Cross Regulator and Distributor Head Regulator.

Cross Drainage Works: Types, Factors Affecting the Suitability of Each Types, Classification of Aqueducts, Design Principles of Different Types of Aqueducts.

River Training Works: River Training and its Objectives, Classification of River Training Works, Marginal Embankment, Guide Banks, Groynes, Cutoffs, Bank Pitching, Launching Aprons, Miscellaneous Types of River Training Works.

Water Power Engineering: Development of Hydro Power in India, Assessment of Available Power, Utilisation Factor, Load Factor, Diversity Factor, Storage and Pondage; Types of Hydro Power Schemes; Components of Hydel Schemes – Fore Bay, Intake Structure, Trash Racks, Surge Tanks; Water Hammer Pressure, Substructure and Superstructure of Power House.

Text Books

1. Irrigation and Water Power Engineering by Punmia, B.C. and P.B.B. Lal, Laxmi Publications Pvt. Ltd.
2. Irrigation Water Resources and Water Power Engineering by Modi, P.N., Standard Book House.
3. Irrigation and Hydraulic Structures by Garg, S.K., Khanna Publishers.

Reference Book

1. Hand book of Applied Hydrology, Chow, V.T., McGraw-Hill Book Co.

CE4104 : CONSTRUCTION MANAGEMENT

Bar Charts, Milestone Charts, Weaknesses in Bar Charts

PERT and CPM: Introduction, Event, Activity, Dummy Activities, Rules for Drawing Networks, Numbering the Events (Fulkerson's Law)

Time Estimates and Evaluation of Critical Path – Optimistic Time, Most Likely Time, Pessimistic Time, Expected Time, Earliest Allowable

Occurrence Time, Latest Allowable Occurrence Time, Slack, Project Duration, Probability of Completion, Start and Finish Time Estimates, Floats, Project Scheduling, Critical and Sub-Critical Paths.

Cost-Time Optimization: Direct and Indirect Costs, Normal and Crash Costs and Times, Crashing of The Activity, Optimization of Project Cost.

Updating and Resource Allocation – Process of Updating, Updating Cycle, Updated Networks, Resource Histograms, Resource Smoothing, Resource Leveling.

Works Management and Contracts – Department Execution of Works, Master Roll Form 21, Piece Work Agreement Form, Work Order, Definition of Contract, Element of Contract, Valid Contract, Notice Inviting Tender, Tender Forms, Bidding Process, Earnest Money, Security Deposit, Award of Contract, Types of Contracts – Lumpsum Contract, Item Rate Contract, Cost Plus Percentage Contract, Special Contracts, Disputes, Claim Settlement Through Arbitration.

Management – Significance of Construction Management, Concept of Scientific Management, Qualities of Manager, Organization – Authority, Policy, Recruitment Process and Training Development of Personnel.

Labour Problems, Labour Legislation in India, Workmen Compensation Act 1923, and Subsequent Amendments, Minimum Wages Act 1948.

Text books

1. PERT and CPM Principles and Applications by L. S. Srinath, Affiliated East-West press Pvt. Ltd.
2. Estimating and Costing in Civil Engineering (Theory & Practice) by B.N.Dutta UBS Publishers Distributors Pvt. Ltd; 28th Revised Edition.

Reference Books

1. Project Planning and Control with PERT and CPM by B.C. Punmia, Laxmi Publications.
2. Construction Management and Planning by H.Guha and Sen Gupta, Tata McGraw – Hill Publishing Co. Ltd.

PE-III: CE4105A : PRESTRESSED CONCRETE STRUCTURES

Introduction, Basic Concepts of Prestressing, Need for High Strength Steel and Concrete, Advantages of Prestressed Concrete; Materials for Prestressed Concrete, High Strength Concrete and High Strength Steel. Prestressing Systems (1) Freyssinet System (2) Gifford Udall (3) Magnel-Blatan System, Tensioning Devices, Anchoring Devices. (D) Pretensioning and Post Tensioning

Prestressing Losses, Elastic Shortening, Loss due to Shrinkage, Loss due to Creep, Loss due to Friction, Loss due to Curvature etc.; I.S. Code Provisions

Analysis of Prestressed Members, Assumptions, Pressure or Thrust Line; Concept of Load Balancing, Cable Profile, Kern Distance, Stress in Tendons as Per IS 1343, Cracking Moment.

Deflection of Prestressed Concrete Beams

Limit State Design of Flexural Members, Stresses, I.S. Code Provisions, Design of Symmetrical Beams, Design of Prestressed Concrete Poles, Design for Shear, I.S. Code Provisions.

Transfer of Prestress (Pretensioned Members), Transmission Length, Bond Stress, Transverse Tensile Stress, End Zone Reinforcement, Flexural Bond Stress, I.S. Code Provisions.

Anchorage Zone in Post Tensioned Members, Stress Distribution in End Block, Guyon's Method of Approach of Analysis of End Block (not more than 2 Cables).

Text Book

1. Prestressed Concrete by N.Krishna Raju., Tata McGraw-Hill Education

Reference Books

1. Prestressed Concrete by N.Rajagopalan, Alpha Science International.

2. Prestressed Concrete by P. Dayaratnam, Oxford and IBH Publishers.

3. *Design of Prestressed Concrete Structures* by T.Y. Lin and Ned. H. Burns, Wiley India.

PE III: CE4105B : ELEMENTS OF COASTAL ENGINEERING

Introduction, General Design Considerations for Coastal Engineering. Long Period Waves: Tides, Seiches, Tsunamis, Storm Surge and Wind Set Up.

Solutions of Linear Wave Equation for Progressive and Standing Waves – Pressure Velocity Fields – Surface Profile and Dispersion Relationship – Principle of Super Position – Wave Energy, Energy Flux and Energy Principle – Group Velocity.

Wave Mechanics. Celerity and Group Velocity. Wind Generated Waves. Wave Statistics. Wave Transformation: Shoaling, Refraction, Diffraction and Reflection. Wave Breaking Criteria. Wave Forecasting for Deepwater Waves.

Beach Profiles and Surf Zone Wave Breaking. Sediment Transport.

Impacts of Coastal Structures on Shoreline Changes. Seawalls, Breakwaters, Groins, Jetties, Wharves.

Wave Forces on Walls. Design of Breakwaters: Rubble Mound-Type, Wall-Type, Structural Cross-Section.

Wave Forces on Piles – Basic Assumptions – Values of the Inertia and Drag Coefficients and Their Dependence on the Wave Theory used.

Text Books

1. Water Wave Mechanics for Engineers and Scientists by R.G.Dean and R.A.Darbymple, World Scientific Publishers.

2. *Coastal Hydrodynamics* by J.S.Mani. PHI Publishers 2nd Edition.

Reference Books

1. Basic Coastal Engineering by R.M.Sorensen, 3rd Edition, Springer.

2. Coastal Engineering Manual (CEM). US Army Coastal Engineering Research Center, 2002-2006. (Download from CECIL or USACE website).

PE III: CE4105C : INTRODUCTION TO ROCK MECHANICS

Introduction: Geological Formation of Rocks, Structural Geology, Classification of Rocks, Defects in Rock, Physical, Mechanical Properties of Rocks, Exploration Techniques – RQD and RMR, Laboratory Tests for Shear Strength, Tensile Strength, Flexural Strength, Elastic Constants, Field Tests – Test for Deformability, Shear Tests and Strength Tests

Improvement Techniques for Rock: Grouting, Rock Bolting, Rock Reinforcement - Mechanism, Types of Reinforcement, Steps Involved in Installation, Foundations on Rock, Rock Blasting– Explosives, Selection Criteria for Explosives, Steps Involved in Blasting

Text book

1. Rock Mechanics for Engineers by B.P.Verma, Khanna Publishers

Reference Books

1. Rock Characterization, Testing and Monitoring by E.T.Brown, Pergamon Press, London, U.K

2. Rock Mechanics on the Design of Structures in Rock by Oberti and Duval, W. L. John Wiley & Sons.

3. Rock Mass Classification Systems – A Practical Approach in Civil Engineering by B.Singh and R.K.Goel, Elsevier Publisher.

PE III: CE4105D : SOLID WASTE MANAGEMENT

Introduction: Definition of Solid Waste, Garbage, Rubbish–Sources and Types of Solid Wastes. Characteristics of Solid Wastes: Physical, Chemical and Biological Characteristics– Problems due to Improper Disposal of Solid Waste.

Solid Waste Management: Definition– Reduction, Reuse, Recycling and Recovery Principles of Waste Management – Functional Elements of Solid Waste Management – Waste Generation and Handling at Source – Collection of Solid Wastes – Collection Methods and Services– Guidelines for Collection Route Layout.

Transfer and Transport of Wastes: Transfer Station – Processing and Segregation of the Solid Waste – Various Methods of Material Segregation.

Processing and Transformation of Solid Wastes: Composting: Definition–Methods of Composting – Advantages of Composting – Incineration: Definition – Methods of Incineration–Advantages and Disadvantages of Incineration.

Disposal of Solid Waste: Volume Reduction, Open Dumping, Land Filling Techniques. Landfills: Classification–Design and Operation of Landfills, Land Farming, Deep Well Injection.

Text Books

1. Integrated Solid Waste Management: Engineering Principles and Management Issues by George Tchobanoglous, Hilary Theisen, Samuel A Vigil. McGraw-Hill Series in Water Resources and Environmental Engineering.

2. Environmental Engineering by Howard S. Peavy, Donald R. Rowe and George Tchobanoglous.

PE-IV: CE4106A : ENVIRONMENTAL IMPACT ASSESMENT

Concept of Environment – Definition of EIA and EIS – Elements of EIA – Guidelines for the Preparation of EIS – Governmental Policies for Environmental Protection.

Environmental Setting – Environmental Attributes – Air, Water, Soil, Noise, Ecological, Social, Economical, Cultural, Human and Aesthetic Aspects – Environmental Indices.

Methodology for the Identification of Impacts – Criteria for the Selection of Methods – Methodologies – Adhoc, Checklist, Overlaying, Matrix and Network Methods.

Prediction and Assessment of Impacts on – Air, Water, Soil, Noise, Ecological, Social, Economical, Cultural, Human Environments and Aesthetic Aspects.

Review of Environmental Impact Statement – Cost Benefit Analysis – Measures for Environmental Impact Mitigation and Control – Case Studies.

Text Books

1. *Environmental Impact Assessment* by Larry W. Canter. McGraw-Hill Co.

2. *Environmental Impact Assessment Methodologies* by Y Anjaneyulu, and Valli Manikkam,, BSP Books PVT Ltd.

Reference Book

1. Environmental Impact Assessment by R.K. Jain, L.V. Urban, G.S. Stacey and H.E. Balbach, McGraw-Hill Co.

PE-IV: CE4106B : EARTH RETAINING STRUCTURES

Earth Pressure: Basic Concepts, Rankine and Coulomb Earth Pressure Theories, Determination of Active and Passive Pressures: Culmann's Graphical Method, Logarithmic Spiral Methods, Friction Circle Method. Consideration of Surcharge, Seepage, Earthquake, Wave Effect, Stratification, Type of Backfill, Wall Friction and Adhesion.

Retaining Structures: Uses, Types, Stability and Design Principles of Retaining Walls, Backfill Drainage, Settlement and Tilting. Sheet Pile Walls: Types, Design of Cantilever Sheet Pile Walls in Granular and Cohesive Soils; Design of Anchored Sheet Pile Walls by Free and Fixed Earth Support Methods, Rowe's Theory of Moment Reduction, Design of Anchors. Braced Excavations: Types of Sheet piling and Bracing Systems, Lateral Earth Pressure on Sheet piling in Sand and Clay, Design Components of Braced Cuts. Cellular Cofferdams: Types – Diaphragm and Circular Type, Design by TVA Method. Stability of Cellular Cofferdams, Cellular Cofferdams in Rocks and Soils.

Text Book

1. Foundation design by W. C. Teng, Prentice Hall

Reference Books

1. Basic and Applied Soil Mechanics by Gopal Rajan and A.S.R. Rao, New Age International Publishers.

2. Soil Mechanics in Engineering Practice by K. Terzaghi and R.B. Peck, John Wiley & Sons.

3. Foundation Analysis and Design by J. E. Bowles, McGraw-Hill Publishing Co.

PE-IV: CE4106C AIRPORT PLANNING AND DESIGN

Air Transport: History of Air Transport, Structure and Organisation of Air Transport, National Airports Authority, Airports Authority of India, International Civil Aviation Organisation. Airport Characteristics: Requirements of Aircraft Types, Weight Components, Aeroplane Component Parts, Classification of Flying Activity, Aircraft Characteristics.

Airport Planning: Airport Master Plan, Regional Planning, Airport Site Selection, Estimation of Future Air-Traffic Needs. Airport Obstructions: Zoning Laws, Classification Of Obstructions.

Runway Design: Runway Orientation, Basic Runway Length, Corrections, Airport Classification, Runway Geometry Design. Airport Capacity and Configuration, Runway Intersection Design,

Taxiway Design: Geometric Design Standards, Exit Taxiways, Holding Aprons.

Terminal Area and Airport Layout: Building Area, Terminal Area, Apron, Hangar, Typical Airport Layouts. Visual Aids: Airport Marking, Airport Lighting

Air Traffic Control: Need of Air Traffic Control Air Traffic Control Network, Air Traffic Control Aids – Enroute Aids and Landing Aids, Instrumental Landing System

Text Book

1. Airport Planning and Design by S.K. Khanna, M.G. Arora, S.S. Jain, Nem-Chand and Bro.

Reference Book

1. Airport Engineering by Rangwala, Charotar Publications.

PE IV: CE4106D : FINITE ELEMENT METHOD OF ANALYSIS

Matrix Methods of Analysis – Introduction, Analysis of Beams and Portal Frames (One Bay, One Storey Two Bay, Two Storey) by Stiffness Method and Flexibility Method.

Introduction: A Brief History of F.E.M, Need of the Method, Applications of FEM, Review of Basic Principles of Solid Mechanics, Basic Equation in Elasticity Equations of Equilibrium, Constitutive Relationship, Concept of Plane Stress, Plain Strain, Concept of Axi-Symmetric Elements. Concept of Energy Principles and Methods.

Basic Theory Relating to the Formulation of the Finite Element Method, Element Shapes, Nodes, Nodal Degree of Freedom, Node Numbering, Coordinate System (Local and Global), Convergence Requirements, Compatibility Requirement, Geometric Invariance.

Finite Element Analysis of Single Bar Element (One-Dimensional Problem) – Shape Functions, Derivation of Stiffness Matrix, Stress-Strain Relations – All with Reference to Bar Element and Trusses under Axial Forces.

Text Books

1. Structural Analysis – A Matrix Approach by G.S.Pandit and S.P.Gupta, Tata McGraw-Hill Publishing Co. Ltd.

2. Introduction to the Finite Element Method by C.S.Desai and J.F.Abel, Van Nostrand.

3. Finite Element Analysis by C.S.Krishnamoorthy, Tata McGraw-Hill Publishing Co. Ltd.

Reference Books

1. Introduction to Finite Elements in Engineering by Tirupathi R. Chandrupatla, Ashok D.Belegundu, Prentice-Hall of India Private Limited.

2. Finite Element Analysis by S.S.Bhavikatti, New Age International Publishers.

3. Basic Structural Analysis by C.S. Reddy, Tata McGraw-Hill, New Delhi.

4. Finite Element Methods for Engineers by Reger, T. Fenner, The Macmillan Ltd., London.

CE4107 : GEOTECHNICAL ENGINEERING LABORATORY – II

1. Field identification and Classification of Soils

2. Determination of Relative Density of Sand

3. Determination of Unconfined Compressive Strength of Clay

4. Determination of Shear Parameters of Soil by Direct Shear Test

5. Determination of Undrained Shear Parameters of Soil by Triaxial Compression Test

6. Determination of Undrained Shear Strength and Cohesion of Soft Clay by Vane Shear Test

7. Determination of Differential Free Swell and Swell Pressure of Clay

8. Determination of Coefficient of Consolidation of Clay by Taylor and Casagrande Methods of Time Fitting Demonstration experiments

1. Standard Penetration Test

2. Determination of Compression Index of Clay by Oedometer Test

Reference Books

1. Relevant IS Codes of Practice

CE4108 : FLUID MECHANICS LABORATORY– II

1) Study of Characteristics of a hydraulic jump – To measure and draw $(E_1 - E_2)/E_1$ vs F_1 and L_j / y_2 vs F_1 , and compare with theoretical results wherever possible.

2) Study of Rugosity Coefficients in an Open Channel Flow.

3) Study of Major Losses in Pipes – Pipe Friction – To Compute Darcy-Weisbach Friction Factor.

4) Study of Drag Characteristics of a Circular Cylinder with its Axis Normal to the Direction of Flow.

To measure the Pressure Distribution on the Surface of a Cylinder and Plot the Dimensionless Pressure Variation around the Cylinder and Compute the Pressure Drag.

To measure the Velocity Variation in the Wake of the Cylinder, Velocity of Approach, and Compute the Total Drag by Momentum Principle.

5) Study of Performance Characteristics of a Centrifugal Pump – To Measure the Discharge, Head Developed and Power Input at Various Discharges for Centrifugal Pump and Draw the Performance Characteristics.

6) Study of Performance Characteristics of a Reciprocating Pump – To Measure the Discharge, Head Developed and Power Input at Various

Discharges for Reciprocating Pump and Calculate Percentage Slip and Efficiency.

7) Study of Performance Characteristics of a Pelton Turbine – To Measure the Discharge, Head Difference across the Turbine, the Brake load, Speed of Turbine for Various Discharges and Draw the Performance Characteristics.

8) Study of Performance Characteristics of a Francis Turbine – To Measure the Discharge, Head difference across the Turbine, the Brake Load, Speed of Turbine for Various Discharges and Draw the Performance Characteristics.

9) Study of Impact of a Jet on Flat and Curved Vanes.

IV Year IInd Semester (CE 4201 Project Work)

Proposed Scheme of Instruction and Examination

B.Tech (NAVAL ARCHITECTURE AND MARINE ENGINEERING)

Effective Admitted Batch 2019-20

III / IV First semester

Code No Credits	Subject	Periods			Exam Hours	Sessionals Marks	Exam Marks	Total
		L	T	P				
NAM 3101	Industrial Electronics (OEC)	3	1	—	3	30	70	100
NAM 3102	Fluid Mechanics	3	1	—	3	30	70	100
NAM 3103	Ship Design - I	3	1	—	3	30	70	100
NAM 3104	Ship Construction	3	1	—	3	30	70	100
NAM 3105	Resistance & Propulsion	3	1	—	3	30	70	100
NAM 3106	(PEC-I) a) FEA b) Computer Graphicsc) MPPE	3	1	—	3	30	70	100
NAM 3107	Marine Thermal Lab	-	-	3	3	50	50	100
NAM 3108	Ship Drawing - III	—	—	3	3	50	50	100
TOTAL		30			24	280	520	800

III / IV Second semester

Code No Credits	Subject	Periods			Exam Hours	Sessionals Marks	Exam Marks	Total
		L	T	P				
NAM 3201	Strength of Ships	3	1	—	3	30	70	100
NAM 3202	Marine Hydrodynamics	3	1	—	3	30	70	100
NAM 3203	Ship Design - II	3	1	—	3	30	70	100

NAM 3204	PEC - II a. Marine RAC b. Intro to Offshore structures c. Ocean Structures & matls	3	1	—	3	30	70	100
NAM 3205	Marine Manufacturing Technology	3	1	—	3	30	70	100
NAM 3206	CASD	3	1	—	3	30	70	100
NAM 3207	PEC-III: a. Dynamics of Offshore structures b. Marine Diesel Engines c. Underwater Acoustics	3	1	—	3	30	70	100
NAM 3208	Marine Instrumentation and Metrology lab	—	—	3	3	50	50	100
NAM 3209	CASD Lab	—	—	3	3	50	50	100
NAM 3210	Mandatory Course (MC): Indian Constitution/Essence of Indian Traditional Knowledge	-	-	-	-	-	-	-
0								
TOTAL		34			27	310	590	900

IV / IV First semester

Code No Credits	Subject	Periods			Exam Hours	Sessionals Marks	Exam Marks	Total
		L	T	P				
NAM 4101	Sea Keeping and Maneuverability	3	1	—	3	30	70	100
NAM 4102	Ship Structural Design and Vibrations	3	1	—	3	30	70	100
NAM 4103	PEC - IVa. FVTb. Design of Small craftsc. Naval Vessels	3	1	—	3	30	70	100
NAM 4104	Marine Instrumentation and Control	3	1	—	3	30	70	100
NAM 4105	Managerial Economics	3	1	—	3	30	70	100
NAM 4106	PEC - Va. Advanced Welding Technology							
	b. Advanced Ship Systems	3	1	—	3	30	70	100
	c. Marine Pollution							
NAM 4107	Ship Hydrodynamics Laboratory				3	50	50	100
TOTAL		27			21	230	470	700

IV / IV Second semester

21.5

Code No Credits	Subject	Periods	Exam	Sessionals	Exam	Total	
		L T P	Hours	Marks	Marks		
NAM 4201	Project	— — 28	—	50	50	100	13
TOTAL		28	6	50	50	100	13

Total Credits: 160

Year	I Semester	II Semester	Total
First	19	19.5	38.5
Second	21	21	42.0
Third	21	24	45.0
Fourth	21.5	13	34.5
Total Credits			160.0

III / IV First semester

Code No Credits	Subject	Periods	Exam	Sessionals	Exam	Total	
		L T P	Hours	Marks	Marks		
NAM 3101	Industrial Electronics (OEC)	3 1 —	3	30	70	100	3
NAM 3102	Fluid Mechanics	3 1 —	3	30	70	100	3
NAM 3103	Ship Design - I	3 1 —	3	30	70	100	3
NAM 3104	Ship Construction	3 1 —	3	30	70	100	3
NAM 3105	Resistance & Propulsion	3 1 —	3	30	70	100	3
NAM 3106	(PEC-I) a) FEA b) Computer Graphics c) MPPE	3 1 —	3	30	70	100	3
NAM 3107	Marine Thermal Lab	- - 3	3	50	50	100	1.5
NAM 3108	Ship Drawing - III	— — 3	3	50	50	100	1.5
TOTAL		30	24	280	520	800	21

III / IV Second semester

Code No Credits	Subject	Periods	Exam	Sessionals	Exam	Total	
		L T P	Hours	Marks	Marks		
NAM 3201	Strength of Ships	3 1 —	3	30	70	100	3
NAM 3202	Marine Hydrodynamics	3 1 —	3	30	70	100	3
NAM 3203	Ship Design - II	3 1 —	3	30	70	100	3
NAM 3204	PEC - IIa. Marine RAC b. Intro to Offshore structures c. Ocean Structures and mats	3 1 —	3	30	70	100	3

NAM 3205	Marine Manufacturing Technology	3 1 —	3	30	70	100	3
NAM 3206	CASD	3 1 —	3	30	70	100	3
NAM 3207	PEC-III: a. Dynamics of Offshore structures b. Marine Diesel Engines c. Underwater Acoustics	3 1 —	3	30	70	100	3
NAM 3208	Marine Instrumentation and Metrology lab	— — 3	3	50	50	100	1.5
NAM 3209	CASD Lab	— — 3	3	50	50	100	1.5
NAM 3210	Mandatory Course (MC): Indian Constitution /Essence of Indian Traditional Knowledge	- - -	-	-	-	-	0
TOTAL		34	27	310	590	900	24

B.Tech. III / IV - Naval Architecture and Marine Engineering (I-SEMESTER)

NAM 3101 - Industrial Electronics (OEC)

Periods/week : 4 Ses. : 30 Exam : 70

Examination Theory: 3hrs. Credits: 3

1. Devices: Semi-conductor diode, Zenor diode - Transistor - Silicon control rectifier. Rectifiers, Amplifiers, Oscillators, Cathode ray oscilloscope.

2. Industrial Applications: Poly-phase rectifiers - Control circuits - Motor speed control voltage control, Time delay relay circuits - Photo electric circuits. Resistance welding, Inducting heating - Dielectric heating.

3. Servomechanism: Open loop and closed loop systems (Elementary treatment only).

4. Introduction to Digital Electronics: Fundamentals of digital electronics, Number system and codes, Logic gates, Boolean algebra, Arithmetic - logic units, Flip-flops, Registers and counters, Memories: ROM, PROM, EPROM and RAM.

5. Introduction to Microprocessors: The Intel-8085 microprocessor; Architecture, Instruction set, Execution of instructions, Addressing structures, Timing and machine cycles of 8085 and programming I/O operations, Interrupts, Serial input and serial output, Programming the I/O ports, Programming the timer.

Text Books:

1. Industrial Electronics by Mithal (Khanna Publications).

2. Digital Computer Electronics - An Introduction to Micro Computer by Albert Paul Malvino, Tata McGraw-Hill Publishing Co. Ltd., New Delhi-2.

References:

1. Engineering Electronics by Ryder-McGraw Hill.
2. Micro Processors by Leventhal.
3. Industrial Electronics by Bhattacharya, Tata Mc-Graw Hill.
4. Industrial Electronics and Control by S.K. Bhattacharya and S. Chatarjee, 1995 Ed., Tata Mc-Graw Hill Pub. Co. Ltd.

NAM 3102 Fluid Mechanics

Periods/week : 4

Ses. : 30 Exam : 70

Examination Theory: 3hrs.

Credits: 3

1. Basic Concepts and properties of fluids – pressure and its measurement – hydrostatic forces on surfaces .

2. Fluid kinematics: Description of fluid motion – Lagrangian method – Eulerian Method. Types of fluid flow-steady and unsteady flows-uniform and non-uniform flows-one, two and three dimensional flows-rotational and irrotational flows-laminar and turbulent flows-compressible and incompressible flows.

Types of flow lines-path line-stream line -stream tube- streak line – Rate of flow or discharge. Continuity equation. Continuity equation in Cartesian co-ordinates. Equation of continuity in polar co-ordinates. Circulation and vorticity. Velocity potential and stream function-velocity potential-stream function-relation between stream function and velocity potential. Flow nets-methods of drawing the flow nets-uses and limitations of flow nets

3. Fluid Dynamics:- Equations of Motion-Euler's Equation of Motion-Bernoulli's Equation from Euler's Equation-Application Bernoulli's Equation-Venturimeter , orifice meter and pitot-tube-the momentum Equation-Moment of Momentum equation-Free liquid jets.

4. Laminar and turbulent flow, and flow through pipes: Introduction, Reynolds experiment, flow of viscous fluid through circular pipes and between two parallel plates-loss of head due to friction in viscous flow-turbulent flow-frictional losses in pipe flow – expression for the loss of head due to friction in pipes and coefficient of friction in terms of shear stress- J Boussinesq expression for shear stress in turbulent flow- Reynolds's shear stress and Prandtl mixing length theory for turbulent shear stress-velocity distribution in turbulent flow in pipes-Hydro dynamically smooth and rough boundaries-velocity distribution for turbulent flow for smooth and rough pipes-loss of energy in pipes-All major and minor losses-loss of head energy due to friction –Hydrostatic gradient line(H.G.L) and Total energy line(T.E.L)-Flow through pipes in series, compound pipes, parallel pipes and branched pipes-Power transmission through pipes-Flow through nozzles-water hammer in pipes

5. Dimensional and Model Analysis: Dimensional Homogeneity – Methods of Dimensional Analysis – Rayleigh's Method- δ -Theorem – Model Analysis – Similitude-Types of similarities – Dimensionless Numbers – Reynolds's numbers etc...- Model laws of similarity laws – model testing of partially submerged bodies.

6. Boundary Layer Flow: Laminar Boundary Layer- turbulent layer and Laminar sub-layer – Boundary layer thickness (δ) – displacement thickness (δ^*) and momentum thickness – energy thickness (δ^{**}) - Drag force on a flat plate due to boundary layer-Turbulent Boundary layer on a flat plate – analysis of turbulent boundary layer – total drag on a flat plate due to laminar and turbulent boundary layer – separation of boundary layer.

7. Forces on Submerged Bodies : Force exerted by a flowing fluid on a stationary body – Expression for Drag and lift – dimensional analysis of drag and lift- Drag on a sphere – terminal velocity of a body – Development of lift on a circular cylinder – Magnus effect – Development of lift on an airfoil

8. Compressible flow – thermodynamic Relations – Basic equations of compressible flow – Velocity of sound or Pressure wave in a fluid etc..- Mach number- stagnation properties - Area velocity relationship for compressible flow – flow of compressible fluid through orifices and nozzles fitted to a large tank – Rate of flow is equal to sonic velocity and pitot-static tube in a compressible flow

Text Books:

1. Fluid Mechanics and Hydraulic Machines, by R.K. Bansal, Laxmi publications.
2. Fluid Mechanics and Hydraulic Machines by R.K. Rajput, s. Chand & Co.

References:

1. foundations of fluid Mechanics, by Yuan, prentice Hall of India
2. Fluid Mechanics and its applications, by S.K. Gupta and A.K. Gupta, Tata McGraw Hill, New Delhi
3. fluid Mechanics, by A.K. Mohanty, Prentice Hall of India Pvt .Ltd

NAM 3103 Ship Design – I

Periods/week : 4

Ses. : 30

Exam : 70

Examination Theory: 3hrs.

Credits: 3

1. General Considerations and Introduction to Ship Design Methods: Marketing, manufacturing and operational considerations in Ship design. Technological, economic and sociological factors and national priorities. Ship design as a science and as an art. Owner's requirements, shipyard production facilities and operational constraints to be considered in the design process. Introduction to ship design method using basic ship or parent ship types, ship design as an iterative process and stages of ship

design. The design spiral, design ship categories such as dead weight carriers, capacity carriers, and linear dimension ships. Displacement and volume estimation. Dead weight-displacement ratio, components of dead weight and displacement, determination of main dimensions and form coefficients, use of computers in ship design process.

2. Estimation Of Weight And Volume Components, Design Of Hull Form And Determination Of Stability And Other Criteria: Weight and capacity equations and their use in ship design. Use of cubic equation. Calculation of weight and volume components using parent ship data or other compiled data. Calculation of steel, wood, outfit and machinery weights, using formulas. Estimation of dead weight components, design of hull form from first principles. Sectional area curve. Design of load water line, sections, stem and stern profiles, other water lines and development of the lines plan., determination of position of the LCB. Preliminary estimation of power and propeller diameter. Preliminary check for rudder area. Use of series data such as BSRA series and Taylor's series. Calculation of stability, free board, trim capacity and tonnage. Stowage factors. Volume required for cargo fuel fresh water and Ballast.

3. Determination of Engine Power and Selection of Main and Auxiliary Machinery: Calculation of engine power. Relation between resistance and engine power. Criteria for selection of main propulsion plant. Types of main propulsion plants and fuels-their advantages and disadvantages. Different types of power transmission and shafting systems used in ships. Selection of propeller. Propeller types and number and estimation of main propeller parameters, such as diameter, rpm, number of blades, blade area ratio etc. Determination of location, area and volume of engine room. Estimation of size of engine casing. Estimation of electrical power requirement in the ship and deck area and volume required for installation of generators and main switchboard. Functions of various other auxiliary machinery such as boilers, cargo pumps, fuel and lube oil pumps, separators, cooling systems etc.

4. Cargo Systems and Cargo Handling Gear: Introduction to various types of cargo systems and cargo handling gear used on board ships such as cranes, derricks, Sampson posts, pumping systems etc. Properties and requirements for carriage of different types of cargo. General cargo carriers, light and heavy bulk cargo carriers and ore carriers. Unitised cargo- pallets, containers, barges, etc. and specialised ships for their carriage. Wheeled cargoes. RO-RO ships and ferries. Liquid cargoes-oil tankers liquefied gas carriers and chemical tankers. Selection of cargo handling gear-arrangements for general, bulk, unitised and liquid cargoes. Piping arrangement for tankers.

5. Important Design Features of Various Types of Ships and other Considerations: General cargo carriers, container ships, oil tankers, passenger vessels, bulk carriers, fishing trawlers, tugs, dredgers, barges, ferries. Different types of hull forms, propulsion systems, main and auxiliary

machinery, cargo handling systems and operational requirements suitable of the above mentioned ships. Other consideration in ship design such as water tight integrity, damage stability, manoeuvring and sea keeping criteria, propulsive efficiency, minimisation of hull vibrations, compartments and super structure design in different types of ships. Trimming calculations in various operating considerations. Ballasting arrangements and estimation of total ballast.

Reference Books:

1. Ship Design and Construction by R.Taggart
2. Basic Ship Theory, Vol.1 & 2 by K.J.Rawson and E.C.Tupper
3. Principles of Naval Architecture, Vol. 1,2&3 byEd.V. Lewis

NAM 3104 : Ship Construction

Periods/week : 4	Ses. : 30	Exam : 70
Examination Theory: 3hrs.		Credits: 3

Introduction to ship building and materials used: A typical ship construction program. Building berth. Building Dock. Multi-stage construction methods. Equipment used in building berths. Use of Goliath cranes. Floating Docks. Ship types. Shipyard layout. Classification societies, development and application of classification rules, role of statutory bodies. Materials for ship construction. Structural steels, special steels, non-ferrous steels, non-metallic materials, material properties and testing of materials. Joining methods of materials, non-destructive testing.

Storage and preparation of material and structural elements: Material handling and storage, transport system in steel stockyard, material preparation devices- cleaning, marking processes. The cutting process, Mechanical cutting, thermal cutting, optically and numerically controlled cutting, bending of rolled and built-up sections, plate bending. Nesting of plates.

Fabrication of sub assemblies, units and hull erection: Process of prefabrication, welding in prefabrication and erection stages, sub-assemblies, flat sections, panels- flat and curved, double bottom sections, side tank units, fore-end and aft-end structures, deck and bulkhead structures. Assembly of hull-units. Erection of hull-units on building berth/dock.

Ship structural components: Functions and details of ship structural components, framing systems, single and double bottom construction, shell and deck plating, bulkheads, pillars, girders and hatch-coaming, machinery casings, super structures and deck-houses. Bow and stern Structures. Bossing and struts, bilge keels and fenders.

Out Fitting, Welding, Testing And Trials And Launching: Various components of outfitting, consisting of systems, equipment and fittings of hull, machinery and electrical groups. Hull Preservation methods. Various outfitting methods. Advanced outfitting. Methods of welding, metallurgy of welding weld defects, distortion and stresses in welds, testing of welds. Inspection and testing during various stages of ship construction. Testing of structures and tanks. Bollard tests and sea trials. Details of launching arrangements.

References:

1. Merchant Ship Construction by D. A. Taylor
2. Ship Construction by D.J. Eyres
3. Ship Design and Construction by R. Taggart
4. Ship Building Technology. By J.H. Dixon

NAM 3105 Resistance & Propulsion

Periods/week : 4 Ses. : 30 Exam : 70

Examination Theory: 3hrs. Credits: 3

1. Introduction to resistance: Concept of resistance, flow of non-viscous and viscous fluids past submerged bodies and surface of ships. Introduction to important components of resistance such as frictional resistance, wave making resistance, eddy making resistance and air & wind resistance. Dimensional analysis, conditions of similarity, corresponding speeds of ship and model, Introduction to towing tank experiments and determination of ship resistance.

2. Viscous resistance and air & wind resistance: Froude's experiments with planks and plates, Reynold's experiments with pipes. Turbulence stimulation, friction lines, form resistance, boundary layer separation, effect of hull roughness, appendage drag, resistance in shallow water full scale tests and ship model correlation.

3. Wave resistance, estimation of total resistance and effective horsepower: Kelvin wave pattern, waves generated by ship, wave interference, Froude's method of resistance prediction. Resistance data presentation, estimation of total resistance and effective power, trial and service allowances. Aspects of hull form design. Statistical analysis of resistance data by regression.

4. Propeller Design and hull propeller interaction: Screw propeller terminology and geometry. Dimensional analysis and conditions of similarity. Propeller in open water. Propeller coefficients, hull- propeller interaction, wake and thrust deduction, hull efficiency, relative rotative efficiency, propulsive coefficient. Cavitation, fully cavitating propellers. Propeller design using methodical series data, design of free running propellers, propellers for tugs and trawlers. Elementary treatment including basic principles of

momentum theory, blade element theory, lifting line theory and lifting surface theory of propeller. Design of propellers for a variable wake.

5. Ship Propulsion devices, prediction of ship's power and strength of propellers: Ship Propulsion devices and their historical development, water jet propulsion, controllable pitch propellers, vertical axis propellers, shrouded propellers, tandem and contra-rotating propellers and paddle-wheels, super conducting electric propulsion. Model propulsion experiments in towing tanks and Cavitation tunnels. Ship trails and service performance analysis, estimation of power based on model experiments and propeller design charts, use of Br- d charts, Kt- Kq- J diagrams. Propeller blade strength methods of calculation, classification society rules, Propeller materials.

Reference Books:

1. Principles of Naval Architecture, Vol. II by Ed. V. Lewis.
2. Resistance and Propulsion of Ships by S.A. Harvald.
3. Marine Propellers and Propulsion by J.C. Carlton.

NAM 3106 (A) FINITE ELEMENT ANALYSIS (PEC-I)

Periods/week : 4 Ses. : 30 Exam : 70

Examination Theory: 3hrs. Credits: 3

1. Fundamental Concepts: Introduction, Historical background, Outline of presentation, Stresses and Equilibrium, Boundary conditions, Strain-Displacement relations, Stress-Strain relations, Plane stress, Plane strain problems, Temperature effects, Potential energy and equilibrium. The Rayleigh-Ritz method, Hamilton's principle. Galerkin's method, Saint Venant's principle.

2. One-dimensional Problems: Introduction, Finite element modeling, Coordinates and Shape functions. The potential energy approach. The Galerkin approach, Assembly of the global stiffness matrix- mass matrix and load vector, Treatment of boundary conditions, Quadratic shape functions, Temperature effects. Trusses: Introduction, Plane trusses, Three-dimensional trusses, Assembly of global stiffness matrix for the Banded and Skyline solutions.

3. Two-dimensional Problems Using Constant Strain Triangles: Introduction, Finite element modeling, Constant strain triangle, In plane and Bending, problem modeling and boundary conditions.

4. Axisymmetric Solids Subjected to Axisymmetric Loading: Introduction, Axisymmetric formulation, Finite element modeling, Triangular element, Problem modeling and boundary conditions.

5. Two-dimensional Isoparametric Elements and Numerical Integration: Introduction, The four-node quadrilateral, Numerical integration, Higher-order elements. Beams and Frames: Introduction, Finite element

formulation, Load vector, Boundary considerations, Shear force and bending moment, Beams on elastic supports, Plane frames.

Text Book:

1. Introduction to Finite Elements in Engineering, by Tirupathi R. Chandrupatla, Ashok D. Belegundu (chapters 1 to 8 only).

References:

1. Introduction to Finite Element Method, by Abel & Desai.
2. Finite Element Method, by O.C. Zienkiewicz.
3. Concepts and Applications of Finite Element Analysis, by Robert D. Cook.

4. Introduction to Finite Element Method, by J.N. Reddy.

NAM 3106 (B) Computer Graphics (PEC-I)

Periods/week : 4 Ses. : 30 Exam : 70

Examination Theory: 3hrs. Credits: 3

Representing and displaying images, Modifying and understanding images, Chaos, Attractors, and Fractals, Graphics primitives: lines, circles, ellipses, Polygons

Rasterization & 2-D anti-aliasing, 2-D Transformations, 2-D Viewing, 2-D Clipping, Hierarchical modeling system, 3-D Transformations, 3-D Viewing pipeline

3-D Hierarchical Modeling system, 3-D object models, Splint curves & surfaces, Hidden surface removal, Z-buffer algorithm, Shading Midterm Exam (Oct 28) Illumination models, Rendering techniques, Texture-Mapping, Animation, Particle Systems, Behavioral Modeling, Radiosity & Ray-Tracing, Rendering 3-D data.

Textbooks:

1. Computer Graphics by Rogers and Rogers & Adams.
2. Graphics fundamentals by Shirley
3. I CG mathematics by Lengye.

References:

1. D. F. Rogers, Procedural Elements for Computer Graphics, 2nd Ed., McGraw-Hill, Boston, MA, 1998. (suggested text)
2. P. Shirley, Fundamentals of Computer Graphics, 1st ed, AK Peters Ltd, 2002. (suggested text)
3. Hearn, D., and M. P. Baker, Computer Graphics (C Version), 2nd Ed., Prentice Hall, Upper Saddle River, NJ, 1997. (alternative text)
4. A. Watt, 3D Computer Graphics, 3rd Ed., Addison-Wesley, Reading, MA, 2000. (alternative text)

5. Foley, Van Dam, Feiner, Hughes, and Phillips, Introduction to Computer Graphics, Addison-Wesley, Reading, MA, 1994. (alternative text)

6. E. Lengyel, Mathematics for 3D Game Programming and Computer Graphics, 2nd ed., Charles River Media, 2003. (suggested graphics math text)

7. D. F. Rogers and J. A. Adams, Mathematical Elements for Computer Graphics, 2nd Ed., McGraw-Hill, Boston, MA, 1990. (suggested graphics math text)

8. M. Mortenson, Mathematics for Computer Graphics Applications: An Introduction to the Mathematics and Geometry of Cad/Cam, Geometric Modeling, Scientific Visualization, and Other CG Applications, 2nd ed, Industrial Press, 1999. (alternative graphics math text)

9. P. Schnelder, D. Eberly, Geometric Tools for Computer Graphics (Morgan Kaufmann Series in Computer Graphics and Geometric Modeling), 1st ed, Morgan Kaufmann, 2002. (alternative graphics math text)

10. F. Dunn and I. Parberry, 3D Math Primer for Graphics and Game Development, 1st ed., Wordware Publishing, 2002. (alternative graphics math text)

NAM 3106 (C) MARINE POWER PLANT ENGINEERING (PEC-I)

Periods/week : 4 Ses. : 30 Exam : 70

Examination Theory: 3hrs. Credits: 3

1. Introduction: Classification of Power Plants, Comparison between land based and Marine Power Plants Performance Characteristics of Marine Power Plants, Fuel Consumption under varying conditions, Marine Power Plants layout.

2. Marine boilers: Marine Boilers of Fire Tube, Composite and water-tube boilers. Feed water treatment. Feed water supply systems and controls.

3. Marine steam turbines: Construction details, Compounded steam turbines for Marine applications, Operation and maintenance.

4. Marine gas turbines: Gas Turbine cycles for Marine applications, Recent trends and developments, Free piston engines, Combined Cycle Plants.

5. Nuclear power plants: Nuclear fission reaction, types of reactors, Fuels, moderators, Coolants, Control and safety rods, radiation hazards and shielding, Radioisotope applications, Radioactive Waste disposal, Nuclear Powered propulsion, Indian reactor developments.

6. Marine Refrigeration and Air Conditioning: Marine refrigeration systems- operation and maintenance-application in modern passenger ships, bulk carriers and refrigerated vessels. Air conditioning systems on

board the ships-temperature and humidity control-comfort conditioning.
Cabin and cargo ventilation- piping and ducting-insulating materials

Text books:

- 1) Marine Power Plants — P.Akinov
- 2) Nuclear Engineering — D.K.Singhal
- 3) Marine Engineering — R.Harrington
- 4) Introduction to Marine Engineering — D.A.Taylor.

NAM 3107 Marine Thermal Lab

Periods/week : 3 Ses. : 50 Exam : 50

Examination Practical: 3hrs.

Credits: 1.5

List of experiments to be conducted:

1. Determination of flash and fire points of oil samples - using Cleveland's apparatus
2. Determination of flash point of oil samples - using Abel's and Pensky-Martin's apparatus
3. Determination of Kinematic viscosity - using Redwood Viscometer – I & II, Saybolt's viscometer
4. Determination of calorific value of solid and liquid fuels using Bomb Calorimeter.
5. Aniline point test,
9. Calibration of pressure gauge - dead weight tester.
10. Volumetric efficiency of reciprocating air compressor.
11. Valve timing diagrams of IC engines(2 & 4 stroke engines).
12. Study of equipment to supplement theory, Boiler models,& I.C. Engine Components.
13. Experiments covering performance and other tests on Diesel Engines – Single cylinder, and Multi cylinder
14. Experiments covering performance and other tests on Petrol Engines
- 15 Refrigerating system and ice plant
- 16.Wind Tunnel

NAM 3108 Ship Drawing - III

Periods/week : 3 Ses. : 50 Exam : 50

Examination Theory: 3hrs.

Credits: 1.5

Theory (Stability and trim) : Transverse and longitudinal stability and trim calculations, effects of movement of liquids, cargo, fuel, fresh water, grain, rules for stability. Calculations and plotting of cross curves, G-Z curves. Stability booklet for ships, DWT scale, cargo loading and unloading,

Ballasting and de-ballasting. Inclining equipment, Calculation and estimation of GM in different service conditions. Weight calculations. Introduction and importance of weight calculations in ship design and construction. Calculation of weights of plates and sections, weight calculation data. Detailed estimation of steel weight of ships hull. Calculation of LCG and VCG of ship and off-centerline moments of ship. Calculation of total weight of the ship based on group weights. Calculation of centroid of sections and plates and other structural elements.

Practical:

Drawing of Stability Curves, Analysis of inclining experiment and weight calculations, LCG and VCG calculation.

B.Tech III/IV NAVAL ARCHITECTURE AND MARINE ENGINEERING (II-SEMESTER)

NAM 3201 Strength of Ships

Periods/week : 4 Ses. : 30 Exam : 70

Examination Theory: 3hrs.

Credits: 3

1. Introduction to functions and analysis of ship structures: Functions of ship structure, the forces acting up on a ship at sea, static forces, dynamic forces. The distortion of ship's structure. Application of theory and experience. Limitations of the theory. Distinction between strength and stiffness of hull girder. Forces and moments acting on ship's structures in regular waves in head seas, and oblique seas. Nature of stresses in ship's hull when ship is floating in still water and on a wave. Modeling of ship's structures including general remarks on structural strength. Three-dimensional analysis of a ship structures (elementary treatment only). Assumptions and simplification of longitudinal strength calculations. Introduction to the use of probability theory in the assessment of longitudinal strength.

2. Longitudinal strength of hull girder and ultimate strength: Modeling of ship hull Girder as a beam. Assumed form of wave systems. Conditions of Hogging and Sagging. The buoyancy curve. The weight curve. Distributions of dead weight items. The Load, shearing force and bending moment curves. Characteristics of shear force and bending moment curves. Still water bending moment, wave bending moment and total bending moment. Bending theory applied to ship structures and its limitations. Calculations of hull girder section modulus and hull deflection. Dynamic effects on loads acting on the hull due to ship motions and wave action such as slamming. Thermal effects on hull girder. Stresses in the inclined condition. Application of plastic theory to ship structures, stress-strain diagram, calculation of plastic neutral axis and plastic moment. Ultimate strength of a simply supported beam and a fixed end beam. Ultimate longitudinal strength of a ship.

3. Transverse strength of hull girder and ship hull material: Transverse loads on ship's hull such as hydrostatic loads, weights, wave loads, racking, and torsion. Effect of hatches and other openings. Strain energy method, moment distribution method and comparison of the two methods, Influence of bracketed connections. Manufacture of steel. Requirement of ship building quality steels, high strength steels, Aluminum alloys and glass reinforced plastics.

4. Mechanical properties and chemical composition of structural materials: Testing of steels such as tensile test bend test and impact test. Brittle fracture. Steels for very low temperature applications.

5. Strength of bulk heads, decks and tank tops, foundations, super structure, deck houses and structural discontinuities and local strength problem: Types of bulkheads and loads on bulkheads. Strength analysis of bulkheads. Types of foundations - loads on foundations and Strength analysis. Generation of loads on superstructure. Factors affecting superstructure efficiency. Effective superstructure. Strength of Aluminum alloy superstructure. Strength analysis of decks and tank tops. Determination of scantlings of superstructure decks on the basis of simple bending theory. Strength of deckhouses, structural discontinuities such as holes in plates, notches in beams and girders, deck openings, ends of superstructure, ends of girders and other structural members. Stress concentration due to various structural discontinuities mentioned above. Applications of three-moment theorem to ship structures. Use of strain energy method for solution of bending moment problems and redundant structural problems.

6. Theory of thin plates, buckling of structures, composite construction, grillage analysis, calculation of scantlings as per rules: Thin plate theory and solution for different boundary conditions. Application of plain stress theory to ship structural problems. Case of a plate acted upon by a concentrated load; Buckling of plates. Influence of stiffeners (longitudinal and or transverse) on the buckling stress of ship's plating. Bending and membrane stresses in plates (application to bulkheads, shell plates etc.) Composite construction- Two materials with same elastic modulus. Two materials of different elastic Moduli. Bending of composite beam. Introduction to Grillage. Analysis of simple Grillage. Scantling calculations according to the rules of classification societies.

Reference books:

1. Ship Construction by D.J.Eyres Merchant Ship Construction by D.A.Taylor
2. Principles of Naval Architecture, Vol. II by Ed.V. Lewis.

NAM 3202 Marine Hydrodynamics

Periods/week : 4 Ses. : 30 Exam : 70

Examination Theory: 3hrs.

Credits: 3

1. Small Amplitude Wave Theory Formulation and Solution: Review of hydrodynamics-Boundary Value Problems, summary of two-dimensional periodic water wave BVP, solution of linearized water wave BVP for a horizontal bottom, dispersion equation, engineering wave properties-water particle, kinematics of progressive waves, pressure field under a standard wave, partial standing waves, energy and energy propagation in progressive waves- principle of conservation of energy. Energy Flux.

2. Wave Forecasting: Generation of waves-theories of wave generation by Kelvin, Phillips, Milne, Jeffrey, Swerdrup and munk. Concept of fully developed sea, Characteristics of ocean waves, significant wave height and period, wave height variability, energy spectra of waves, simplified wave prediction models-SMB and PNJ. Methods, wave forecasting charts, effects of moving storms and variable wind speed and direction.

3. Wave Transformation and Wave statistics: Transformation of wave entering shallow water, shoaling of waves in shallow water, wave reflection, refraction and diffraction, combined refraction, diffraction, and wave breaking. Wave Height distribution-single wave train, wave groups, narrow banded spectra, Rayleigh's distribution, wave spectrum, directional wave spectrum-JONSWAP, PNJ and Bretschneider spectra.

4. Wave Forces: Wave forces on vertical cylindrical bodies due to non-breaking waves – Basic concepts, calculations of forces and moments, Transverse forces due to eddy shedding (Lift forces), selection of hydrodynamic force coefficient, C_d and C_m , calculation of forces and moments on groups of vertical and non-vertical cylindrical bodies due to breaking and non-breaking waves.

Textbook:

1. Shore Protection Manual, Vols. 1 & 2 by US army coastal engineering research center publication

Reference Books:

1. Water Wave Mechanics by Dean and Dyrnpole
2. An introduction to Hydrodynamics and Water Waves by B. Le Mehaute
3. Estuary and Coastline Hydrodynamics by A.T. Ippen

NAM 3203 Ship Design – II

Periods/week : 4 Ses. : 30 Exam : 70

Examination Theory: 3hrs. Credits: 3

1. General Arrangements of Ships: General arrangement of ships. Layout of main and other decks. Water tight subdivision of the ships hull. Disposition of bulk heads and decks. Allocation of cargo and machinery spaces. Bridge and navigation spaces. Arrangements of tanks for fuel oil,

ballast water and other liquids. Engine room layout. Cargo handling arrangement, requirement for ships. Accommodation in ships. Design philosophy of accommodation spaces. Living spaces, commissionery spaces, spaces for dining, recreation and services. Access diagrams. Design of super structure and layout. General arrangement and deck layout of general cargo ship, bulk carrier, oil tanker, container ship, passenger ship, fishing trawler, ferry, tug and dredger.

2. Hull Fittings, Navigational aids and life saving appliances: Closing devices, water tight, weather tight, gas tight and non-water tight floors. Windows and portholes. Bulkhead openings, hull openings, cargo port, bow doors, stern ramps. Man holes and access doors.

Hatch covers-weather deck and between deck. Types of hatch covers-sliding, rolling and pontoon. Operating mechanisms. Arrangements for ensuring water tightness. Life saving equipment primary and secondary types and ship requirements. Navigational equipment. Bulwarks railings and awnings, gangway, gangplanks, and gangway adders. Masts and rigging, mast designs.

3. Auxiliary machinery and other Ship Systems: Ship auxiliaries and equipment. Functions of auxiliary machinery and design requirements for location and installation. Selection of components and space allocation for ship systems including electrical system, Fuel and lubricating oil systems. Fresh water and sea water systems, Air conditioning, ventilation, and refrigeration systems, anchoring and mooring gear, Steering gear types and location, automation of ship systems and ship operation. Unmanned machinery spaces.

4. International and National regulatory Bodies: Safety and habitability. Impact of the regulatory bodies in ship design, IMO and classification societies, SOLAS, ILLC, ITTC, MMD. Prevention of marine pollution-MARPOL regulations. Free board assignment. Stability in various operating conditions, important features of maritime law of India -regulations regarding a/c, ventilation, noise, vibrations. Survival after damage. Carriage of dangerous goods. Collision prevention.

Ship design organisation and design consideration for special ships and use of computers: Evolution of design philosophy. Changes effected over the years. The "Titanic Disaster" and impact.

Design features of special types of ships- ice breakers, refrigerated cargo carriers, liquefied gas carriers, aircraft carriers, Ro-RO vessels, SWATH vessels, luxury passenger ships and high speed ships. Double hull structures for tankers. Hatch coverless containers. Offshore supply vessels, deep sea fishing vessels, use of computers in design of general arrangement and systems. Trends of future developments. Aesthetic considerations in ship design.

Reference Books:

1. Ship Design and Construction by R.Taggart
2. Principles of Naval Architecture, Vol. 1,2&3 by Ed.V. Lewis

NAM 3204 (A) MARINE REFRIGERATION AND AIR CONDITIONING (PEC-II)

Periods/week : 4 Ses. : 30

Exam : 70

Examination Theory: 3hrs.

Credits: 3

1. Thermodynamics: Thermodynamic principles and diagrams-properties of real fluids and refrigerants –change of phase-liquid and dilute solutions-mixture of liquids – steady flow processes with binary mixtures. Properties of ideal refrigerants. Types of commercial refrigerants- cycles of refrigeration- Air cycle and steam Jet refrigeration.

2. REFRIGERATION SYSTEMS: Vapor compression refrigeration-cycles-Multi-pressure systems- Refrigeration components like compressors, heat exchangers and expansion devices- Controls. Vapor Absorption system- Ammonia, Electrolux, Lithium bromide systems-Applications.

3. PSYCHROMETRY-DEFINITIONS: Evaporative cooling of air, dehumidification and other psychometric processes-representation on psychometric chart and calculations.

4. AIR CONDITIONING: Standards for marine Air conditioning-Types of air conditioning systems-Application of air conditioning systems in Cargo ships, refrigerated vessels, Passenger ships- Comfort and cargo air conditioning. Ventilation and ducting, Ship board ventilation- Engine room, Cargo holds accommodation and stores, ducting controls- Food preservation technology.

Text Books:

- 1.Refrigeration and Air Conditioning by W.F.Stocker.
- 2.Refrigeration and Air Conditioning by P.L.Ballaney.

Reference Books:

- 1.Marine Engineering by R.L.Harington.
2. Marine Auxiliary Machinery by D.W.Smith.

NAM 3204(B) INTRODUCTION TO OFFSHORE STRUCTURES (PEC-II)

Periods/week : 4 Ses. : 30

Exam : 70

Examination Theory: 3hrs.

Credits: 3

Types of offshore structures and conceptual development - Analytical models for jacket structures - Materials and their behaviour under static and dynamic loads - Statutory regulations - Allowable stresses - Various design methods and Code Provisions - Design specification of API, DNV, Lloyd's

and other classification societies - Construction of jacket and gravity platforms

Operational loads - Environmental loads due to wind, wave, current and buoyancy - Morison's Equation - Maximum wave force on offshore structure - Concept of Return waves - Principles of Static and dynamic analyses of fixed platforms - Use of approximate methods - Design of structural elements.

Introduction to tubular joints - Possible modes of failure - Eccentric connections and offset connections - Cylindrical and rectangular structural members – In plane and multi plane connections - Parameters of in-plane tubular joints - Kuang's formulae - Elastic stress distribution - Punching shear Stress - Overlapping braces - Stress concentration - Chord collapse and ring stiffener spacing - Stiffened tubes - External hydrostatic pressure - Fatigue of tubular joints - Fatigue behaviour - S-N curves - Palmgren-Miner cumulative damage rule - Design of tubular joints as per API Code

Analysis of offshore structures.- Fatigue analysis, inplace analysis, loadout analysis, launch analysis, transportation analysis

Corrosion - Corrosion mechanism - Types of corrosion - Offshore structure corrosion zones – Biological corrosion - Preventive measures of Corrosion - Principles of cathode protection systems - Sacrificial anode method and impressed current method – Online corrosion monitoring - Corrosion fatigue.

References

1. Dawson, T. H., Offshore Structural Engineering, Prentice Hall, 1983.
2. API RP 2A., Planning, Designing and Constructing Fixed Offshore Platforms, API., 2000.
3. McClelland, B & Reifel, M. D., Planning & Design of fixed Offshore Platforms, Van Nostrand, 1986.
4. Graff, W. J., Introduction to Offshore Structures, Gulf Publ. Co.1981.
5. Reddy, D. V & Arockiasamy, M., Offshore Structures Vol.1 & 2, Kreiger Publ. Co.1991.
6. Morgan, N., Marine Technology Reference Book, Butterworths, 1990.
7. B.C Gerwick, Jr. Construction of Marine and Offshore Structures, CRC Press, Florida, 2000.
8. Offshore pipelines by B. Gou, S. Song, J. Chacko and A. Ghalambor, GPP Publishers, 2006

NAM 3204 (C) Ocean Structures and Materials (PEC-II)

Periods/week : 4 Ses. : 30 Exam : 70

Examination Theory: 3hrs. credits: 3

1. Brief introduction of ocean, Oil and gas resources. Near shore structures. Different types of ocean structures and systems (fixed, floating,

semi-submersibles, submersibles, TLP s pipelines, intakes) for exploitation of oil and gas, minerals and energy.

2. Different materials for marine applications: Behavior of Metals, concrete and other Composite materials for marine environment. Principles of corrosion, properties and selection of materials, Non-destructive testing of materials and structures. Ocean pollution and its effect on ocean structures. Dredging and dredgers.

3.. Brief outline of planning, design and construction. Regulation and codes of practices The environment and environmental forces. Structural analysis and principles of design Foundation and sea bed anchors. Towing, launching and installation.

References :

1. Ben C.Gerwick, Jr., Construction of Marine and Offshore Structures, CRC Press, New York, 2000
2. Reddy, D.V.and Arockiasamy, M., Editors, Offshore Structures, Vol.I and II, Krieger Publishing Company, Florida, 1991
3. Per Bruun, Port Engineering, Volume I and II, Gulf Publishing Company, 1989

NAM 3205 : Marine Manufacturing Technology

Periods/week: 4 Ses : 30 Exam: 70

Examination Theory: 3hrs.

Credits: 3

1. Foundry: Foundry tools and appliances, layout – pattern types, materials, allowances, pattern making, moulding sands, types. Moulding methods, equipment for moulding, casting methods.
2. Lathe: Working principle, classification, specification, different operations on a lathe, methods of taper turning, cutting speed, feed, depth of cut, machining time and power required for cutting. Turret and capstan lathes.
3. Shaper and Planer (Elementary Treatment only): Principal parts, classification – quick return mechanisms, table feed mechanism working on shaper and planer, a comparison. Work holding devices.
4. Drilling and Boring Machines (Elementary Treatment only): Classification, specifications, cutting speed, feed, machining times, parts and description of boring machines, types.
5. Linear and angular measurements: Micrometers, Slip gauges, Vernier and optical bevel Protractors, sine bar Angle gauges.
6. Comparators: Types, Mechanical, Electrical, Electronic comparators.
7. Grinding: Introduction-abrasives-grinding wheels, bonding processes, selection of grinding wheels-grinding machines-classification-

honing-lapping, super-finishing, buffing, polishing, selection of process parameters.

Textbooks:

1. Engineering Metrology by R.K. Jain
2. Production Technology by R.K. Jain and S.C. Gupta

References:

1. Production Technology by P.C. Sharma
2. Workshop Technology, Vol.1, 2&3 by W.A.J. Chapman
3. Machine Tools by Bhattacharya

NAM 3206 : Computer Aided Ship Design

Periods/week : 4 Ses. : 30 Exam : 70

Examination Theory: 3hrs. Credits: 3

1. Fundamentals of CAD - Introduction - The design process - Application of computers for design - Operating systems - Hardware in CAD: The design work station - I/O Devices - CAD system configuration - Creating database for manufacturing - Benefits of CAD.

2. Interactive Computer Graphics - Graphic display devices- Graphics system- Graphics standards - Graphical user interface- Transformation systems- windowing - clipping - 2D and 3D transformations - Linear transformation- Display files for 3D data - Geometric Modeling - Modeling Techniques - Wire frame Modeling - Surface Modeling - 3 D Solid Modeling.

3. Introduction to Finite Element Analysis - CAD techniques to finite element data preparation- Automatic mesh generation- presentation of results - 3-dimensional shape description and mesh generation- CAD applications of FEM.

4. CASD (Computer Aided Ship Design) applications and exposure to CAD packages: Application to ship design, model manufacturing and testing, CAD applications in ship building. Simple examples of computer aided drafting, design and analysis of ships. Introduction to CAD packages like ANSYS, NASTRAN, NISA.

Text Books:

1. CAD/CAM- Computer Aided Design & Manufacturing, by M.D.Groover & E. W. Zimmer.
2. Computer Aided Design and Manufacturing, by Dr.Sadhu Singh, Khanna Publishers.

References:

1. Elements of Computer Aided Design & Manufacturing, by Y.C.Pao.
2. CAD/CAM/CIM by Radhakrishna, New age international.
3. Computer aided Kinetics for Machine Design, by D.L. Ryan

4. Computer Aided ship Design by Panagiotis Kaklis, A-A.I. Ginnis, K.V. Kostas & C. Feurer, National Technical University of Athens (NTUA), School of Naval Architecture and marine engineering (Sname), Ship Design Laboratory (SDL)

5. Computer- Aided analysis & design by S. Ghosal, Prentice Hall of India

6. Computer Aided design and manufacturing, by C.B. Nesant & C.W.K. Lui.

7. Computer Aided Design in Mechanical Engineering, by V. Rama Murthy.

NAM 3207 –(A) Dynamics of Offshore Structures (PEC – III)

Periods/week : 4 Ses. : 30 Exam : 70

Examination theory: 3hrs. Credits: 3

Module 1 (9 hours)

A Dynamic perspective. Introduction to different types of ocean structures. Development of structural forms for deep and ultra deep waters. Basis of structural design of ocean structures. Environmental forces. Structural dynamics. Basics-SDOF systems Fundamentals of structural dynamics. Mathematical modeling of structural systems. Single Degree of Freedom (SDOF) systems. Characteristics of single degree of freedom model – formulation of equation of motion. Free and Forced vibration of single degree of freedom systems. Undamped and damped systems.

Module 2 (14 hours)

Structures in the offshore environment - Description of typical offshore structures – Fixed- Compliant- Floating - Solid fluid interaction parameters - Spring factor - Added mass and damping Response of offshore structures - Modeling of offshore structures – single and multi-degree freedom systems – effect of foundations

Module 3 (12 hours)

Structural action of ocean structures - Multi-Degree of freedom (MDOF) systems. Formulation of equation of motion - Influence coefficients - Eigen value problems. Dynamic matrix method. Dunkerley's method - Matrix iteration method - Stodla's method. Mode superposition. Mode truncation. Rayleigh-Ritz method. Damping. Rayleigh damping – Caughey damping. Application of dynamics. Fluid structure interaction (FSI). Perforated members. Articulated tower (AT). Freely moving structures - Stability of submerged and floating structures - Stability at small and large angles

Module 4 (10 hours)

Experimental Structural Dynamics. Experimental studies-free floating studies-free decay studies. Experimental investigation on perforated

cylinders & perforated TLP model. Structural dynamics, introduction to stochastic dynamics of ocean structures. Motion analysis in random waves - Low frequency oscillation. Dynamic positioning.

Module 5 (6 hours)

Stochastic Dynamics – Introduction to Stochastic Dynamics of ocean structures. Fatigue Prediction. Random Environmental Processes – Response Spectrum.

References

1. Wilson, J. F., Dynamics of Offshore Structures, John Wiley, 2002.
2. Clauss, G, Lehmann, E & Ostergaard, C., Offshore structures - Vols 1 & 2, Springer Verlag, 1992.
3. Chakraborti, S. K., Non Linear methods in Offshore Engineering, Elsevier Science Publ, 2002.
4. Hooff, J. P., Advanced Dynamics of Marine Vehicles, John Wiley, 1982.

NAM 3207 (B) MARINE DIESEL ENGINES(PEC – IV)

Periods/week : 4 Ses. : 30 Exam : 70

Examination theory: 3hrs.

Credits: 3

1. Basic theory: Actual cycles, power rating and engine testing, test code
2. Fuels, lubrication and cooling: Fuel properties, Heavy oil burning, fuel oil systems, Lubricant oil properties, Lubricating oil systems, Lubricating oil contamination and purification, cooling systems—Fresh water and sea water, piston cooling.
3. Scavenging and supercharging: Types of scavenging, scavenging parameters, Super charging, Pulse and constant pressure Supercharging, exhaust grouping.
4. Engine components: Crank shaft alignment and failure, piston and cylinder liner, Diesel Engine bearings.
5. Starting, reversing and automation: Starting systems, Compressor air starting, Reversing methods for 2-stroke and 4-stroke engines, controls and automation.
6. Hazards and maintenance: Scavenge fire, Crankcase explosion, oil mist detectors, Overhaul and maintenance of Marine Diesel Engines.
7. Medium speed engines and auxiliary engines: Uses and advantages of medium speed engines, Power transmission to Propellers, use of auxiliary engines.

Text book:

- 1) Principles & Practices of Marine Diesel Engines – D.K.Sanyal

Reference Books:

1) Internal Combustion Engines —P.L.Ballaney

2) Internal Combustion Engines-Theory & Practice—S.P.Sen

NAM 3207 (C) UNDERWATER ACOUSTICS (PEC – IV)

Periods/week : 4 Ses. : 30

Exam : 70

Examination theory: 3hrs.

Credits: 3

Introduction

Sound Wave motion, Sound pressure, Reference intensity, Source level, Radiated power, Limitations to sonar power, Cavitation, Interaction, Changes to arrays, Projector sensitivity, Hydrophone sensitivity, Spectrum level, Sound in air and in sea water, Arrays

Need for projector arrays, Need for hydrophone arrays, Beam patterns, Directivity of a dipole, The general line array, Shading, Shaded arrays: transmit source levels, Directivity index, Line array: beam pattern vs. steer angle, Broadside array: length and spacing, Beam pattern for a continuous line, DI of a simple dipole, DI of a line array, DI of a planar array, DI of a cylindrical array, DI formulae based for simple arrays, Conformal arrays, Spherical arrays, Volumetric arrays, Beam formers, Domes and arrays.

Propagation of Sound in the Sea

Propagation loss, Losses, Spreading losses, Absorption losses, Spherical spreading and absorption, Propagation in the real ocean, The speed of sound, Sound speed profiles, Deep sound channel, Reliable acoustic path, Surface duct propagation, Convergence zone propagation, Bottom bounce propagation, Propagation loss models, Ray theory and the Hodgson model, Hodgson example, Performance prediction, Multipath propagation

Target Strength

Definition, Formulae, Measurement, Dependence on pulse type and duration, TS of a sphere, TS of some simple shapes, TS of small targets, Mine target strength, Torpedo target strength, Submarine echoes, Beam aspect target strength, Bow aspect target strength, Submarine target strengths, Towed arrays, Target strength reduction, Practical values.

Noise in Sonar Systems

Sources of noise, Thermal noise, Noise from the sea, Noise from a vessel, the sonar environment, Self-noise

Electrical noise, Machinery noise, Flow noise, Propeller noise, Variation with speed, Variation with frequency,

Directivity, Self-noise and radiated noise, Addition of noise levels, Receiver noise factor, Noise factor of a sonar, Acceptable receiver noise level, Alternative calculation, Practical values

Reverberation

Sources of reverberation, Scattering and reflection, Boundary roughness, Classes of reverberation, Backscattering strength, Reverberation target strength, Volume reverberation, Boundary reverberation, Scattering layers, Volume scattering strength, Sea surface scattering strength, Bottom scattering strength, Variation with frequency, Reverberation under ice

The Sonar Equations

The basic sonar equation, The basic passive equation, The basic active equation, Detection threshold and detection index, Receiver operating characteristics, ROC curves,

Passive Sonar

Radiated noise, Radiated noise: source level, Nature of radiated noise, Practical values, Broadband and narrowband, Normalization, A Note on Swaths, Passive arrays, Passive aural, Passive displays, Formulae for detection threshold, Broadband square law detector, Broadband cross-correlator detector, Narrowband processor, Narrowband amplitude detector processor, Passive ranging, Triangulation, Vertical direct passive ranging, Horizontal direct passive ranging, Towed arrays, Bearing ambiguity, Self-noise,

Active sonar

Pulse types, Active sonar equations, Reverberation index, Reverberation and Target Echoes in the main lobe, and sidelobes, Range, pings and doppler shift, Reverberation rejection by CW pulses, Practical reverberation envelopes, Full- and half-beam processing, Beam forming, FM phase binning process, CW processing, Large aperture array, Detection performance, Noise and reverberation-limited detection ranges, Ambiguity diagrams, Very long pulses, Operational degradation factor, Active displays, Unified detection and classification, Bandwidth, Beamwidth, CADAC, Levels of CADAC, CADAC and pulse features, Statistical analysis, Amplitude profiles, Multipath affects classification

Textbook:

Sonar for Practicing Engineers – A.D. Waite - Third Edition – John Wiley

References:

1. Principles of Underwater Sound – (1983) Robert J Urick – Mc Graw Hill Publications
2. Understanding Active Noise Control C.H. Hansen
3. Underwater Acoustic Systems Rodney F.W. Coates
4. Underwater acoustics Leon Camp

NAM 3208 - MARINE INSTRUMENTATION&METROLOGY LABORATORY

Periods/week: 3
50

Ses. : 50

Exam:

Examination Practical: 3hrs
1.5

Credits:

Metrology experiments

- Calibration of mechanical comparator
 - Calibration of Micrometer
 - Testing of Concentricity trueness and parallelism of a mandrel
 - Measurements of taper bar using Dial gauge, bevel protractor and sine bar.
 - Distance between two holes of a template using Vernier height gauge.
 - Measuring the central height of a circular spigot
 - Measuring the pitch diameter, diametral pitch and pressure angle of an involute spur gear
 - Study of flatness of slip gauges using optical flats and monochromatic light.
 - Calibration of Vernier calipers.
 - Calibration of Vernier Height gauge
- #### Instrumentation experiments
- Calibration of thermocouple, thermistors.
 - Calibration of force and stresses using strain gauges.
 - Flow rate measurement and roto meter.
 - Calibration of pressure gauge.

NAM 3209 : Computer Aided Ship Design Lab

Periods/week: 3 Ses : 50 Exam: 50

Examination Theory: 3hrs. Credits: 1.5

2-D and 3-D Structural Problems:

Modelling, Meshing and solving using FEM packages. CAD techniques to finite element data preparation- Automatic mesh generation- presentation of results - 3-dimensional shape description and mesh generation- CAD applications of FEM.

CASD (Computer Aided Ship Design)

Exposure to CASD packages like Rhino, NAPA, TRIBON, Shipflow etc: Application to ship design, CAD applications in ship building. Simple examples of computer aided drafting, design and analysis of ships. Lines

Plan, fairing of lines using Rhino/NAPA, Hydrostatic Curves, Stability using NAPA software

MARINE ENGINEERING

Proposed Scheme of Instruction and Examination

B.Tech (NAVAL ARCHITECTURE AND MARINE ENGINEERING)

Effective Admitted Batch 2019-20

IV / IV First semester

Code No	Subject	Periods			Exam Hours	Sessionals Marks	Exam Marks	Total Credits	
		L	T	P					
NAM 4101	Sea Keeping and Maneuverability	3	1	—	3	30	70	100	3
NAM 4102	Ship Structural Design and Vibrations	3	1	—	3	30	70	100	3
NAM 4103	PEC - IVa. FVTb. Design of Small craftsc. Naval Vessels	3	1	—	3	30	70	100	3
NAM 4104	Marine Instrumentation and Control	3	1	—	3	30	70	100	3
NAM 4105	Managerial Economics	3	1	—	3	30	70	100	3
NAM 4106	PEC - Va. Advanced Welding Technologyb. Advanced Ship Systemsc. Marine Pollution	3	1	—	3	30	70	100	3
NAM 4107	Ship Hydrodynamics Laboratory				3	50	50	100	1.5
TOTAL		27	21			230	470	700	21.5

IV / IV Second semester

Code No	Subject	Periods			Exam Hours	Sessionals Marks	Exam Marks	Total Credits	
		L	T	P					
NAM 4201	Project	—	—	28	—	50	50	100	13
TOTAL				28	6	50	50	100	13

B.Tech IV/IV NAVAL ARCHITECTURE AND MARINE ENGINEERING (I-SEMESTER)

NAM 4101 : Sea Keeping and Maneuverability

Periods/week : 4. Ses. : 30 Exam : 70

Examination Theory : 3hrs.Credits: 3

1. Introduction to sea keeping: Importance of sea keeping analysis. Behaviour of a ship in a seaway. Regular waves, Sinusoidal and trochoidal Theories.Characteristics of waves; Sea surface. Analytical and statistical representations. Descriptive characterisation of the sea. Average and

significant wave heights. Wave histogram. Characterisation by energy spectrum. Standard sea spectra. Beaufort scale.

2. Ship motions in regular waves: Surge, sway, heave, roll, pitch and yaw. Coupled and uncoupled motions. Equations of motion, inertial, damping, restoring and exciting forces and moments. Determination of the forces and moments. Tuning factor and Magnification factor. Added mass. Coupled heaving and pitching. Motions in shallow water.

3. Ship Motions in Irregular waves: Encounter spectrum. Response amplitude operators and their calculation by theory and experiment. Motion spectrum and statistical characteristics of motions in irregular waves.

4. Dynamic effects: Relative bow motion. Deck wetness and slamming. Added Resistance in waves. Added power. Power increase due to wind and waves. Loss of speed in a seaway. Loads due to motion. Wave loading and bending moments. Vertical and Rolling effects. Sea sickness

5. Stabilization of ship motions: Roll stabilisers- Bilge keels, Gyroscopic stabilisers, Movement of weight, Rudder action, Jet flaps, Stabilizing fins, Passive and Active tank stabilisers.

6. Pitch stabilization methods: Ship motion experiments. Generation of Regular and Irregular waves. Captive and free running model tests. Full scale Tests.Design considerations for sea keeping. Seakeeping criteria. ITTC Guidelines. Effect of design parameters and hull form on seakeeping.

7. Introduction to Manoeuvrability: Controlled and uncontrolled motions. Control Loop. Course keeping. Motion stability of ocean vehicles. Equations of motion. Hydrodynamic derivations. Stability criterion. Course changing. Tuning circle, zigzag and spiral manoeuvres. Heel while turning. Manoeuvring trials.

8. Control Surfaces: Control surface geometry. Rudders- types and characteristics. Effect of stall, aeration and cavitation.(Flow around rudder,Influence of ship- features on controls fired stability.) Design of rudders. Calculation of steering gear torque. Bending moment and stresses in rudder stock. Structural design of rudders. Other maneuvering devices. Maneuvering in restricted waters. Squat in shallow water. Bank suction effects- Interaction between ships. Theoretical determination of hydrodynamic derivatives of ship and control surfaces. Experimental determination of hydrodynamic derivatives. Estimation of maneuvering characteristics form hydrodynamic derivatives.

References:

- 1.Dynamics of Marine Vehicles by Rameshwar Bhattacharya.
- 2.Principles of Naval Architecture, Vol. III by Ed.V. Lewis

NAM 4102 : Ship Structural Design and Vibrations

Periods/week : 4 Ses. : 30Exam : 70

1. Introduction, Historical review: The structure of wooden ships. Transition from wood to steel. The structure of riveted ships and welded ships. Riveting and welding in ship building. Structural changes from riveted to welded ships. General mid-ship section structural arrangements for different types of ships- general cargo ship, oil tanker-single and double hull, bulk carrier, container ship, tug, trawler, passenger ship, cross channel ferry.

2. Structural parts and functions and classification rules: Different structural elements- keel, transverse frames, longitudinal frames, web frames, vertical keelson, beams, girders, floors, brackets, pillars, stem bars, stern frames, bulkhead stiffeners, platings etc.-their structural configuration, design features and functional aspects. Assembly of various structural elements into the structural parts of the ship such as double bottom structure, side shell, single bottom structure, bulk head structure, deck structure, aft-end structure, fore-end structure, super structure etc. Structural design as per classification society rules. Use of relevant standards in structural design.

3. Structural Design of Bottom, Side Shell, Bulkhead, deck, fore-end, aft-end structures: Bottom structures, structural design of single bottom and double bottom structures, their structural configuration and determination of dimensions and scantlings of stiffeners, frames, longitudinal, inner and outer bottom plating, Shell plating and framing-layout of strakes, spacing of framing, shell expansion plan, longitudinal and transverse frames, ordinary and web frames, end connections of frames, Bulk heads-structural arrangement of bulk heads, longitudinal and transverse bulk heads, determination of scantlings and sizes of structural parts of bulkheads, plating and stiffening of bulk heads, in flat, corrugated, Swaged and non-water tight bulk heads, connection of bulkheads with side shell, decks etc., partial bulk heads. Decks - deck plating, subdivision of strakes and structural arrangements of longitudinal and transverse stiffeners. Determination of scantling, end-connections of deck stiffeners. Fore-end structure-stem profiles, plating and stiffening of the fore end structures, panting arrangement, stem design-built up or cast, bulbous bow construction, details of arrangements, chain locker, hawse pipes, paint stores, forward collision bulkheads, determination of scantlings. Aft-End structure-stern profiles, plating and stiffening of aft-end structure, stern frame - built up or cast, details of stern tube, bossings, shaft struts etc. Different types of rudder configurations and stern fittings for these rudder types. Nozzles and propeller arrangements. Determination of structural scantlings.

4. Structural Design of Engine Room, Superstructure, Cargo Handling Arrangements, Hatches, Special Ships, Welded Structures and Computer Applications: Engine Room – Horizontal subdivision of engine room, platforms, decks, shaft tunnel and recesses, Engine casting, foundations of Diesel engines, turbines, boilers, auxiliary machinery. Static and dynamic loads in engine room. Structural design of engine room and determination of

scantlings. Superstructure – Structural design and details of openings, expansion joints etc. Determination of scantlings, Construction and design of cargo handling systems and equipment – loads on derricks, masts and rigging. Determination of scantlings. Deck cranes –details of installation and structural arrangements necessary.

Hatch covers – loads acting on hatch covers, various types of hatch covers and their structural design. Structural design of special types of ships – fishing vessels, tugs, tankers, dredgers, icebreakers, and submarines.

Stress Concentration and fatigue in ship structures. Computer applications in structural design. Various methods of joining structural parts and elements. Design of welded structures. Problem of fracture in welded structures. Design and strength of butt – welds, fillet welds, Tee and corner joints, bracketed connections. Structural fire protection.

5. Hull Vibration of Ships: Flexural vibrations of a beam. Free and forced vibrations, vibration of undamped spring-mass system, damped vibrations. The exciting forces on hull of ships, modes of hull vibration. Calculation of hull frequencies – factors influencing frequency, empirical formulae for hull frequency estimation. Analytical methods for calculation of hull modes (elementary treatment only). The Stodala's interpolation method.

Propeller exciting forces. Damping – Types of damping. Special local vibration problems – Rudder vibration, cavitation, stress and vibration levels, human reaction to vibration. General methods of reducing vibrations. Devices for reducing main hull vibration. Synchronising devices for twin – screw ships, rotating weight neutralisers, Kurt nozzles.

Reference Books:

1. Strength of Ship Structures by W. Muckle
2. Ship Construction by D.J. Eyers
3. Principles of Naval Architecture by Ed.V. Lewis
4. Ship Design and Construction by R.Taggart

NAM 4103 (A) FISHING VESSELS TECHNOLOGY(PEC-III)

Periods/week : 4 Ses. : 30Exam : 70

Examination Theory: 3hrs. Credits: 3

Importance of fishing, Classification of fish for harvesting. Fishing methods- Purse seining, Drift netting, Gillnet fishing, Long line fishing. Pole and line fishing, Trawling, Harpooning. Fishing Gear- Towed gear, Bottom trawling, side trawling, Towing arrangements, stern trawling operations and equipment, multiring trawling, Midwater trawling, Purse seining Types, Analysis of fishing nets. Storing and preservation of fish on board a vessel, Fish hold arrangement. Insulation, icing and freezing. Refrigeration machinery.

Design of fishing vessels. Side trawlers, stern trawlers, purse seining. General arrangement, Layout and equipment on deck. Determination of main dimensions. Estimation of component weights. Development of lines. Estimation of resistance. Design of propellers for trawlers. Machinery- main and auxiliary, Electrical systems, structural arrangements. Materials for the construction of fishing vessels.

Economics of fishing vessels. Estimation of initial and operation costs. The influences of size, speed, power, selling price, distance optimised fishing vessel design. Design and economics of simple low cost country fishing crafts.

References:

1. Design of Small Fishing Vessels by John Fyson
2. Fishing Boats of the World by Jan-Olof Traung

NAM 4103 - (B) DESIGN OF SMALL CRAFTS (PEC –III)

Periods/week : 4 Ses. : 30 Exam : 70

Examination Theory: 3hrs. Credits: 3

1. Tugs and towing vessels: Types, stability requirements, Bollard pull, powering, Features of tow hook, Equipment. General arrangement, Special features of pusher tugs, Kort-nozzle, Voith-Schneider and Schottel propulsion in tugs. Design aspects.

2. Dredgers: Types of dredgers, Hydrostatics and stability construction. Powering and dredging machinery and equipment. Disposal of dredged material. Design considerations.

3. High speed crafts: Their role in offshore and naval operations. Special features. Design considerations

4. Fishing vessels: Types of fishing vessels and fishing methods. Special features. Stability requirements and IMCO recommendations. General arrangement. Fishing gear and equipment. Preservation and processing of catch and by-products. Fishing vessel design.

Text Books:

1. Principles of Naval Architecture by Ed.V. Lewis
2. Tugs, Towboats and Towing by Edward M. Brady

NAM 4103 (C) NAVAL VESSELS (PEC –III)

Periods/week : 4 Ses. : 30 Exam : 70

Examination Theory: 3hrs. Credits: 3

1. Historical development of different types of naval vessels: Distinguishing features of warship types. Indigenous design and production of naval vessels. Mission requirements and constraints. Concept exploration and development of warship criteria. Determination of main dimensions.

Volumes based and weight based criteria. Space allocation and general arrangement.

2. Design of Hull Form: Warship resistance data, Hydrodynamics of naval vessels. Propellers for warships. Design and construction. Propeller data for heavily loaded propellers. Hydrodynamic design methods. Stability criteria for warships. Damage survival considerations.

3. Main and auxiliary machinery in warships: Comparative methods of steam, diesel and gas turbine plants. Combined plants. Requirements of sea keeping and stability platform. Stabilisation systems. Special manoeuvring requirements for naval vessels.

4. Structural arrangements in naval ships: Structural design criteria and design procedures. Shock and methods to reduce its effects. Accommodation. Habitability standards. A/C requirements. Nuclear, bacteriological and chemical defense arrangements. Weapon systems. Guns torpedoes, depth chargers, mines and missiles. Radar and Sonar weapon control systems. Counter Measures.

5. Detailed study of some modern naval ships: Submarine: General description, pressure hull external structure, diving and surfacing systems. A/C and ventilation systems. Stability, equilibrium polygon. Distance when submerged and while on surface. Propulsion system. Rudder and hydroplanes. Nuclear submarines

NAM 4104 : Marine Instrumentation and Control

Periods/week : 4 Ses. : 30 Exam : 70

Examination theory: 3hrs. Credits: 3

1. Instrumentation: Concepts of measurements, static performance, characteristics accuracy of measurement and its analysis. Instrumentation, for measurement: Force, torque, strain. pressure, flow, temperature and vibration.

2. Optical Methods of Measurement: Introduction, Laser beam as a light pointer, length/displacement measurement, temperature sensors, seismographic measurement. Introduction to fiber optics, fiber types, properties of optical fibres and a fibre optic sensor configuration.

3. Introduction: Control systems, Feedback and its effects. Transfer Function, Block Diagram and Signal Flow Graph: Impulse response and Transfer functions of linear systems, Block diagrams.

4. Mathematical Modeling of Physical Systems: Equations of electrical networks, Modeling of mechanical system elements, Equations of mechanical systems. State-variable Analysis of Linear Dynamic Systems: Matrix representation of state equations, State transition matrix, State transition equation, relationship between state equations and high-order

differential equations, relationship between state equations and transfer functions, Characteristic equation, eigen values and eigen vectors.

5. Time-Domain Analysis of Control Systems: Typical test signals for the time response of control systems, Time- domain performance of control systems- The steady- state error, Time-domain performance of control systems- Stability of control systems- stability, Characteristic equation and the state transition matrix, Methods of determining stability of linear control systems, Routh- Hurwitz criterion.

6. Frequency-domain Analysis of Control Systems: Introduction, Nyquist stability criterion, Application of the Nyquist criterion, Stability of multi loop systems, Stability of linear control systems with time delays.

Text Books:

1. Automatic Control Systems, by Benjamin C. Kuo.
2. Mechanical Measurements, by R.S.Sirohi, H.G. Radha Krishna, Wiley Eastern, New Delhi.

References:

1. Experimental Methods for Engineers, by J.P.Holman, McGraw-Hill.
2. Instrumentation for Engineering Measurements, by R.H. Cerni and L.E.Foster, J.Wiley & Sons, New York.
3. Mechanical and Industrial Measurement, by R.K.Jain, Khanna publishers, Delhi.
4. Control Systems Engineering by Nagrath/Gopal ,New age international.

NAM 4105 : Managerial Economics

(Common for all Branches)

Course Objectives:

1. To bring about an awareness about the nature of Managerial Economics and its linkages with other disciplines.
2. To understand the Micro and Macro Environment of Business.
3. To familiarize the prospective engineers with the concepts and tools of Managerial Economics with an objective to understand the real world of business.

Course Outcomes:

After completion of the course, student will be able to:

1. Understand the various economic activities in business and industry.
2. Analyse the real world business problems.
3. Make optimal business decisions for the effective and efficient management of Organisations.

SYLLABUS

Significance of Economics and Managerial Economics:

Economics: Definitions of Economics- Wealth, Welfare and Scarcity definition Classification of Economics- Micro and Macro Economics (Two periods)

Managerial Economics: Definition, Nature and Scope of Managerial Economics, Differences between Economics and Managerial Economics, Main areas of Managerial Economics, Managerial Economics with other disciplines. (Four periods)

Demand Analysis : Demand - Definition, Meaning, Nature and types of demand, Demand function, Law of demand - Assumptions and limitations. Exceptional demand curve. (Two periods)

Elasticity of demand - Definition, Measurement of elasticity, Types of Elasticity (Price, Income, Cross and Advertisement), Practical importance of Price elasticity of demand, Role of income elasticity in business decisions, Factors governing Price Elasticity of demand. (Four periods)

Demand Forecasting - Need for Demand forecasting, Factors governing demand forecasting, Methods of demand forecasting: Survey methods- Experts' opinion survey method and consumers Survey methods. (Four periods)

Utility Analysis: Utility- Meaning, Types of Economic Utilities, Cardinal and Ordinal Utility, Total Utility, Marginal Utility, The law of Diminishing Marginal Utility and its Limitations. (Two periods)

Theory of Production and Cost analysis:

Production - Meaning, Production function and its assumptions, use of production function in decision making; Law of Variable Proportions: three stages of the law. (Four periods)

Cost analysis - Nature of cost, Classification of costs - Fixed vs. Variable costs, Marginal cost, Controllable vs. Non - Controllable costs, Opportunity cost, Incremental vs. Sunk costs, Explicit vs. Implicit costs, Replacement costs, Historical costs, Urgent vs. Postponable costs, Escapable vs. unavoidable costs, Economies and Diseconomies of scale. (Four periods)

Market Structures : Definition of Market, Classification of markets; Salient features or conditions of different markets - Perfect Competition, Monopoly, Duopoly , Oligopoly, Importance of kinked demand curve ;Monopolistic Competition. (Four periods)

Pricing Analysis : Pricing - Significance: Different Pricing methods- Cost plus pricing, Target pricing, Marginal cost pricing, Going -rate pricing, Average cost pricing, Peak load pricing , Pricing of joint Products, Pricing over the life cycle of a Product, Skimming pricing Penetration pricing, Mark-up and Mark-down pricing of retailers. (Four periods)

Business cycles, Inflation and Deflation:

Business cycles - Definition , Characteristics , Phases, Causes and Consequences; Measures to solve problems arising from Business cycles. (Four periods) Inflation -Meaning, Types, Demand- pull and Cost push inflation, Effects of Inflation, Anti- inflationary measures. **(Four periods) Deflation-** Meaning, Effects of Deflation, Control of Deflation, Choice between Inflation and Deflation. **(Two periods)**

Text Books:

1. Sankaran,S., Managerial Economics, Marghan Publications, 2015, Chennai.
2. Aryasri, A.R., Managerial Economics and Financial Analysis, MC Graw Hill Education, New Delhi,2015.

Reference Books:

1. Dwivedi, D.N., **Managerial Economics**, Vikhas Publishing House Pvt. Ltd. 6th Edition, New Delhi,2004.
2. Dewett, K.K., **Modern Economic Theory**, S.Chand & Company Ltd., New Delhi, 2005.

NAM 4106 (A) ADVANCED WELDING TECHNOLOGY (PEC – V)

Periods/week : 4 Ses. : 30 Exam : 70

Examination Theory: 3hrs. Credits: 3

1. Introduction: Classification of welding and related processes. General conditions for welding, edge preparations, and design of welded joints, welding codes and symbols, weldability of metals and metallurgy in welding.
2. Plastic Welding: Forge Welding: Types, Forged joints etc. Resistance Welding: Principle, types, spot, seam, etc. Thermit welding.
3. Gas Welding: Principle, equipment, different gas flames, gas welding techniques, types of gas welding, oxy-acetylene, air-acetylene, and oxy-hydrogen welding etc.
4. Arc Welding: Principle and theory. Arc welding equipment, arc welding current and voltage, polarity of electrodes, angularity of electrodes, precautions in arc welding. Arc welding types, Carbon arc, metal arc, MIG, TIG etc.

5. Solid State Welding: Principle and types. Latest welding techniques, electron beam, laser beam, metal flame spraying etc. Under water welding (elementary treatment only). Related processes, oxy-acetylene cutting, arc cutting, brazing, soldering etc.

6. Welding of various Metals: Cast Iron, steel, non-ferrous metals, etc. Welding defects, inspection and testing-design for welding. Safety practices and training in welding and welding machines (elementary treatment).

Textbooks:

1. Welding Engineering by R.L. Agrawal and Tahir Manghnani
2. A Text book of Welding Technology by O.P. Khanna
3. Welding Technology by N.K. Srinivasan

References:

1. Welding Engineering and Technology by R.S. Parmar
2. Welding and Welding Technology by Richard L. Little
3. Welding by A.C. Davies
4. Production Technology by R.K. Jain and S.C. Gupta
5. Elements of Workshop Technology, Vol.1 by S.K. Hajra Choudury et. al.
6. Welder Trade Theory by S.K. Singh

NAM 4106 (B) Advanced Ship Systems (PEC – V)

Periods/week : 4 Ses. : 30 Exam : 70

Examination Theory: 3hrs. Credits: 3

Ship systems: Introduction, Ship system formulations, main and auxiliary systems. Arrangement of machinery, piping diagrams.

Fuel system, Steam and condensate system, Automation systems.central cooling and central priming systems, control and service air system, domestic fresh water and sea water service system, drinking water system, fire main system. Fire detection and extinction systems, pumping systems on board such as bilge, ballast and cargo pumping operations, refrigeration system, and sewage system.

System Components: viz. Pumps, piping and valves in the various systems- their construction, operation and maintenance.

Operation systems: Steering system, shafting system, main propulsion system, navigation systems, Anchoring and mooring systems - systems – operation, construction, care and maintenance

Powergeneration and distribution systems : generators, switchboards and panels, lighting and power distribution.

Heating, Ventilation and Air Conditioning systems: Psychometrics, heating load, cooling load, comfort, ventilation and room air distribution.

Humidifying and dehumidifying, ducting and piping and their components and construction, ventilation system and venting system for cargo holds, tankers and accommodation.

Helideck systems and Armament systems- construction and operation Lifesaving systems - Use of survival equipment – Survival craft and rescue boat. Primary and secondary types of life saving equipments.

TEXT BOOKS:

1. D.W. Smith, "Marine Auxillary Machinery", 6th Edition, Butter worths, London, 1987.

2. H.D. McGeorge, "Marine Auxillary Machinery", 7th Edition, Butter worth, London, 2001.

3. Introduction to marine engg – D.A. Taylor – Butter worth- Heinemann REFERENCE:

1. H.D. McGeorge, "General Engineering Knowledge", 3rd edition, Butter worth – Heineman, London, 1991.

2. Victory, "Fire Fighting Equipment And Its Use In Ships", Marine Engineering Practice, Vol 1, Part 05, IMarEST, London

NAM 4106 (C) Marine Pollution (PEC – V)

Periods/week : 4 Ses. : 30 Exam : 70

Examination theory: 3hrs. Credits: 4

Chapter I Ocean pollution: kinds and quantities of pollutants entering oceans - ocean dumping - fate of pollutants - toxic effects and nuclear waste disposal, Sources and Effects of Marine Pollution.

Chapter II : Oil spills, Fate of spilled oil; Treatment of oil at sea; disposal of oil platforms and other structures at sea, accomplishments and case studies towards reducing pollutant/contaminant inputs to the ocean. Aerial observation of oil; Beach cleaning; Environmental impact; Net Environmental Benefit Analysis; Public health risks and commercial damage; Case Studies

Chapter III : Plastics in the marine environment - Nature of plastic materials - Potential plastic pollutants - Distribution and impact of plastics - Trace metals as pollutants - Factors influencing the toxicity of trace metals to marine organisms – Case studies of marine pollution with reference to Mercury, Cadmium, etc.

Chapter IV : Harmful Algae Bloom: Definition; Causative organisms; Impact; Relation with Eutrophication; In situ treatment; Case Studies, Pollution by sewage and nutrients - discharges by rivers and estuaries - piped outfalls to the sea - sewage and micro-organisms - Disposal of persistent organic compounds - Effects of persistent organic compounds on marine organisms. How to address the Marine Pollution

Chapter V : IMO and regulatory mechanism to check pollution: Elementary treatment only.

Books Recommended

Text Book : 1. Clark, R.B. "Marine Pollution", 5th Edition, Oxford University Press, 2001

2. Marine Pollution by Sebastian A. Gerlach, Springer Verlag

Reference Books: Marine Pollution, Chris Frid, Martin Atterill and Robert Clark; Oxford University Press, Marine Pollution by Johnson, R., Academic Press, Chemical Oceanography, Volumes 1 to 9, Academic Press, Estuarine Chemistry by Burton and Liss, Academic Press.

NAM 4107 : Ship Hydrodynamics Laboratory

Periods/week : 3 Ses. : 50 Exam : 50

Examination Practical: 3hrs. Credits: 1.5

5 Experiments covering the following aspects:

Pressure, Velocity and flow rate measurements,

calibration of Venturimeter,

Reynolds number of steady pipe flow.

Calibration of small orifices and mouth pieces.

Calibration of orifice meters and flow nozzles.

Vortex motion on the aft portion of blunt bodies.

Pressure distribution around aerofoil sections.

Determination of metacentric height of a floating model.

Visits to Model testing tank to do ship model testing and understand basic facilities.

B.Tech in COMPUTER SCIENCE & ENGINEERING

COMMON SCHEME OF INSTRUCTION & EXAMINATION

III/IV B.TECH (FOUR YEAR COURSE) &

III/VI B.TECH (SIX YEAR DOUBLE DEGREE COURSE)

(With effect from 2019-2020 admitted batch onwards)

B.TECH. (CSE) IIIYEAR I-SEMESTER SCHEME OF INSTRUCTION AND EXAMINATION

Sub. Ref	Name of the Subject	Periods			Maximum Marks		Credits
		Theory	Tutorial	Lab	Exam	Sessionals	
CSE311	Computer Networks	3	1	—	70	30	100 3
CSE312	Operating Systems	3	1	—	70	30	100 4
CSE313	Formal Language & Automata Theory	3	1	—	70	30	100 3
CSE314	Object Oriented Software Engineering	3	1	—	70	30	100 4
CSE315	Operations Research	3	1	—	70	30	100 3

CSE316	Elective - 1	3	1	—	70	30	100	3
CSE317	Data Communications And Computer Network Lab	—	—	3	50	50	100	1.5
CSE318	Operating Systems Lab	—	—	3	50	50	100	1.5
CSE319	Soft Skills Lab	—	—	3	50	50	100	1.5
TOTAL		18	02	9	570	330	900	24.5

ELECTIVE - I:

1. Microprocessors
2. Data Communications
3. Principles of Programming Languages

CSE 311: COMPUTER NETWORKS

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 Hours Credits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives:

1. To make the students understanding of basic requirements of network hardware, software and its architecture.
2. Familiarize the students with layered architecture of the network software and hierarchal nature of the network physical infrastructure.
3. Study of various network interconnecting devices and other associated network hardware.
4. Introduction of advanced networking concepts and wireless and wireless sensor networks.

Course Outcomes:

1. The student must be able to understand the design and estimate the requirements for practical setup of a given network scenario and size.
2. Realize the Operation, maintenance and management of the Internet by mapping the theoretical networking concepts to the real-time network scenarios.
3. Demonstrate the applications of wireless Networks and over view of advanced networking concepts.
4. Identify different networking devices and their usage and functionality

SYLLABUS

1. Introduction to Computer Networks: Introduction, Network Hardware, Network Software, Reference Models,

2. The Medium Access Control: The Channel Allocation Problem, CSMA Protocols, Collision Free Protocols, The Ethernet, Wireless LANS

3. Network Layer : Network Layer Design Issues, Routing Algorithms- Shortest path routing algorithm, Congestion Control Algorithms, Network Layer in the Internet, IP Protocol, IP Address,

4. Transport layer: Transport Service, Elements of Transport Protocols, TCP and UDP Protocols, Network Performance Issues.

5. Application Layer: Over View of DNS, SNMP, Electronic Mail, World Wide Web, Firewalls.

6. Network Devices: Over View of Repeaters, Bridges, Routers, Gateways, Multiprotocol Routers, Hubs, Switches, Modems

7. Overview of Cellular Networks, Ad-hoc Networks, Mobile Ad-hoc Networks, Sensor Networks

Text Books:

1. Computer Networks, Andrews S Tanenbaum,, 5th Edition, Pearson Edu.
2. An Engineering Approach to Computer Networks-S.Keshav, 2nd Edition, Pearson Education.

References:

1. Data Communications and Networking, Behrouz A Forouzan , Tata McGraw-Hill Co Ltd, Second Edition, ISBN: 0-07-049935-7
1. Computer networks, Mayank Dave, CENGAGE.
2. Computer networks, A system Approach, 5thed, Larry L Peterson and Bruce S Davie, Elsevier.
3. Understanding communications and Networks, 3rd Edition, W.A. Shay, Thomson.

CSE312 : OPERATING SYSTEMS

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 Hours Credits: 4

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course objectives:

1. To understand evolution of Operating System.
2. To understand operating system as a layer of abstraction above physical hardware that facilitates usage convenience and efficient resource management of computer system resources.
3. To learn design and implementation of policies and mechanisms for OS subsystem.

4. To investigate case studies to understand the design philosophies / paradigm for popular multiuser or single user operating system.

Course Outcomes:

1. The student understands OS evolution, its structure and services provided by it.

2. Learn process life cycle, process scheduling objectives, policies and mechanisms, process synchronization, inter process communication, deadlocks and other process subsystem related concepts.

3. Learn memory hierarchy, allocation and deallocation policies and mechanism for main and auxiliary memory, file system design and implementation issues.

4. investigate UNIX/ LINUX and Windows OS platforms w.r.t similarities and differences in design philosophies.

SYLLABUS

1. Introduction to Operating Systems: Over View of Operating Systems, Types of Operating Systems, Operating System Structures, Operating System Services, System Calls, Virtual Machines, Operating System Design and Implementation.

2. Process Management: Process Concepts, Operations on Processes, Cooperating Processes, Threads, Inter Process Communication, Process Scheduling, Scheduling Algorithms, Multiple- Processor Scheduling, Thread Scheduling.

3. Process Synchronization: The Critical Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classical Problems of Synchronization, Critical Regions, Monitors.

4. Deadlocks: System Model, Deadlock Characterization, Methods For Handling Deadlocks, Deadlock Prevention, Avoidance, Deadlock Detection, Recovery from Deadlocks

5. Memory Management: Logical versus Physical Address, Swapping, contiguous memory allocation, paging, structure of the page table, segmentation, Virtual Memory, Demand Paging, Page Replacement, Allocation of Frames, Thrashing, Memory-Mapped files

6. File Systems, Implementation, and Secondary-storage Structure: Concept of a file, Access Methods, Directory Structure, Protection, File System Structure, Allocation Methods, Free Space Management, Directory Management, Device Drivers, overview of Mass-storage structure, Disk structure, disk attachment, disk scheduling, swap-space management.

7. Case study: Overview of LINUX, Windows Operating systems

Text Book:

1. Operating Systems, Abraham Silberschatz, Peter Baer Galvin, and Greg Gagne, John Wiley Publ., Seventh Edition.

1. Operating Systems; A Practical Approach. Rajiv Chopra.

Reference Books:

1. Modern Operating Systems, Andrew S. Tanenbaum, 2nd edition, 1995, PHI.

2. Operating Systems, William Stallings 5th Edition - PHI

3. Operating Systems: A Design-Oriented Approach', Charles Crowley, 'Tata Hill Co., 1998 edition.

CSE 313 : FORMAL LANGUAGES & AUTOMATA THEORY

Common with 6 years integrated B.Tech(CSE)+M.Tech

Instruction: 3 Periods/week, Univ. Exam: 3 Hours Credits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course objectives:

1. To introduce the concepts in automata theory and theory of computation to design grammars and recognizers for different formal languages.

2. To employ finite state machines to solve problems in computing.

3. To introduce finite state machines, context free grammars and Turing Machines and their properties as the basis for the formal expressivity of computer languages for solving linguistic decision problems.

4. To understand the concepts of tractability and decidability, the concepts of NP-completeness and NP-hard problem and also the challenges for Theoretical Computer Science and its contribution to other sciences.

Course outcomes:

1. Ability to think analytically and intuitively for problem solving situations in related areas of theory in computer science

2. Ability to describe the language accepted by an automata or generated by a regular expression or a context-free grammar;

3. Ability to Understand the functioning of Finite-State Machines, Deterministic Finite-State Automata, Nondeterministic Finite-State Automata and Pushdown Automata and Turing Machines.

SYLLABUS

1. Definitions of alphabet, strings, language, grammar, types of grammar, types of machines, generation of languages from grammar, construction of grammar from the given description of languages

2. Definition of finite state machine, Definite state machine, indefinite state machine, representations in mathematical diagram, tabular etc., id of

finite state machine's, design of finite state machine from the given description, elimination of λ -transitions, indefinite state machine to definite state machine, optimization of finite state machine

3. Conversion of regular grammar to finite state machine, finite state machine to regular grammar, discussion of pumping lemma, systematic way of construction of finite state machine

4. Definition of regular expression, regular algebra, minimization of regular expressions, closure properties, construction of regular expression from the given description, regular expression to finite state machine, finite state machine to regular expression, construction of regular expression for the given finite state machine- a systematic way using Arden's theorem

5. Definition of push down machine, push down machine, types of push down machine's, push down machine to context free grammar, context free grammar to push down machine, design methodology of various push down machine's, push down machine by empty stack, push down machine by final states, conversion from one type to other type, applications of push down machine's

6. Parsing tree, bottom-up parsing, top-down parsing, types of context free grammar's, left-most and right most derivations, productions, reductions, optimization of context free grammar's, elimination of λ productions, unit productions, normal forms- cnf, gnf

7. Definition of Turing machine, ways of representing Turing machine's- tabular form, diagram, mathematical form, quintuples etc., design of Turing machine, id of Turing machine, types of Turing machine, halting problem, church's thesis, universal Turing machine, Gödel number, definitions of recursive functions- prf, rf, decidability.

NOTE: Theorem proofs are eliminated

Text books:

1. Introduction to automata theory, languages and computation, John.E.H.P croft/ Rajeew Motwani& JD Ullman—pearson education- III edition

2. Theory of computation, K.L.P.Mishra and N.Chandrasekhar, PHI

Reference Books :

1. Theory of computation, formal languages and automata theory, G P SaradhiVarma, B.ThirupathiRao—Sci Tech publications.

CSE 314 : OBJECT ORIENTED SOFTWARE ENGINEERING

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods+1Tut/week, Univ. Exam: 3 Hours Credits: 4

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course objectives:

1. To explain the importance of OOSE in Software development.
2. To explain the students the importance of Requirements Engineering.
3. To explain the role of UML and Testing in Software Development.
4. To explain the entire Software Development Process with aid of case studies.

Course Outcomes:

1. Ability to define a problem and perform Requirements Engineering.
2. Ability to draw UML diagrams for the requirements gathered.
3. Ability to implement the designed problem in Object Oriented Programming Language and
4. test whether all the requirements specified have been achieved or not.

1. Introduction to Object Oriented Software Engineering: Nature of the Software, Types of Software, Software Engineering Projects, Software Engineering Activities, Software Quality, Introduction to Object Orientation, Software Process Models-Waterfall Model, Opportunistic Model, Phased Released Model, Spiral Model, Evolutionary Model, Concurrent Engineering Model

2. Requirements Engineering: Domain Analysis, Problem Definition and Scope, Requirements Definition, Types of Requirements, Techniques for Gathering and Analyzing Requirements, Requirement Documents, Reviewing, Managing Change in Requirements.

3. Unified Modeling Language & Use Case Modeling: Introduction to UML, Modeling Concepts, Types of UML Diagrams with Examples; User-Centered Design, Characteristics of Users, Developing Use-Case Models of Systems, Use-Case Diagram, Use-Case Descriptions, Basics of User Interface Design, Usability Principles, User Interfaces.

4. Class Design and Class Diagrams: Essentials of UML Class Diagrams, Associations and Multiplicity, Other Relationships, Generalization, Instance Diagrams, Advanced Features of Class Diagrams, Interaction and Behavioral Diagrams: Interaction Diagrams, State Diagrams, Activity Diagrams, Component and Deployment Diagrams.

5. Software Design and Architecture: Process of Design, Principles Leading to Good Design, Techniques for Making Good Design Decisions, Good Design Document; Pattern Introduction, Design Patterns: Abstraction-Occurrence Pattern, General Hierarchical Pattern, Play-Role Pattern, Singleton Pattern, Observer Pattern, Delegation Pattern, Adaptor Pattern, Façade Pattern, Immutable Pattern, Read-Only Interface Pattern and The Proxy Pattern; Software Architecture Contents of Architecture

Model, Architectural Patterns: Multilayer, Client-Server, Broker, Transaction Processing, Pipe & Filter and MVC Architectural Patterns

6. Software Testing: Overview of Testing, Testing Concepts, Testing Activities, Testing Strategies, Unit Testing, Integration Testing, Function Testing, Structural Testing, Class Based Testing Strategies, Use Case/Scenario Based Testing, Regression Testing, Performance Testing, System Testing, Acceptance Testing, Installation Testing, OOTest Design Issues, Test Case Design, Quality Assurance, Root Cause Analysis, Post-Mortem Analysis.

7. Software Process Management: Introduction to Software Project Management, Rationale Management, Configuration Management, Activities of Software Project Management, Structure of Project Plan, Software Engineering Teams, Software Cost Estimation, Project Scheduling, Tracking and Monitoring.

CASE STUDY:

1. Simple Chat Instant Messaging System
2. GPS Based Automobile Navigation System
3. Waste Management Inspection Tracking System (WMITS)
4. Geographical Information System

Text Books:

1. Object-Oriented Software Engineering Practical software development using UML and Java by Timothy C. Lethbridge & Robert, Langanier McGraw-Hill
2. Software Engineering, K.K. Agarwal, New Age Publications 2008
3. Object-Oriented Software Engineering: Using UML, Patterns and Java, Bernd Bruegge and Allen H. Dutoit, 2nd Edition, Pearson Education Asia.

Reference:

1. Software Engineering: A Practitioner's Approach, Roger S Pressman.
2. A Practical Guide to Testing Object-Oriented Software, John D. McGregor; David A. Sykes, Addison-Wesley Professional.

CSE 315 : OPERATIONS RESEARCH

Common with 6 years integrated B.Tech(CSE)+M.Tech

Instruction: 3 Periods/week, Univ. Exam: 3 Hours Credits: 3
Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives

1. To discuss about basic Operation Research concepts, Formulation of LPP and its solution using graphical method.

2. To discuss about standard form of LPP. solving LPP using various methods.

3. To study the various solutions of transportation problems and assignment problems.

4. To discuss about PERT and CPM charts

5. To discuss about replacement problems, inventory problems and game theory.

Course Outcomes:

1. Ability to solve LPP problems using various methods.
2. Ability to solve transportation and assignment problems using several methods.
3. Analyze the PERT and CPM charts
4. Ability to solve replacement problems and game theory problems.

SYLLABUS

1. Overview of Operations Research, Types of OR Models, Phases of Operations Research—OR Techniques, Introduction to Linear Programming, Formulation of Linear Programming Problem, Graphical Solution; Graphical Sensitivity Analysis,

2. Standard Form of LPP, Basic Feasible Solutions, Unrestricted Variables, Simplex Algorithm, Artificial Variables, Big M Method, Two Phase Simplex Method, Degeneracy, Alternative Optimal, Unbounded Solutions, Infeasible Solutions, Primal And Dual Problems And Their Relations, Dual Simplex Method

3. Transportation Problem as LPP, Initial Solutions, North West Corner Rule, Lowest Cost Method, Vogel's Approximation Method, Optimum Solutions of TPP, Degeneracy in Transportation, Transportation Algorithms,

4. Assignment Problem, Assignment Problem as LPP, Hungarian Method, Travelling Salesman Problem, Solutions Of TSP, Sequencing Problems, N-Jobs Two Machine Problems, N-Jobs K Machines Problems, Two-Jobs M-Machine Problems, Crew Scheduling Problems

5. Network Representation of A Project, CPM and PERT, Critical Path Calculations, Time-Cost Optimizations, PERT Analysis and Probability Considerations, Resource Analysis in Network Scheduling.

6. Replacement Problems-Individual And Group Replacement Policy, Reliability & System Failure Problems, Inventory-Factors Effecting Inventory-EOQ, Inventory Problems With and Without Shortages, Inventory Problems With Price Breakups, Multi Item Deterministic Problems. Probabilistic Inventory Problems

7. Game Theory: Two Person Zero Sum Games, Mixed Strategy Games and Their Algorithms.

TextBooks:

1. Operations Research, KantiSwaroop, P.K. Gupta, Man Mohan, SulthanChand&SonsEducation
2. PublishersOperationsResearch–AnIntroduction,HandyATaha–PearsonEducation.

Reference B:

1. Operations Research PanneerSelvan Prentice Hall OfIndia.
2. Operations Research By S.DSharma
3. Introduction To Operations Research, F.S. Hiller, G.J. Liberman,TMH
4. Operations Research, Richard Bronson, Schaum'sSeries,Mcgrawhill

CSE 316 : ELECTIVE-I MICROPROCESSORS

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 Hours Credits: 3
Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives:

1. To discuss the architectures of 8085, 8086 microprocessors, their instruction sets and related ALP programs.
2. To discuss interfacing semiconductor memories, interfacing peripheral to Intel 8086.
3. To study interfacing data converters to 8086 and discuss about micro controller 8051 architecture.

Course Outcomes:

1. Understand the basic architectures of 8085 and 8086 microprocessors.
2. Ability to write ALP programs using instruction sets.
3. Understand the various interfacing concepts and micro controllers.

SYLLABUS

1. Introduction to Microprocessors and Microcomputers: A Brief Architecture and Programming of 8085Microprocessor.
2. Architecture: Instruction Set and Programming of 8086Microprocessor
3. Interfacing Semiconductor Memories and I/O Devices: Semiconductor Memories:ClassificationInternalOrganization& Functional Description, Interfacing SRAMs and EPROMs to8086, Interfacing

Characteristics of I/Devices, I/O Device addressing methods, I/O DeviceProgramming Methods.

4. Interfacing Peripherals to Intel8086 -1: Parallel I/O Interface-8255,Serial I/O Interface –8251, Timer Interface -8253/8254
5. Interfacing Peripheral to Intel8086 -2:Keyboard/ Display Interface-8279,InterruptControllerInterface–8259
6. Interfacing Data Converters to 8086: D/A Conversion Methods, A/D Conversionmethods, Interfacing DAC, InterfacingADC.
7. Introduction to Micro controllers: Intel 8051Architecture andProgramming

TextBooks:

1. Microprocessor Architecture, Programming, and Applications with the8085 Ramesh S.Gaonkar, 4thEdition, PenramInternational,1999
2. The 80x86 Family, Design, Programming and Interfacing, John E.Uffenbeck, 3rdEdition,Pearson Education Inc.,2002
3. KennethJ.Ayala, 8051 Microcontroller Architecture, Programming AndApplications,2ndEdition, Penram InternationalPublications,1999

Reference Books:

1. BARRYB.BREY,TheIntelMicroprocessors8086/8088,80186/80188, 80286,80386and 80486,Pentium, PentiumPro Processor, Pentium II, Pentium III, Pentium 4, Architecture, Programming and Interfacing, 8thEdition,PearsonEducationInc.,2009
2. WalterA.TribelandAvtarSingh, The8088and8086 Microprocessors, Programming, interfacing, Software, Hardware, and Applications, 4thEdition, Pearson Education Inc.,20033.MicroprocessorsandInterfacing, Programming and Hardware, 2ndEdition, Douglass V. Hall,TMH Edition,1999
3. SanjayK Bose, Hardware and Software of Personal Computers, New Age International (P)Ltd.,1991
4. MykePredko, Programming and Customizing the 8051 Microcontroller, TMH,1999

CSE 316 : ELECTIVE-1 DATACOMMUNICATIONS

Instruction: 3Periods/week, Univ. Exam: 3 Hours Credits: 3
Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives:

1. To study basics of data communication systems.
2. To study the various types of transmission media.

3. To study the various hardware concepts related to data communications.

4. To discuss about modem and multiplexing techniques.

Course Outcomes:

1. Student will able to understand basic concepts related communication systems.

2. Ability to understand different transmission medias

3. Ability to understand concepts related to data communication hardware.

4. Ability to understand basic functionality of modems.

SYLLABUS

1. Introduction to Data Communications: A Communications Model, Data Communications and Data Communications Networking, Protocols and Protocol Architecture, Characteristics of Data Transmission: Concepts and Terminology, Analog and Digital Data Transmission, Transmission Impairments

2. Transmission Media: Guided Transmission Media, Wireless Transmission Data Encoding, Digital Data, Digital Signals, Digital Data, Analog Signals, Analog Data, Digital Signals, Analog Data, Analog Signals

3. Data Communication Interface: Asynchronous and Synchronous Transmission, Line Configurations, Interfacing. Data Link Control Flow Control, Error Detection, Error Control, High-Level Data Link Control (HDLC), Other Data Link Control Protocols.

4. Data Communications Hardware: Terminals: Introduction, Basic Terminal Components, Enhanced Terminal Components, General-Purpose Terminals, Remote Job Entry Terminals, Transaction Terminals, Clustering of Terminal Devices.

5. Communications Processing Hardware: Introduction, Switching Processors, Multiplexers, Concentrators, Front-End Processors.

6. Modems: Network Attachment and Regulations, Line Conditioning and Leased Lines, Modems and Modem Circuits.

7. Multiplexing: Frequency-Division Multiplexing, Synchronous Time-Division Multiplexing: Characteristics, TDM Link Control, Digital Carrier Systems Statistical Time-Division Multiplexing: Characteristics.

TEXTBOOKS:

1. William Stallings, Data and Computer Communications, 10th Edition, PHI/Pearson Edu. Inc., 2014

2. Data Communications and Computer Networks. Brijendra Singh.

3. Mary E.S. Loomis, Data Communications, PHI-N.J., 1983 (Chapter 3, Chapter 5)

4. Paul Bates, Practical Digital and Data Communications, PHI-N.J., 1987 (Chapter 5)

REFERENCE BOOKS:

1. Behrouz A. Forouzan, Data Communications and Networking, 3rd Edition TMH, 2004

2. William A. Shay, Understanding Data Communications & Networks, 2nd Edition Thomson-Brooks/Cole – Vikas Publishing House, 1999

3. Michale A. Miller, Data & Network Communications, Thomson/Delmar – Vikas Pub. House, 2000

CSE 316: ELECTIVE-I PRINCIPLES OF PROGRAMMING LANGUAGES

Instruction: 3 Periods/week, Univ. Exam: 3 Hours Credits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course objectives:

1. To learn the underlying principles and concepts of programming language.

2. To understand programming language translation process.

3. To expose students to the important paradigms of programming.

4. To understand the concepts of distributed processing and network programming.

Course outcomes:

1. Ability to compare different programming languages.

2. Ability to discuss the significant achievements in programming language history.

3. Ability to assess the programming languages in scientific manner.

SYLLABUS

1. Language Design Issues: Study Programming Languages, History of Programming Languages, Role of Programming Languages, Programming Environments.

2. Impact of Machine Architectures: Operation of a Computer, Virtual Computers and Binding Times; Language Translation Issues: Programming Language Syntax, Stages in Translation, Formal Translation Models, Recursive Descent Parsing; Modeling Language Properties: Formal Properties of Languages, Language Semantics.

3. Elementary Data Types: Properties of Types and Objects, Scalar Data Types, Composite Data Types Encapsulation: Structured Data Types, Abstract Data Types, Encapsulation by Subprograms, Type Definitions. Inheritance: Abstract Data Types Revisited, Inheritance, Polymorphism.

4. Sequence Control: Implement and Explicit Sequence Control, Sequence with Arithmetic Expressions, Sequence Control Between Statements, Sequencing with Non-arithmetic Expressions.

5. Subprogram Control: Subprogram Sequence Control, Attributes of Data Control, Parameter Transmission, Explicit Common Environment.

6. Storage Management: Elements Requiring Storage, Programmer and System – Controlled Storage, Static Storage Management, Heap Storage Management.

7. Distributed Processing: Variations on Subprogram Control, Parallel Programming, Hardware Developments, Software Architecture. Network Programming: Desktop Publishing, The World Wide Web.

Text Book:

1. Programming languages – Design and Implementation by Terrence W. Pratt Marvin V. Zelkowitz. 3rd Edition, Prentice Hall of India.

2. Principles of Programming Languages by Er. Anil Panghal and Ms. Sharda Panghal

Reference Books:

1. Concepts of Programming Languages by Robert L. Sebesta, 4th Edition, Pearson Education.

2. Fundamentals of Programming Languages, Design & Implementation by Seyed H. Roosta. Vikas Publications.

3. Programming Languages by Paradigm and Practice – Doris Appleby Julius J. Vendekopple Tata McGraw Hill Edition.

CSE317 : DATA COMMUNICATIONS AND COMPUTER NETWORKS LAB

Common with 6 years integrated B.Tech(CSE)+M.Tech

Instruction: 3 Periods/week, Univ. Exam: 3 Hours Credits: 1.5

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

FIRST CYCLE OF EXPERIMENTS

1. PC-to-PC COMMUNICATIONS UNDER DOS WITH NULL MODEM
a) Using Serial Ports and RS-232 C Cable Connection b) Using Parallel Ports and Parallel Cable Connection

2. PC-to-PC COMMUNICATIONS UNDER DOS WITH MODEM and 4-LINE EXCHANGE Using Communication Software: COMIT or XTALK

3. PC-to-PC COMMUNICATIONS UNDER WIN 98's DIRECT CABLE CONNECTION with NULL MODEM a) Using Serial Ports and RS-232 C Cable Connection b) Using Parallel Ports and Parallel Cable Connection

4. PC-to-PC COMMUNICATIONS UNDER WIN 98's DIAL-UP NETWORKING WITH MODEM and 4-LINE EXCHANGE

5. PC-to-PC COMMUNICATIONS UNDER WIN 98's HYPER TERMINAL WITH MODEM and 4-LINE EXCHANGE

6. LAN WITH BUS TOPOLOGY with a minimum of two systems i) Windows Peer-to-Peer Network ii) Windows NT Client-Server Network b) LAN WITH STAR TOPOLOGY with a minimum of two systems

7. a) LAN WITH BUS TOPOLOGY with a minimum of two systems using NOVELL Netware b) LAN WITH STAR TOPOLOGY with a minimum of two systems using NOVELL Netware

NETWORK PROGRAMMING

1. Socket Programming

a. TCP Sockets

b. UDP Sockets

c. Applications using Sockets

2. Simulation of Sliding Window Protocol

3. Simulation of Routing Protocols

4. RPC

5. Development of applications such as DNS/ HTTP/ E – mail/ Multi – user Chat

Reference Books:

1. Internet and Web Technologies by Raj Kamal, Tata McGraw-Hill

2. Programming the World Wide Web by Robert W. Sebesta, Pearson Education

CSE 318 : OPERATING SYSTEMS LAB

Common with 6 years integrated B.Tech(CSE)+M.Tech

Instruction: 3 Periods/week, Univ. Exam: 3 Hours Credits: 1.5

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

Course Objectives:

1. To learn about UNIX/LINUX operating system, its intervals.

2. To learn system programming for UNIX/LINUX Operating System.

3. To understand UNIX/LINUX shell and its programming.

4. To understand resource management policies and mechanisms and their performance evaluation.

Course Outcomes:

1. The student practices UNIX commands, Vi editor, shell commands.
2. The student develops skill in writing C programs using system calls for process management, inter process communication and other aspects.
3. The student learns shell programming and develops skill for writing scripts for batch level tasks.
4. The student learns to simulate OS resource management aspects like process scheduling, page replacement and others to evaluate performance.

Module I

1. OS lab familiarization, Home Assignment on Unix commands, Vi editor
2. Simple C programs using command line arguments, system calls, library function calls, make utility
3. C programs using fork system call to create processes and study parent, child process mechanism
4. C programs to create process chaining, spawning
5. C programs to handle errors using errno, perror() function
6. C programs to use pipe system call for inter process communication

Module II

1. Familiarization of Unix shell programming
2. Simple shell programming exercises
3. Shell programming using decision making constructs
4. Shell programming using loop constructs
5. Shell programming for file and directory manipulation

Module III

1. C programs to study process scheduling implementing FCFS, Shortest Job First, and Round Robin algorithms
2. C programs to study page replacement implementing FIFO, Optimal, and LRU page replacement algorithms
3. C programs to study deadlock avoidance and detection
4. C Programs to simulate free space management

References:

1. Unix concepts and applications by Sumitabha Das, TMH Publications.
2. Unix programming by Stevens, Pearson Education.
3. Shell programming by Yashwanth Kanetkar.

4. Operating System Concepts by Silberschatz, and Peter Galvin.

CSE319 : SOFTSKILLSLAB

Common with 6 years integrated B.Tech(CSE)+M.Tech

Instruction: 3 Periods/week,

Univ. Exam: 3 Hours Credits:1.5

Internal: 50 Marks

University Exam: 50 Marks

Total: 100

Marks

1. English Language Skills
2. Spoken English Skills
3. Presentation Skills

COMMON SCHEME OF INSTRUCTION & EXAMINATION

III/IV B.TECH (FOUR YEAR COURSE) &

III/VI B.TECH (SIX YEAR DOUBLE DEGREE COURSE)

(With effect from 2019-2020 admitted batch onwards)

B.TECH. (CSE) III YEAR II-SEMESTER SCHEME OF INSTRUCTION AND EXAMINATION

Sub. Ref	Name of the Subject	Periods			Maximum Marks		Credits
		Theory	Tutorial	Lab	Exam	Sessionals	
CSE311	Computer Networks	3	1	—	70	30	3
CSE321	Compiler Design	3	1	—	70	30	3
CSE322	Web Technologies	3	1	—	70	30	3
CSE323	Elective – II	3	1	—	70	30	3
CSE324	Elective – III	3	1	—	70	30	3
CSE325	Data Warehousing & Data Mining	3	1	—	70	30	3
CSE326	Sensor Networks	3	1	—	70	30	3
CSE327	Elective - II Lab	—	—	3	50	50	1.5
CSE328	Web Technologies Lab	—	—	3	50	50	1.5
TOTAL		15	0	10	500	300	21

ELECTIVE - II

1. Computer Graphics
2. Embedded Systems
3. Soft Computing

ELECTIVE - III

1. Artificial Intelligence
2. Image Processing
3. Distributed Systems

CSE 321 : COMPILER DESIGN

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 HoursCredits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course objectives:

1. To explain the basic understanding of grammars and language definition and Introducing various phases of designing a compiler.
2. To make the student to understand the concepts underlying the design and implementation of language processors and its mechanisms.
3. To extend the knowledge of parser by parsing LL parser and LR parser.
4. To enrich the knowledge in various phases of compiler ant its use, code optimization techniques, loop optimization techniques, machine code generation, and use of symbol table..

Course outcomes:

1. Ability to design & conduct experiments for Intermediate Code Generation in compiler.
2. Ability to learn the new code optimization techniques to improve the performance of a program in terms of speed & space.
3. Ability to acquire the knowledge of modern compiler & its features.

SYLLABUS

1. Introduction: Introduction to Compilers and Language processors, Programming Language basics, Structure & D ifferent Phases of a Compiler, Review of Compiler Structure, Structure of Optimizing Compilation, Compiler construction tools, Boot strapping, Crosscompilers.
2. Finite Automata & Lexical Analysis : Introduction to Lexical Analysis, Lexical Analyzers, Approachesto design Lexical Analyzers, Language for specifying lexical analyzers, Introduction toFinite automata, Regular Expressions & Languages, Recognition of Tokens, TransitionDiagrams, Implementation of lexical analyzers, Lexical Analyzer GeneratorLEX.
3. Syntax Analysis: Syntactic Specification of Programming Languages, Context Free Grammars & Languages, Introduction to Parsers.Top-down parsing techniques: Brute force parsing, Recursive Descent Parsing, Predictive Parsing, Bottom–upParsing:Shiftreduceparsing,Operator parsing, LR (k)parsing.
4. Semantic Analysis and Intermediate Code Generation:Semantic Actions, Syntax Directed Translations, Translation on the parse Tree, Implementation of Syntax Directed Translator, Intermediate Codes, Syntax

Directed translation to Post fixcode, Syntax Trees, Intermediate Code Generation,Three Address Code-Translation of Expressions, Type Checking& Type Conversions.

5. CodeOptimization:Principal sources of Code Optimization, Loop Optimization, Basic Blocks & Flow Graphs, DAG Representation of Basic Blocks, Applications of DAG, Local Optimization,,Unreachable Code Elimination, Dead Code Elimination, Data Flow Analysis, Data Flow Equations & Computations,Peep-Hole Optimization. MachineDependentOptimizations, Overview of Informal Compiler Algorithm Notation (ICAN), If Simplification,Loop Simplification, Loop Inversion, Branch Optimization andPrediction

6. Code Generation and Code Scheduling : Issues in Code Generation, Input to Code Generator, Instruction Selection, Register Allocation, Simple Target Machine Model, Program and Instruction Costs, Register allocation& Assignments,Code GenerationAlgorithm,CodeGenerators, Optimal Code Generation for Expressions, Code Generation FromDAG.

7. SymbolTables, Runtime Environment and Error Handling: Contents of a Symbol Table, Data Structures for Symbol Tables; Run time Environments, Implementation of a simple Stack allocation, Heap Management, Block Structured Languages; Error Detection & Recovery,Lexical Phase Errors, Syntactic & Semantic Errors, Error Handling Routines.

TextBooks:

1. Principles of Compiler Design by Aho,D. Ullman, Lam and Ravi Sethi, Pearson EducationSecond Edition
2. Advanced Compiler Design and Implementation, Steven Muchnic, ElsevierPublications.

ReferenceBooks:

1. Compiler Construction by Kenneth. C. Loudon,VikasPub.House.
2. Compiler Design, A.A. Pentambekar,TechnicalPublications
3. Modern Compiler Design, Grune.D, Van Reeuwijk K, Bal H.E, Jacobs C J H, LangendoenK, Springer,

CSE 322 : WEB TECHNOLOGIES

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 Hours Credits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives:

On completing this course student will be able to

1. Understand the principles of Web based application development.
2. Design dynamic content in Web Pages using JavaScript.
3. Understanding the concepts of java Servlets, java Server Pages and design applications using them.
4. Understand the concepts of Component development and design applications by establishing connections to Databases

Course Outcomes :

1. Students will be able to construct web based applications and Identify where data structures are appearing in them.
2. Students will be able to connect java programs to different databases.
3. Students will be able to develop EJB programs

SYLLABUS

1. Introduction to HTML , Core Elements , Links and Addressing, Images , Text , Colors and Background, Lists, Tables and Layouts , Frames, Forms , Cascading Style Sheets.
2. Introduction to Java Scripts, Elements of Objects in Java Script, Dynamic HTML with Java Script
3. Document type definition, XML Syntax, XML Schemas, Document Object model, Presenting XML, Using XML Processors
4. Introduction to Servlet, Servlet Life Cycles, Servlet Basics, Tomcat Web Server, Configuring ApacheTomcat, Handling Client Request and Response, Handling Cookies, Session Tracking.
5. Introduction to PHP, Language Basics, Functions, Strings, Arrays.
6. Web Techniques, Data bases, Graphics, PDF, Dates and Times.
7. MYSQL Installation, Accessing MySQL Using PHP, Form Handling, Cookies, Sessions, and Authentication, Tables, Inserting Data into Tables , Selecting Data from a Table, Updating Table , Deleting data from Table, Webpage creation.

Text Books:

1. Web Programming, building internet applications, 2nd Ed., Chris Bates, Wiley Dreamtech
2. Web Technologies; by Uttam K. Roy
3. The complete Reference HTML and DHTML, Thomas A. Powey

Reference Books:

1. Internet , World Wide Web , How to program, Dietel , Nieto, PHI/PEA
2. Web Tehnologies, Godbole, kahate, 2nd Ed., TMH

CSE 323: ELECTIVE-II COMPUTERGRAPHICS

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 Hours Credits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives:

1. Provides a comprehensive introduction to computer graphics with a foundation in Graphics Applications.
2. A thorough introduction to computer graphics techniques.
3. To give the basics of Geometric Transformations and projections.
4. To introduce three dimensional concepts and object representations with color models and basics of computer animation.

Course Outcomes:

1. The students will understand graphics principles and graphics hardware.
2. The students can demonstrate geometrical transformations.
3. The students can create interactive graphics applications and demonstrate computer graphics animation.

SYLLABUS

1. Introduction: Computer Graphics and their applications: Computer Aided Design, Computer Art, Entertainment, Education and Training, Graphical User Interfaces; Overview of Graphic systems: Video Display Devices, Raster Scan Systems, Random Scan Systems, Graphics Monitors And Work stations, Input Devices, Hard Copy Devices, Interactive Input Methods, Windows and Icons, Virtual Reality Environments, Graphics Software.

2. Output primitives : Points and Lines, , Line and Curve Attributes, Color and Gray scale levels, Antialiasing, Loading the Frame buffer, Line function, Line Drawing Algorithms, Circle Generating Algorithms, Ellipse Generating Algorithms, Pixel Addressing, Area Fill Attributes, Filled Area Primitives, Filled Area Functions, Cell Array, Character Generation, Character Attributes, Bundled Attributes, Curve Functions, Parallel Curve Algorithms.

3. Two Dimensional Transformations: Basic 2D Transformations, Matrix Representations, Homogeneous Coordinates, Composite Transformations, Other Transformations, Transformations between Coordinate Systems, Affine Transformations.

4. Three Dimensional Transformations & Projections: Translation, Rotation, Scaling, Other Transformations, Composite Transformations, 3D Transformation Functions, Modeling and Coordinate Transformations, Need for projections, Parallel & Perspective projections, General Projection Transformations.

5. Viewing Pipeline and Clipping operations : Viewing Pipeline, Viewing Coordinates & Reference frames, Window-to-Viewport Coordinate Transformation, Two Dimensional Viewing Functions, Three Dimensional Viewing, View Volumes, Clipping and its Operations, Types of clipping operations- Point Clipping, Line Clipping, Polygon Clipping, Curve Clipping, Text and Exterior Clipping.

6. Three Dimensional Concepts and Object representations: 3D display methods, 3D Graphics, Polygon Surfaces, Curved Lines and Surfaces, Quadratic Surfaces, Super Quadrics, Blobby Objects, Spline Representations, Cubic Spline methods, Bézier Curves and Surfaces, B-Spline Curves and Surfaces,

7. Color Models and Basics of Computer Animation: Intuitive color concepts, Basics of RGB Color model, YIQ Color Model, CMY & HSV Color models. Design of animation sequences, Raster Animations, Key Frame systems: Morphing, A Simple program on Animation.

Text Books:

1. Computer Graphics, Donald Hearn & M. Pauline Baker, Pearson Education, New Delhi.

2. Computer Graphics by Dr. Rajiv Chopra.

Reference Books:

1. Procedural Elements for Computer Graphics, David F. Rogers, Tata McGraw Hill Book Company, New Delhi, 2003

2. Computer Graphics: Principles & Practice in C, J.D. Foley, S.K. Van Dam, F.H. John, Pearson Education, 2004

3. Computer Graphics using OpenGL, Francis S. Hill Jr, Pearson Education, 2004.

4. Computer Vision and Image Processing: A Practical Approach using C++ Tools, S. E. Umbaugh, Prentice Hall, 1998

CSE 323 : ELECTIVE-II EMBEDDED SYSTEMS

Common with 6 years integrated B.Tech(CSE)+M.Tech

Instruction: 3 Periods/week, Univ. Exam: 3 Hours Credits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives:

1. To study the basics of embedded systems and its examples.
2. To study the 8051 Microcontroller architecture and its instruction set.
3. To discuss various software architectures in embedded systems.
4. To discuss Inter Task Communication procedures in RTOS and design issues of RTOS.
5. To study various embedded software development tools and debugging techniques.

Course Outcomes:

1. Student will be able to understand the basic architecture of 8051 micro controller.
2. Ability to write ALP programs using 8051 instruction set.
3. Ability to understand the concepts related to RTOS and its Inter Task Communication methods.
4. Ability to understand various design issues of RTOS.
5. Understand about embedded software development tools.

SYLLABUS

1. Introduction to Embedded Systems: Examples, Typical Hardware, Memory, Microprocessors, Buses; Introduction to 8051 Microcontroller, Architecture, Instruction set, Programming. Interrupts: Interrupt Basics, Shared-Data problem, Interrupt Latency.

2. Software Architectures: Round-Robin Architecture, Round-Robin with Interrupts Architecture, Function-Queue Scheduling Architecture, Real-Time Operating Systems Architecture, Selection of Architecture.

3. Real Time Operating System: Tasks and Task States, Tasks and Data, Semaphores and Shared Data, Semaphore Problems, Semaphore variants. Inter Task Communication: Message Queues, Mailboxes, Pipes, Timer Functions, Events, Memory Management, Interrupt Routines in RTOS Environment.

4. Design issues of RTOS: Principles, Encapsulation Semaphores and Queues, Hard Real-Time Scheduling Considerations, Saving Memory Space, Saving Power.

5. Embedded Software development Tools: Host and Target Machines, Linker/Locator for Embedded Software, Getting Embedded Software into the Target System. Embedded Software Debugging Techniques: Testing on your Host Machine, Instruction Set Simulators, Laboratory Tools used for Debugging.

6. Introduction to the Internet of Things: History of IoT, IoT Architecture, M2M – Machine to Machine, Web of Things, IoT protocols, The Layering concepts, IoT Communication Pattern, IoT protocol Architecture.

Text Books:

1. The 8051 Microcontroller Architecture, Programming & Applications, Kenneth J. Ayala, Penram International.
2. Introduction to Embedded Systems by K.V Shibu
3. An Embedded Software Primer, David E. Simon, Pearson Education , 2005.
4. Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, Marina Ruggieri & Homayoun Nikookar, River Publishers Series in Communications.

Reference Book:

1. Embedded Systems: Architecture , Programming and Design, Raj Kamal, Tata McGraw-Hill Education, 2008

CSE 323 : ELECTIVE-II SOFTCOMPUTING

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 HoursCredits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course objectives:

1. To make the student to understand the role of imprecision and uncertainty in real world scenarios.
2. To explain the role of Soft Computing in addressing the imprecision and uncertainty.
3. To explain the principal components of soft computing that include Fuzzy Sets and Fuzzy Logic, Artificial Neural Networks, Genetic Algorithms and Rough Sets.
4. To learn the Design and Implementation of Soft Computing methodologies.
5. To explain the design of hybrid systems which is combination of one or more soft computing methodologies mentioned.

Course outcomes:

1. Ability to represent Uncertainty / imprecision data.
2. Ability to select a suitable method of Soft Computing to solve a particular problem.
3. Ability to build hybrid systems using Soft Computing techniques.

SYLLABUS

1. Soft Computing: Introduction to Fuzzy Computing, Neural Computing, Genetic Algorithms, Associative Memory, Adaptive Resonance Theory, Different Tools and Techniques, Usefulness and Applications.

2. Fuzzy Sets and Fuzzy Logic: Introduction, Fuzzy Sets Versus Crisp Sets, Operations on Fuzzy Sets, Extension Principle, Fuzzy Relations and Relation Equations, Fuzzy Numbers, Linguistic Variables, Fuzzy Logic, Linguistic Hedges, Applications,

3. Interference in fuzzy logic: fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzifications and Defuzzifications, Fuzzy Controller, Fuzzy Controllers, Fuzzy Pattern Recognition, Fuzzy Image Processing, Fuzzy Database.

4. Artificial Neural Network: Introduction, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks. Various learning techniques, perception and convergence rule, Auto-associative and hetero-associative memory , Hebb's Learning, Adaline, Perceptron

5. Multilayer Feed Forward Network: Back Propagation Algorithms, Different Issues Regarding Convergence of Multilayer Perceptron, Competitive Learning, Self-Organizing, Feature Maps, Adaptive Resonance Theory, Associative Memories, Applications.

6. Evolutionary and Stochastic Techniques: Genetic Algorithm (GA), Genetic Representations, (Encoding) Initialization and Selection, Different Operators of GA, Analysis of Selection Operations, Hypothesis of Building Blocks, Schema Theorem and Convergence of Genetic Algorithm, Simulated Annealing and Stochastic Models, Boltzmann Machine, Applications.

7. Rough Set: Introduction, Imprecise Categories Approximations and Rough Sets, Reduction of Knowledge, Decision Tables and Applications. Hybrid Systems: Neural-Network-Based Fuzzy Systems, Fuzzy Logic-Based Neural Networks, Genetic Algorithm for Neural Network Design and Learning, Fuzzy Logic and Genetic Algorithm for Optimization, Applications

Text Books:

1. Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications, S. Rajsekaran and G.A. Vijayalakshmi Pai, Prentice Hall of India.

2. Rough Sets, Z. Pawlak, Kluwer Academic Publisher, 1991.

3. Intelligent Hybrid Systems, D. Ruan, Kluwer Academic Publisher, 1997

References:

1. Artificial Intelligence and Intelligent Systems, N.P. Padhy, Oxford University Press.

2. Neural Fuzzy Systems, Chin-Teng Lin & C. S. George Lee, Prentice Hall PTR. Addison-Wesley

3. Learning and Soft Computing, V. Kecman, MIT Press, 2001

4. Fuzzy Sets and Fuzzy Logic, Klir & Yuan, PHI, 1997

CSE 324 : ELECTIVE-III ARTIFICIAL INTELLIGENCE

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 HoursCredits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives:

1. To learn about AI problem, Production Systems and their characteristics.
2. To understand the importance of search and the corresponding search strategies for solving AI problem.
3. To introduce to Planning, Natural Language Processing and Expert Systems.

Course Outcomes:

1. The Student understands AI problem characteristics, state space approach for solving AI problem, Production System framework.
2. The student learn several optimal search strategies and the use of heuristics.
3. The student learns relational, inferential, inheritable and procedural knowledge and the corresponding knowledge representation approaches.
4. The student is introduced to applying AI problem solving approaches to natural language processing, planning and expert systems.

SYLLABUS

1. Introduction to Artificial Intelligence: Artificial Intelligence, AI Problems, AI Techniques, Defining the Problem as a State Space Search, Problem Characteristics, Production Systems.
2. Search Techniques: Issues in The Design of Search Programs, Un-Informed Search, BFS, DFS; Heuristic Search Techniques: Generate-And-Test, Hill Climbing, Best-First Search, A* Algorithm, Problem Reduction, AO* Algorithm, Constraint Satisfaction, Means-Ends Analysis.
3. Knowledge Representation using Rules: Procedural Vs Declarative Knowledge, Logic programming, Forward Vs Backward Reasoning, Matching Techniques, Partial Matching, RETE Matching Algorithm AI Programming languages: Overview of LISP and PROLOG, Production System in Prolog.
4. Symbolic Logic: Propositional Logic, First Order Predicate Logic: Representing Instance and is-a Relationships, Computable Functions and Predicates, Unification & Resolution, Natural Deduction; Structured Representations of Knowledge: Semantic Nets, Partitioned Semantic Nets, Frames, Conceptual Dependency, Conceptual Graphs, Scripts.

5. Reasoning under Uncertainty: Introduction to Non-Monotonic Reasoning, Truth Maintenance Systems, Logics for Non-Monotonic Reasoning, Statistical Reasoning: Bayes Theorem, Certainty Factors and Rule-Based Systems, Bayesian Probabilistic Inference, Bayesian Networks, Dempster-Shafer Theory, Fuzzy Logic: Crisp Sets, Fuzzy Sets, Fuzzy Logic Control, Fuzzy Inferences & Fuzzy Systems.

6. Natural Language Processing: Steps in The Natural Language Processing, Syntactic Processing and Augmented Transition Nets, Semantic Analysis, NLP Understanding Systems; Planning: Components of a Planning System, Goal Stack Planning, Non-linear Planning using Constraint Posting, Hierarchical Planning, Reactive Systems.

7. Experts Systems: Overview of an Expert System, Architecture of an Expert Systems, Different Types of Expert Systems-Rule Based, Frame Based, Decision Tree based, Case Based, Neural Network based, Black Board Architectures, Knowledge Acquisition and Validation Techniques, Knowledge System Building Tools, Expert System Shells.

Text Books:

1. Artificial Intelligence, Elaine Rich and Kevin Knight, Tata Mcgraw-Hill Publications
2. Python Programming: A modular approach by Pearson; by Taneja Sheetal (Author), Kumar Naveen.

References:

1. Artificial Intelligence, George F Luger, Pearson Education Publications
2. Artificial Intelligence : A modern Approach, Russell and Norvig, Printice Hall
3. Introduction To Artificial Intelligence & Expert Systems, Patterson, PHI publications

CSE 324 : ELECTIVE-III IMAGE PROCESSING

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 HoursCredits:3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course objectives

1. To explain fundamentals of Image processing concepts.
2. To provide mathematical foundation of image enhancement, image compression and image segmentation.
3. To explain the students about Morphology and its applications in image processing.

4. To explain various methods and techniques for image transformation.

Course outcomes

1. Ability to develop algorithms for fundamental concepts in Image processing.
2. Ability to perform image enhancement , image compression and image segmentation using various methods.
3. Ability to implement Image transformation techniques

SYLLABUS

1. Fundamentals of Image Processing : Image Acquisition, Image Model, Sampling, Quantization, Relationship Between Pixels ,Distance Measures, Connectivity, Image Geometry, Photographic Film. Histogram: Definition, Decision Of Contrast Basing On Histogram, Operations Basing on Histograms Like Image Stretching, Image Sliding, Image Classification. Definition and Algorithm of Histogram Equalization.

2. Image Enhancement in Spatial Domain: Arithmetic and Logical Operations, Pixel or Point Operations, Size Operations; Smoothing Filters- Mean, Median, Mode Filters- Comparative Study.

3. Edge enhancement in spatial domain: Edge enhancement filters, Directional Filters, Sobel, Laplacian, Robert, KIRSCH Homogeneity & DIFF filters, PREWITT Filter, Contrast based edge enhancement techniques, Comparative study, Lowpass filters, Highpass filters, Sharpening filters, Comparative study, Color fundamentals and color model

4. Image Compression: Run Length Encoding, modified run length encoding, Contour Coding, Huffman Code, Compression Due to Change in Domain, Compression Due to Quantization Compression at the Time of Image Transmission. Brief Discussion on:- Image Compression Standards.

5. Image Segmentation: Definition of segmentation, Characteristics of Segmentation, Detection of Discontinuities, Thresholding. Pixel Based Segmentation Method. Region Based Segmentation Methods, Segmentation by Pixel Aggregation, Segmentation by Sub Region Aggregation, Histogram Based Segmentation, Split and Merge Technique, Segmentation of moving objects.

6. Morphology: Dilation, Erosion, Opening, Closing, Hit-And-Miss Transform, Thinning, Thickening, Skeletons , Pruning Extensions to Gray – Scale Images Application of Morphology in I.P

7. Image Transforms : A Detail Discussion On Fourier Transform, DFT, FFT, Properties of Fourier transform, WALSH Transform, WFT, HADAMARD Transform, DCT Image Enhancement in Frequency Domain: Design of Low Pass, High Pass, EDGE Enhancement, Smoothing Filters in Frequency Domain. Butter

Worth Filter, Homomorphic Filters in Frequency Domain Advantages of Filters in Frequency Domain, Comparative Study of Filters in Frequency, Domain and Spatial Domain.

Text Books:

1. Digital Image Processing, Rafael C. Gonzalez And Richard E. Woods, Addison Wesley
2. Digital Image Processing, S. Jayaraman, S. Esakkirajan & T. Veera Kumar, TMH

Reference Books:

1. Fundamentals Of Electronic Image Processing By Arthyr – R – Weeks, Jr. (PHI)
2. Image Processing, Analysis, And Machine Vision By Milan Sonka Vaclav Halavac Roger Boyle, Vikas Publishing House.
3. Fundamentals of Digital Image Processing, Chris Solomon, Tobi Breckon, Wiley-Blackwell

CSE 324 : ELECTIVE-III DISTRIBUTED SYSTEMS

Common with 6 years integrated B.Tech(CSE)+M.Tech

Instruction: 3 Periods/week,

Univ. Exam: 3 Hours Credits: 3

Internal: 30 Marks

University Exam: 70 Marks

Total: 100

Marks

Course Objectives:

This course provides an introduction to the fundamentals of distributed computer systems, assuming the availability of facilities for data transmission.

Course Outcomes:

By the end of the course, students should be able to build distributed systems that:

1. Scale as the number of entities in the system increase
2. Can sustain failures and recover from them
3. Work with distributed, fault tolerant file systems
4. Can handle and process large data volumes
5. Are secure and handle certain classes of distributed denial of service attacks
6. Are loosely coupled, transactional and eventually stable

SYLLABUS

1. Introduction to Distributed Systems, What is a Distributed System?, Hardware concepts, Software concepts, Design issues.

2. Communication in Distributed Systems, Layered Protocols, ATM networks, The Client – server model, Remote Procedure call, Group communication.

3. Synchronization in Distributed System, Clock Synchronization, Mutual Exclusion, Election algorithms, Atomic transactions, Deadlocks in Distributed Systems.

4. Process and processors in Distributed System threads, System Models, Processors allocation, Scheduling in Distributed System, Fault tolerance, Real time Distributed System.

5. Distributed File Systems, Distributed File System Design, Distributed File System implementation, Trends in Distributed File System.

6. Distributed Shared Memory, Introduction, What is Shared memory?, Consistency models, Page based Distributed Shared memory, Shared – variable Distributed Shared memory, Object based Distributed Shared Memory.

Text Books:

1. Distributed Operating Systems, Andrew S. Tanenbaum
2. Advanced Concepts in Operating Systems, Mahesh Singhal and Niranjana G. Shivaratna

CSE 325 : DATA WARE HOUSING & DATA MINING

Common with 6 years integrated B.Tech(CSE)+M.Tech and B.Tech(IT)

Instruction: 3 Periods/week, Univ. Exam: 3 Hours Credits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives:

1. To understand the evolution of data warehousing and data mining systems
2. To understand extracting, cleaning and transformation of data into a warehouse.
3. To learn the principles of statistics, information theory, machine learning and other areas AI and implementation of data mining techniques.
4. To understand pattern mining using classification and clustering methods.

Course Outcomes:

1. The student understands the differences between OLTP and OLAP.
2. The student learns how data cube technology supports summarization and querying high dimensional data.

3. The student is introduced to similarity, distance, information gain and other performance and error metrics used for evaluation of mining results.

4. The student is introduced to various approaches to association rule mining, supervised and unsupervised learning and the corresponding classification and clustering approaches involving decision trees, Bayesian approaches, model based and agglomerative approaches.

SYLLABUS

1. Introduction to Data Mining: Importance of Data Warehousing and Data Mining, Kinds of Patterns, Technologies, Applications, Major Issues in Data Mining, Data Objects and Attributes Types, Statistical Descriptions of Data, Estimating Data Similarity and Dissimilarity

2. Data exploration and pre-processing: Data Visualization, Quality data, Data Cleaning, Data Integration, Data Reduction, Data Transformation, Discretization and Concept Hierarchy Generation.

3. Data Warehouse and OLAP Technology: Basic Concepts of Data warehouse, Data Modeling using Cubes and OLAP, DWH Design and usage, Implementation using Data Cubes and OLAPs, Data Generalization with AOI.

4. Data Cube Technology: Preliminary Concepts of Data Cube Computation, Data Cube Computation Methods: Multi-way Array Aggregation for Full Cube, BUC, Star-cubing, Pre-computing shell fragments for High dimensional OLAP

5. Mining Frequent Patterns Based on Associations and Correlations: Basic Concepts, Frequent Itemset Mining Methods: Apriori Algorithm, Association Rule Generation, Improvements to A Priori, FP- Growth Approach, Pattern Evaluation Methods

6. Classification & Prediction: Basic Concepts, Decision Tree Induction, Bayes Classification, Rule- Based Classification, Model Evaluation and Selection, Techniques to Improve Classification Accuracy, Classification by Back Propagation, K-nearest neighbor classifier.

7. Cluster Analysis: Basic Concepts and issues in clustering, Types of Data in Cluster Analysis, Partitioning Methods, Hierarchical Methods, DBSCAN, Grid Based Methods, Evaluation of Clustering Solutions

Text Books:

1. Data Mining- Concepts and Techniques by Jiawei Han, Micheline Kamber and Jian Pei—Morgan Kaufmann publishers —3rd edition
2. Data Mining Techniques, A.K. Pujari, University Press

References:

1. Data mining concepts by Tan, Steinbach, and Vipin Kumar - Pearson Education publishers

CSE 326 : SENSORNETWORKS

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 HoursCredits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

1. Introduction: The vision of Ambient Intelligence, Application examples, Types of applications, Challenges for Wireless Sensor Networks(WSNs), Sensor networks vs Enabling Technologies for WSNs, Single node architecture: Hardware components, Energy consumption of sensor nodes, Operating systems and execution environments

2. Network architecture: Sensor network scenarios, Optimization goals and figures of merit, Design principles for WSNs

3. Physical layer and transceiver design considerations inWSNs:MAC Protocols: Fundamentals of (wireless) MAC protocols, Low duty cycle protocols and wakeup concepts, Contention-based protocols, Schedule-based protocols, The IEEE 802.15.4 MAC protocol, IEEE 802.11

4. Link layer protocols: Fundamentals: tasks and requirements, Error control, Framing, Link management

5. Naming and addressing: Fundamentals, Address and name management in wireless sensor networks, Assignment of MAC addresses, Content-based and geographicaddressing

6. Routing protocols: The many faces of forwarding and routing, Energy-efficient unicast, Broadcast and multicast, Geographicrouting.

7. Data-centric and content-based networking : Introduction, Data-centric routing, Data aggregation, Data-centric storage

TEXT BOOK:

1. Protocols and Architectures for Wireless Sensor Networks, Holger Karl, Andreas Willig., John Wiley & Sons Ltd, 2005

2. Network Management Fundamentals, AlexenderClemn CISCIPress2007

CSE 327 : ELECTIVE-II LAB: COMPUTER GRAPHICS LAB

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3 Periods +0Tut/week, Univ. Exam: 3Hours Credits: 1.5

Internal: 50 Marks University Exam: 50 MarksTotal: 100 Marks

Course Objectives:

5. Provides a comprehensive introduction to computer graphics with a foundation in Graphics Applications.

6. A thorough introduction to computer graphics techniques.

7. To give the basics of Geometric Transformations and projections.

8. To introduce three dimensional concepts and object representations with color models and basics of computer animation.

Course Outcomes:

4. The students will understand graphics principles and graphics hardware.

5. The students can demonstrate geometrical transformations.

6. The students can create interactive graphics applications and demonstrate computer graphics animation.

A. Digital Differential Analyzer Algorithm

B. Bresenham's Line Drawing Algorithm

C. Midpoint Circle Generation Algorithm

D. Ellipse Generation Algorithm

E. Creating various types of texts and fonts

F. Creating two dimensional objects

G. Two Dimensional Transformations

H. Coloring the Pictures

I. Three Dimensional Transformations

J. Curve Generation

K. Simple Animations using transformations

L. Key Frame Animation

CSE 327 : ELECTIVE-II LAB: EMBEDDED SYSTEMS LAB

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3 Periods +0Tut/week, Univ. Exam: 3Hours Credits: 1.5

Internal: 50 Marks University Exam: 50 MarksTotal: 100 Marks

PART- I:

1. Simple Assembly Program for Addition | Subtraction | Multiplication | Division

2. Operating Modes, System Calls and Interrupts, Loops, Branches

3. Write an Assembly programs to configure and control General Purpose Input/Output (GPIO) port pins.

4. Write an Assembly programs to read digital values from external peripherals and execute them with the Target board.

5. Program for reading and writing of a file

6. Program to demonstrate Time delay program using built in Timer / Counter feature on IDE environment

7. Program to demonstrates a simple interrupt handler and setting up a timer

8. Program demonstrates setting up interrupt handlers. Press button to generate an interrupt and trace program flow with debug terminal.
9. Program to Interface 8 Bit LED and Switch Interface
10. Program to implement Buzzer Interface on IDE environment
11. Program to Displaying a message in a 2 line x 16 Characters LCD display and verify the result in debug terminal.
12. Program to demonstrate I2C Interface on IDE environment
13. Program to demonstrate I2C Interface – Serial EEPROM
14. Demonstration of Serial communication. Transmission from Kit and reception from PC using
15. Serial Port on IDE environment use debug terminal to trace the program.
16. Generation of PWM Signal
17. Program to demonstrate SD-MMC Card Interface.

PART- II: Write the following programs to understand the use of RTOS with ARM Processor on IDE Environment using ARM Tool chain and Library:

1. Create an application that creates two tasks that wait on a timer whilst the main task loops.
2. Write an application that creates a task which is scheduled when a button is pressed, which illustrates the use of an event set between an ISR and a task
3. Write an application that Demonstrates the interruptible ISRs (Requires timer to have higher priority than external interrupt button)
4. a). Write an application to Test message queues and memory blocks.
b). Write an application to Test byte queues
5. Write an application that creates two tasks of the same priority and sets the time slice period to illustrate time slicing. Interfacing Programs:
6. Write an application that creates a two task to Blinking two different LEDs at different timings
7. Write an application that creates a two task displaying two different messages in LCD display in two lines.
8. Sending messages to mailbox by one task and reading the message from mailbox by another task.
9. Sending message to PC through serial port by three different tasks on priority Basis.
10. Basic Audio Processing on IDE environment.

CSE 327 : ELECTIVE –II LAB: SOFT COMPUTING LAB

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3 Periods +0Tut/week, Univ. Exam: 3Hours Credits: 1.5

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

Course Objectives:

1. This course introduces soft computing techniques that are different from conventional AI techniques.
2. This course also provides necessary mathematical background for understanding and implementing soft computing Techniques, such as neural networks, fuzzy systems, and genetic algorithms.

Course Outcomes:

1. Understand importance of soft computing.
2. Understand different soft computing techniques like Genetic Algorithms, Fuzzy Logic, Neural Networks and their combination.
3. Implement algorithms based on soft computing.
4. Apply soft computing techniques to solve engineering or real life problems.

Exercises:

Experiment 1: Write a program in MATLAB to plot various membership functions.

Experiment 2: Use Fuzzy toolbox to model tip value that is given after a dinner which can be-not good, satisfying, good and delightful and service which is poor, average or good and the tip value will range from Rs. 10 to 100.

Experiment 3: Implement FIS Editor.

Experiment 4: Generate AND, NOT function using McCulloch-Pitts neural net by MATLAB program.

Experiment 5: Generate XOR function using McCulloch-Pitts neural net by MATLAB program.

Experiment 6: Write a MATLAB program for Perceptron net for an AND function with bipolar inputs and targets.

Experiment 7: Write a MATLAB program for Hebb Net to classify two dimensional input patterns in bipolar with their given targets

Experiment 8: Write a program of Perceptron Training Algorithm

Experiment 9: Write a program to implement Hebb's rule

Experiment 10: Write a program of Back Propagation Algorithm.

CSE328 : WEB TECHNOLOGIES LAB

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 HoursCredits:1.5
 Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

Each student should develop two projects out of this list using JSP, JDBC, J2EE

1. Design Airlines Ticket Reservation System
2. Design ONLINE Banking system.
3. Design Library Information system
4. Design Gram Panchayat Information system for House tax, water tax, wealth tax, Library tax collection, phone bill, Electricity bill collection.
5. Design student information system portal which maintain attendance, marks etc.
6. Design online examination system.

COMMON SCHEME OF INSTRUCTION & EXAMINATION

IV/IV B.TECH (FOUR YEAR COURSE) &

IV/VI B.TECH (SIX YEAR DOUBLE DEGREE COURSE)

(With effect from 2019-2020 admitted batch onwards)

B.TECH. (CSE) IV YEAR I-SEMESTER SCHEME OF INSTRUCTION AND EXAMINATION

Sub. Ref	Name of the Subject	Periods			Maximum Marks		Credits
		Theory	Tutorial	Lab	Exam	Sessionals	
CSE411	Elective – IV	3	1	—	70	30	100 3
CSE412	Elective – V	3	1	—	70	30	100 3
CSE413	GPS Applications	3	1	—	70	30	100 3
CSE414	Computational Biology	3	1	—	70	30	100 3
CSE415	Entrepreneurship	3	1	—	70	30	100 3
CSE416	Cryptography & Network Security	3	1	—	70	30	100 3
CSE417	Elective – IV Lab	—	—	3	50	50	100 1.5
CSE418	Elective – V Lab	—	—	3	50	50	100 1.5
TOTAL		12	0	18	430	270	700 21

ELECTIVE -IV

1. Big Data Analytics
2. Machine Learning
3. R Programming

ELECTIVE - V

1. Cyber security& Digital Forensics
2. IOT

3. Cloud Computing

CSE 411 : ELECTIVE-IV BIGDATA ANALYTICS

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 Hours Credits: 3
 Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives:

- To introduce Big Data and the Data analytics lifecycle to address business challenges that leverage big data.
- To understand the importance of mining data streams and social network graphs.
- To introduce big data analytics technology and tools including MapReduce and Hadoop.

Expected Course Outcome:

- Reframe a business challenge as an analytics challenge.
- Apply appropriate analytic techniques and tools to analyze big data.
- Create models and identify insights that can lead to actionable results.
- Effectively participate in big data and other analytics projects.
- Use tools such as MapReduce / Hadoop.

1. Big Data Concepts and Environment: Big Data Overview-Big Data Challenges and Opportunities- Data analytics lifecycle overview – Phases of Data Analytics: Discovery, Data preparation, Model planning, Model building.

2. Overview of Hadoop and HDFS: Introduction to Hadoop - The Distributed File System: HDFS, GPFS – The Design of HDFS – HDFS- Concepts-Blocks, Name Nodes and Data Nodes; Components of Hadoop- Hadoop Cluster Architecture-Batch Processing- Serialization - Hadoop ecosystem of tools-NoSQL .

3. Map Reduce: MapReduce Basics - Functional Programming Roots - Mappers and Reducers - The Execution Framework -MapReduce Algorithm Design –Shuffling, Grouping, Sorting- Custom Partitioners and Combiners- MapReduce Formats and Features.

4. Data Stream Mining: The Stream Data Model: A Data-Stream-Management System, Examples of Stream Sources, Stream Queries, Issues in Stream Processing. Sampling Data in a Stream, Filtering Streams (The Bloom Filter), Counting Distinct Elements in a Stream, Counting Ones in a Window, Decaying Windows.

5. Big Data Clustering:Overview of clustering techniques, Hierarchical Clustering, Partitioning Methods, CURE algorithm, Clustering stream

6. Mining Social Network Graphs: Link Analysis: Page Rank- Efficient computation of Page Rank- Topic Sensitive Page Rank- Link Spam- Hubs and Authorities. Mining Social Network Graphs: Web Advertising: Online and Offline Algorithms; Social Network Graphs: Clustering of Social Network Graphs- Direct Discovery of Communities- Partitioning of Graphs- Finding overlapping communities- Simrank Counting Triangles- Neighborhood properties of Graphs.

Text Book:

1. RadhaShankarmani, M Vijayalakshmi, "Big Data Analytics", 2nd Edition, Wiley

Reference Books:

1. AnandRajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, 2014.

2. Data Warehousing in the Age of Big Data, Krish Krishnan Elsevier Inc, 2013

CSE 411 : ELECTIVE-IV MACHINE LEARNING

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 Hours Credits: 3
Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

1. Introduction to Machine Learning, Applications of Machine learning, Supervisory Learning: Learning classes from examples, Vapnik-Charvonenkis (VC) Dimension, Probably Approximately Correct(PAC) Learning, noise, learning multiple classes, regression, model selection and generalization, dimensions of supervised machine learning algorithms

2. Bayesian Decision Theory: Classification, losses and risks, discriminant functions, utility theory, value of information, Bayesian networks, Influence diagrams, Association rules, Parametric Methods: Maximum likelihood estimation, evaluating an estimator with bias and variance, Bayes' estimator, parametric classification, regression, tuning model complexity: bias vs variance dilemma, model selection procedures

3. Multivariate methods: Multivariate data, parameter estimation, missing value imputation, univariate normal distribution and classification, discrete features, regression, Dimensionality Reduction: Subset selection, PCA, Factor Analysis, multi-dimensional scaling, LDA

4. Clustering: Mixture densities, K-means clustering, Expectation Maximization algorithm, mixtures of Latent Variable Models, Supervised learning after clustering, Hierarchical clustering, choosing number of clusters

5. Non-parametric methods: Non-parametric methods density estimation, generalisation to multivariate data, nonparametric classification,

condensed nearest neighbors, non-parametric regression: smoothing models, choosing smoothing parameters

6. Decision trees and Linear Discrimination: Univariate classification and regression trees, rule extraction from trees, Multivariate trees, Generalizing linear model, two class and multi-class geometry of linear discriminant, pairwise separation, gradient descent, logistic discrimination for binary and multi-class problems, Support vector machines, optimal separating hyperplane, kernel functions for non-separable spaces, SVM for regression.

7. Hidden Markov Models: Discrete Markov processes, Hidden Markov Models, Three basic problems of HMM, Evaluation problem, finding the state sequence, Learning model parameters, continuous observations, Model selection in HMM Assessing and comparing classification Algorithms: Cross-validation and resampling methods, measuring error, interval estimation, hypothesis testing, assessing performance of a classifier, comparing two classification algorithms, comparing multiple classification algorithms based on variance

Text Book:

1. Introduction to Machine Learning by EthemAlpaydin, Prentice-Hall of India, 2006

2. Machine Learning by SaikatDutt and Subramanian Chandramouli

Reference books:

1. Machine Learning, Tom Mitchell , McGraw Hill, 1997

2. Pattern Classification, Richard O. Duda, Peter E. Hart and David G. Stork, John Wiley & Sons Inc., 2001

CSE 411 : ELECTIVE-IV : R PROGRAMMING

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3 Periods +0Tut/week, Univ. Exam: 3Hours Credits: 3
Internal: 30 Marks University Exam: 70 MarksTotal: 100 Marks

COURSE OBJECTIVS:

After taking the course, students will be able to

- * Use R for statistical programming, computation, graphics, and modeling,
- * Write functions and use R in an efficient way,
- * Fit some basic types of statistical models
- * Use R in their own research,
- * Be able to expand their knowledge of R on their own.

COURSE OUTCOMES:

At the end of this course, students will be able to:

- * List motivation for learning a programming language

- * Access online resources for R and import new function packages into the R workspace
- * Import, review, manipulate and summarize data-sets in R
- * Explore data-sets to create testable hypotheses and identify appropriate statistical tests
- * Perform appropriate statistical tests using R Create and edit visualizations

UNIT-I: Introduction, How to run R, R Sessions and Functions, Basic Math, Variables, Data Types, Vectors, Conclusion, Advanced Data Structures, Data Frames, Lists, Matrices, Arrays, Classes.

UNIT-II: R Programming Structures, Control Statements, Loops, - Looping Over Nonvector Sets, - If-Else, Arithmetic and Boolean Operators and values, Default Values for Argument, Return Values, Deciding Whether to explicitly call return- Returning Complex Objects, Functions are Objective, No Pointers in R, Recursion, A Quicksort Implementation-Extended Example: A Binary Search Tree.

UNIT-III: Doing Math and Simulation in R, Math Function, Extended Example Calculating Probability- Cumulative Sums and Products-Minima and Maxima- Calculus, Functions for Statistical Distribution, Sorting, Linear Algebra Operation on Vectors and Matrices, Extended Example: Vector cross Product- Extended Example: Finding Stationary Distribution of Markov Chains, Set Operation, Input /output, Accessing the Keyboard and Monitor, Reading and writing Files,

UNIT-IV: Graphics, Creating Graphs, The Workhorse of R Base Graphics, the plot() Function – Customizing Graphs, Saving Graphs to Files.

UNIT-V: Probability Distributions, Normal Distribution- Binomial Distribution- Poisson Distributions Other Distribution, Basic Statistics, Correlation and Covariance, T-Tests, -ANOVA.

UNIT-VI: Linear Models, Simple Linear Regression, -Multiple Regression Generalized Linear Models, Logistic Regression, - Poisson Regression- other Generalized Linear Models-Survival Analysis, Nonlinear Models, Splines- Decision- Random Forests,

TEXT BOOKS:

- 1) The Art of R Programming, A K Verma, Cengage Learning.
- 2) R for Everyone, Lander, Pearson
- 3) The Art of R Programming, Norman Matloff, No starch Press.

REFERENCE BOOKS:

- 1) R Cookbook, Paul Teetor, O'Reilly.
- 2) R in Action, Rob Kabacoff, Manning

CSE 412 : ELECTIVE-V CYBER SECURITY & DIGITAL FORENSICS

Common with 6 years integrated B.Tech(CSE)+M.Tech

Instruction: 3 Periods/week, Univ. Exam: 3 Hours Credits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

1. Introduction to Information Security Fundamentals and Best Practices: Protecting Your Computer and its Contents, Securing Computer Networks—Basics of Networking, Compromised Computers, Secure Communications and Information Security Best Practices, Privacy Guidelines, Safe Internet Usage.

2. Ethics in Cyber Security & Cyber Law: Privacy, Intellectual Property, Professional Ethics, Freedom of Speech, Fair User and Ethical Hacking, Trademarks, Internet Fraud, Electronic Evidence, Cybercrimes.

3. Penetration Testing: Overview of the web from a penetration testers perspective, Exploring the various servers and clients, Discussion of the various web architectures, Discussion of the different types of vulnerabilities, Defining a web application test scope and process, Defining types of penetration testing.

4. Web Application Security: Common Issues in Web Apps, What is XSS, SQL injection, CSRF, Password Vulnerabilities, SSL, CAPTCHA, Session Hijacking, Local and Remote File Inclusion, Audit Trails, Web Server Issues.

5. Forensics & Network Assurance: Forensic Technologies, Digital Evidence Collection, Evidentiary Reporting, Layered Defense, Surveillance and Reconnaissance, Outsider Thread Protection

6. Information Risk Management: Asset Evaluation and Business Impact Analysis, Risk Identification, Risk Quantification, Risk Response Development and Control, Security Policy, Compliance, and Business Continuity. Forensic investigation using Access Data FTK, En-Case

7. Cyber Incident Analysis and Response: Incident Preparation, Incident Detection and Analysis. Containment, Eradication, and Recovery. Proactive and Post-Incident Cyber Services, CIA triangle

Text Books:

1. The Official CHFI Study Guide for Computer Hacking Forensic Investigator by Dave Kleiman
2. CISSP Study Guide, 6th Edition by James M. Stewart
3. www.nist.gov/
4. Title: Cyber Forensics by Deje & S. Murugan, OXFORD university Press

CSE 412 : ELECTIVE-V-INTERNET OF THINGS

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 HoursCredits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

1) Introduction to the internet of things. IoT Architecture: History of IoT, M2M –Machine to Machine, Web of Things, IoTprotocolsThe Architecture The Layering concepts ,IoT Communication Pattern, IoT protocol Architecture, The 6LoWPAN

2) prototyping connected objects. Open-source prototyping platforms, Basics of IoTNetworking(IOT components and Gateways)

3) Integrating internet services. XML and JSON. HTTP APIs for accessing popular Internet services (Facebook, Twitter, and others). Practical activities.IoT Application Development: Application Protocols MQTT, REST/HTTP,CoAP, MySQL,RPL,

4) Overview of IoT supported Hardware platforms such as: Raspberry pi, ARM Cortex Processors, ArduinoandIntel Galileo boards

5)Ubiquitouscomputing,applications of IOT,Virtualization of network resources and physical devicesin IOT.

6) Internet of Things Standardisation M2M Service Layer Standardisation OGC Sensor Web for IoT

TEXT BOOK:

Internet OfThings: Converging Technologies ForSmart Environments And Integrated Ecosystems, Marina Ruggieri H, River Publishers Series In Communications

CSE 412 : ELECTIVE-V : CLOUDCOMPUTING

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 HoursCredits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives:

1. To import fundamental concepts in the area of cloud computing.
2. To understand the concept of Virtualization and cloud data storage.
3. To learn cloud Application Development and cloud Governance.
4. To gain competence in Map Reduce and Hadoop Overview.

Course Outcomes:

1. Identify the architecture and infrastructure of cloud computing.
2. Develop applications for cloud computing.
3. Design and Implement a novel cloud computing application.

SYLLABUS

1. Introduction to cloud computing: Cloud computing components, Infrastructure services,storage applications, database services – introduction to Saas, Paas, Iaas, Idaas, data storage incloud

2. Virtualization: enabling technologies, types of virtualization, server virtualization,desktop virtualization, memory virtualization, application and storage virtualization-tools andproducts available forvirtualization

3. SAAS and PAAS: Getting started with Saas, SaaSolutions,SOA , PaaSandbenefits.

4. Iaas and Cloud data storage: understanding Iaas, improving performance for load balancing,server types within Iaas, utilizing cloud based NAS devices, cloud based data storage, and backupservices, cloud based block storage and databaseservices

5. Cloud Application development: Client server distributed architecture for cloud designing cloud based solutions, coding cloud based applications, traditional Appsvs cloud Apps, clientside programming, server side programming overview-fundamental treatment of webapplication frameworks.

6. Cloud Governance and economics: Securing the cloud, disaster recovery and business continuityin the cloud, Managing the cloud, migrating to the cloud, governing and evaluating theclouds business impact andeconomics,

7. Inside Cloud: Introduction to MapReduce and Hadoop-over view of big data and its impact oncloud

TextBooks:

1. Cloud Computing: SaaS, PaaS, Iaas, Virtualization, Business Models, Mobile, Securityand More, Kris Jamsa, Jones & Bartlett Publishers,Paper back edition,2013

2. Hadoop Map Reduce cookbook, SrinathPerera and Thilina Gunarathne, Packtpublishing

References:

1.Cloud Computing: A Practical Approach,Anthony T .Velte, Toby J.Velte, Robert Elsenpeter, Tata McGraw HillEdition

CSE413 : GPS APPLICATIONS

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 Hours Credits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

UNIT-1:Development of NAVSTAR GPS. GPS Satellite configuration-Space segment, Control segment, User segment.

UNIT-2:GPS working principle, basic equations for finding user position, user position determination with least squares estimator.

UNIT-3:Other Global Satellite Constellations, GLONASS, GALILEO, Comparison of 3 GNSS (GPS, GALILEO, GLONASS) in terms of constellation and services provided.

UNIT-4:GPS Signal generation, Pseudorandom noise (PRN) code, C/A code, P code, Navigation data, Signal structure of GPS, signal power.

UNIT-5:Coordinate Systems: Geoid, Ellipsoid, Coordinate Systems, Geodetic and Geo centric coordinate systems, ECEF coordinates, world geodetic 1984 system, Conversion between Cartesian and geodetic coordinate frame.

UNIT-6:GPS Error sources, ionospheric effects on GPS signals and its mitigation methods.

UNIT-7:Satellite based augmentation system-need for GPS augmentation, GPS Aided GEO Augmented System (GAGAN).

Textbook:

1. G S RAO, Global Navigation Satellite Systems, McGraw-Hill Publications, New Delhi, 2010

2. Pratap Mishra, Global positioning system: signals, measurements, and performance, Ganga-Jamuna Press, 2006.

Reference Books:

1. Scott Gleason and DemozGebre-Egziabher, GNSS Applications and Methods, Artech House, 685 Canton Street, Norwood, MA 02062, 2009.

2. James Ba – Yen Tsui, 'Fundamentals of GPS receivers – A software approach', John Wiley & Sons (2001).

3. B.Hoffmann-Wellenhof, GPS theory and practice, 5th Edition, Springer 2001.

CSE 414 : COMPUTATIONAL BIOLOGY

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 HoursCredits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

1. Introduction: Definitions, Sequencing, Biological sequence/structure, Genome Projects, Pattern recognition and prediction, Folding problem, Sequence Analysis, Homology and Analogy, EMBnet, NCBI.

2. Protein Information Resources: Biological databases, Primary sequence databases, Protein Sequence databases, Secondary databases, Protein pattern databases, and Structure classification databases.

3. DNA Sequence analysis: DNA sequence databases, Importance of DNA analysis, Gene structure and DNA sequences, Features of DNA sequence analysis, EST (Expressed Sequence Tag) searches, Gene

hunting, Profile of a cell, EST analysis, Effects of EST data on DNA databases.

4. Pair wise alignment techniques: Database searching, Alphabets and complexity, Algorithm and programs, Comparing two sequences, subsequences, Identity and similarity, The Dotplot, Local and global similarity, different alignment techniques, Dynamic Programming, Pair wise database searching.

5. Multiple sequence alignment: Definition and Goal, The consensus, computational complexity, Manual methods, Simultaneous methods, Progressive methods, Databases of Multiple alignments and searching

6. Secondary database: Searching Importance and need of secondary database searches, secondary database structure and building a sequence search protocol

7. Analysis packages: Comprehensive packages, packages specializing in DNA analysis, Probability and Statistics: Introduction, The beginnings of modern probability theory, Chance and Risk, Degrees of certainty. Bayesian Logic.

Text Books:

1. Introduction to Bioinformatics, by T K Attwood & D J Parry-Smith Addison WesleyLongman

2. Bioinformatics- A Beginner s Guide by Jean-Michel Claveriw, CerdricNotredame, WILEY dreamlech India Pvt. Ltd Reference Books: 1. Introduction to Bioinformatics by M.Lesk OXFORD publishers (Indian Edition)

CSE415 : ENTERPRENUERSHIP

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 Hours Credits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Unit-I : Basic Concepts of Management: Management: Definition, Nature and Importance ; Functions of the Management; Levels of Management; F.W Taylor's Scientific Management; Henry Fayol's Principles of Management;

Unit-II: Forms of Business Organizations: Introduction, Types of Business organizations: Private Sector- Individual Ownership , Partnership, Joint stock companies and Co-Operative organizations; Public sector- Departmental Organizations, Public Corporations and Government Companies; The Joint sector Management.

Unit-III Production and operations Management: Plant location- Factors to be considered in the selection of Plant location; Break - even analysis-

Significance and managerial applications; Importance of Production Planning and Control and its Functions; Human Resource Management and Functions of Human Resource Manager (in brief); Functions of Marketing; Methods of Raising Finance.

Unit-IV Entrepreneurship : Definition, Characteristics and Skills , Types of Entrepreneurs, Entrepreneur vs. Professional Managers, , Growth of Entrepreneurs, Nature and Importance of Entrepreneurs, Women Entrepreneurs, Problems of Entrepreneurship.

Unit-V Entrepreneurial Development and Project Management: Institutions in aid of Entrepreneurship Development, Idea generation: Sources and Techniques; Stages in Project formulation ; Steps for starting a small enterprise - Incentives for Small Scale Industries by Government.

Text Books:

(1)Sharma,S.C, and Banga, T.R., Industrial Organization & Engineering Economics, Khanna Publishers, Delhi, 2000.

(2) Vasant Desai The Dynamics of Entrepreneurial Development and Management (Planning for future Sustainable growth), Himalayan Publishing House, 2018.

Reference Books:

(1) Aryasri , A.R., Management Science, McGraw Hill Education (India Private Limited , New Delhi 2014.

CSE 416 : CRYPTOGRAPHY & NETWORK SECURITY

Common with 6years integrated B.Tech(CSE)+M.Tech

Instruction: 3Periods/week, Univ. Exam: 3 Hours Credits: 3

Internal: 30 Marks University Exam: 70 Marks Total: 100 Marks

Course Objectives:

1. Introduction of the issues in network security- its need and importance, taxonomy and terminology.
2. Discussion of various cryptographic techniques.
3. Exploration of different types of security threats and remedies.
4. Understanding of Internet security protocols and standards

Course Outcomes:

1. Realize the need and importance of network and data security in the Internet and in the distributed environments.
2. Identify the different types of network security issues and their remedies.

3. Application various cryptographic tools and techniques in different contexts and as per need of security levels.

4. Implementation of some Internet security protocols and standards

SYLLABUS

1 Overview: Computer Security Concepts, Threats, Attacks, and Assets, Security Functional Requirements, A Security Architecture for Open Systems, Computer Security Trends, Computer Security Strategy. Cryptographic Tools: Confidentiality with Symmetric Encryption, Message Authentication and Hash Functions, Public-Key Encryption, Digital Signatures and Key Management, Random and Pseudorandom Numbers, Practical Application: Encryption of Stored Data. User Authentication: Means of Authentication, Password-Based Authentication, Token-Based Authentication, Biometric Authentication, Remote User Authentication, Security Issues for User Authentication, Practical Application: An Iris Biometric System, Case Study: Security Problems for ATM Systems.

2 Access Control: Access Control Principles, Subjects, Objects, and Access Rights, Discretionary Access Control, Example: UNIX File Access Control, Role-Based Access Control, Case Study: RBAC System for a Bank. Database Security: The Need for Database Security, Database Management Systems, Relational Databases, Database Access Control, Inference, Statistical Databases, Database Encryption, Cloud Security.

3 Malicious Software: Types of Malicious Software (Malware), Propagation—Infected Content—Viruses, Propagation—Vulnerability Exploit—Worms, Propagation—Social Engineering—SPAM E-mail, Trojans, Payload—System Corruption, Payload—Attack Agent—Zombie, Bots, Payload—Information Theft—Key loggers, Phishing, Spyware, Payload—Stealth—Backdoors, Root kits, Countermeasures. Denial-of-Service Attacks: Denial-of-Service Attacks, Flooding Attacks, Distributed Denial-of-Service Attacks, Application-Based Bandwidth Attacks, Reflector and Amplifier Attacks, Defenses Against Denial-of-Service Attacks, Responding to a Denial-of-Service Attack.

4 Intrusion Detection: Intruders, Intrusion Detection, Host-Based Intrusion Detection, Distributed Host-Based Intrusion Detection, Network-Based Intrusion Detection, Distributed Adaptive Intrusion Detection, Intrusion Detection Exchange Format, Honeypots, Example System: Snort. Firewalls and Intrusion Prevention Systems: The Need for Firewalls, Firewall Characteristics, Types of Firewalls, Firewall Basing, Firewall Location and Configurations, Intrusion Prevention Systems, Example: Unified Threat Management Products.

5 Buffer Overflow: Stack Overflows, Defending Against Buffer Overflows, Other Forms of Overflow Attacks, Software Security: Software Security Issues, Handling Program Input, Writing Safe Program Code, Interacting with the Operating System and Other Programs, Handling Program Output. Operating System Security: Introduction to Operating System Security, System Security Planning, Operating Systems Hardening, Application Security, Security Maintenance, Linux/Unix Security, Windows Security, Virtualization Security.

6 Symmetric Encryption and Message Confidentiality: Symmetric Encryption Principles, Data Encryption Standard, Advanced Encryption Standard, Stream Ciphers and RC4, Cipher Block Modes of Operation, Location of Symmetric Encryption Devices, Key Distribution. Public-Key Cryptography and Message Authentication: Secure Hash Function, HMAC, The RSA Public-Key Encryption Algorithm, Diffie-Hellman and Other Asymmetric Algorithms.

7 Internet Security Protocols and Standards: Secure E-mail and S/MIME, Domain Keys Identified Mail, Secure Socket Layer (SSL) and Transport Layer Security (TLS), HTTPS, IPv4 and IPv6 Security. Internet Authentication Applications: Kerberos, X.509, Public-Key Infrastructure, Federated Identity Management. Wireless Network Security: Wireless Security Overview, IEEE 802.11 Wireless LAN Overview, IEEE 802.11i Wireless LAN Security.

Text Book:

1. Computer Security - Principles and Practices (Except the Chapters 13, 14, 15, 16, 17, 18, 19), 2nd Edition by William Stallings, Pearson Education, Inc.

Reference Books:

1. Cryptography and Network Security by William Stallings, Pearson Education Asia, New Delhi.
2. Network Security Essentials Applications and Standards, by William Stallings, Pearson Education Asia, New Delhi.

CSE 417 : ELECTIVE-IV LAB BIG DATA ANALYTICS LAB

Common with 6 years integrated B.Tech(CSE)+M.Tech and B.Tech(IT)
Instruction: 3 Periods +0 Tut/week, Univ. Exam: 3 Hours Credits: 1.5
Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

Getting Hadoop Up and Running in a cluster:

1. Setting up Hadoop on a standalone machine.
2. Wordcount Map Reduce program using standalone Hadoop.
3. Adding the combiner step to the Wordcount Map Reduce program.
4. Setting up HDFS.

5. Using HDFS monitoring UI
 6. HDFS basic command-line file operations.
 7. Setting Hadoop in a distributed cluster environment.
 8. Running the WordCount program in a distributed cluster environment.
 9. Using Map Reduce monitoring UI
- Hadoop Map Reduce Applications:
10. Choosing appropriate Hadoop datatypes.
 11. Implementing a custom Hadoop Writable datatype.
 12. Implementing a custom Hadoop keytype.
 13. Emitting data of different value types from a mapper.
 14. Choosing a suitable Hadoop Input Format for your input data format.
 15. Formatting the results of Map Reduce Computation – using HadoopOutputFormats.Analytics
 16. Simple analytics using MapReduce.
 17. Performing Group-By using MapReduce.
 18. Calculating frequency distributions and sorting using MapReduce.
 19. Plotting the Hadoop results using GNUplot.
 20. Calculating histograms using MapReduce.
 21. Calculating scatter plots using MapReduce.
 22. Parsing a Complex dataset with Hadoop.
 23. Joining two datasets using MapReduce.

Text Book:

Hadoop Map Reduce Cookbook, Srinath Perera & Thilina Gunarathne, 2013, PACKT PUBLISHING.

CSE 417 : ELECTIVE-IV LAB : MACHINE LEARNING LAB

Common with 6 years integrated B.Tech(CSE)+M.Tech and B.Tech(IT)
Instruction: 3 Periods +0 Tut/week, Univ. Exam: 3 Hours Credits: 1.5
Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

Course objectives:

This course will enable students to

1. Make use of Data sets in implementing the machine learning algorithms.
2. Implement the machine learning concepts and algorithms in any suitable language of choice.

Course outcomes:

The students should be able to:

1. Understand the implementation procedures for the machine learning algorithms.
2. Design Java/Python programs for various Learning algorithms.
3. Apply appropriate data sets to the Machine Learning algorithms.
4. Identify and apply Machine Learning algorithms to solve real world problems.

Description (If any):

1. The programs can be implemented in either JAVA or Python.
2. For Problems 1 to 6 and 10, programs are to be developed without using the built-in classes or APIs of Java/Python.
3. Data sets can be taken from standard repositories (<https://archive.ics.uci.edu/ml/datasets.html>) or constructed by the students.

Lab Experiments:

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.

9. Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.

10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

CSE 417 : ELECTIVE-IV LAB : R- PROGRAMMING LAB

Common with 6years integrated B.Tech(CSE)+M.Tech and B.Tech(IT)

Instruction: 3 Periods +0Tut/week, Univ. Exam: 3Hours Credits: 1.5

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

1. Implement the Following
 - a. To create a data frame df1 to contain 10 observations and 3 variables, column with letters, column 2 with random numbers and column 3 with first 10 natural numbers.
 - b. Create df3 by merging df1 by column1 with another data frame df2 containing 20 observations and 2 variables column4 with letters, column5 with sequence of 20 real numbers from 0 to 1 in equal steps
 - c. Find the dimensionality of data frame df3.
 - d. Rename observations whose column1 value is 'D' from data frame df3
2. Implement the following
 - a. Create h1 to contain 1000 random numbers, distributed in normal distribution and plot the histogram with colors.
 - b. Create a data frame to contain randomly drawn samples of 25 cards from 52 distinct cards with replacements. Use 'table' function to find the 'duplicated' and tabulate the list of cards and their frequency of occurrence in the sample.
3. Write R Program using 'apply' group of functions to create and apply normalization function on each of the numeric variables/columns of iris dataset to transform them into
 - a. 0 to 1 range with min-max normalization.
 - b. a value around 0 with z-score normalization.
4. Create a data frame with 10 observations and 3 variables and add new rows and columns to it using 'rbind' and 'cbind' function.
5. Create a function to discretize a numeric variable into 3 quantiles and label them as low, medium, and high. Apply it on each attribute of iris dataset to create a new data frame. 'discrete_iris' with Categorical variables and the class label.

6. Write R program to find the approximate value of π (pi) by simulation using a large number of uniformly distributed data points with their coordinates in the range of [-1,1] and find the ratio of number of points within the circle of radius 1, to total number of data points. Observe the improvement in accuracy of result with the increased number of data points distributed.

7. Write R programs to find the probability of a variable to have a given value in different distributions like Uniform, Normal, Poisson and Binomial using 'pnorm', 'ppois', and the other such functions.

8. Apply 'ddply' for data summarization of iris dataset based on 'species' and get the same summarization using 'sqldf'

9. After attaching data set 'mtcars' to access its variables, use R statements to visualize the relationship between the variables of 'mtcars':

- using scatter plots with colors.
- boxplots showing the spread of the variable 'mpg' for different values of 'cyl'.
- Find correlations between all pairs of variables.

10. Write R program to implement linear and multiple regression on 'mtcars' dataset to estimate the value of 'mpg' variable, with best R^2 and plot the original values in 'green' and predicted values in 'red'.

11. Write R program to create new variables in low dimensional space using

- PCA and
- SVD and use them for predicting the values of 'mpg' variable.

12. Write R Programs to apply k-mean clustering on 'iris' data set and get the summary statistics. Implement a mini-project to process a collection of text documents / tweets and apply tokenization, stopword removal and stemming to represent the collection as a document – term matrix reflecting the term frequencies. Cluster the documents using a simple clustering algorithm and estimate the purity of the clustering solution.

CSE418 : ELECTIVE-V LAB : CYBER SECURITY LAB

Common with 6 years integrated B.Tech(CSE)+M.Tech

Instruction: 3 Periods/week Credits: 1.5

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

Module-1:

The students will be exposed to different types of attack scenarios and hacking tools with respect to security. Open source tools will be used for the implementation of the lab experiments

Module-II

The students will be exposed to different case studies of cyber-attacks and using open source Cyber Forensic tools they will examine the case.

CSE 418 : ELECTIVE-V LAB: INTERNET OF THINGS LAB

Common with 6 years integrated B.Tech(CSE)+M.Tech

Instruction: 3 Periods Univ. Exam: 3 Hours Credits: 1.5

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

LIST OF EXPERIMENTS:

- Study Of Various Network Protocols Used In IoT.
- Application Of Wifi In IoT Systems.
- Application Of 6lowpan In IoT Systems.
- Application Of Bluetooth In IoT Systems.
- Application Of 802.15.4 Zigbee. In IoT Systems.
- Design A Simple IoT System Comprising Sensors, Wireless Network Connection, Data Analytics

CSE418 : ELECTIVE-V LAB : CLOUD COMPUTING LAB

Common with 6 years integrated B.Tech(CSE)+M.Tech

Instruction: 3 Periods/week Credits: 1.5

Internal: 50 Marks University Exam: 50 Marks Total: 100 Marks

Use Eucalyptus or Open Nebula or equivalent to set up the cloud and demonstrate.

- Find procedure to run the virtual machine of different configuration. Check how many virtual machines can be utilized at particular time.
- Find procedure to attach virtual block to the virtual machine and check whether it holds the data even after the release of the virtual machine.
- Install a C compiler in the virtual machine and execute a sample program.
- Show the virtual machine migration based on the certain condition from one node to the other.
- Find procedure to install storage controller and interact with it.

COMMON SCHEME OF INSTRUCTION & EXAMINATION

IV/IV B.TECH (FOUR YEAR COURSE) &

IV/VI B.TECH (SIX YEAR DOUBLE DEGREE COURSE)

(With effect from 2019-2020 admitted batch onwards)

B.TECH. (CSE) IV YEAR II-SEMESTER SCHEME OF INSTRUCTION AND EXAMINATION

Sub. Ref	Name of the Subject	Periods			Maximum Marks		Credits
		Theory	Tutorial	Lab	Exam	Sessionals	
CSE421	PROJECT WORK	—	—	—	50	50	14.5
	TOTAL						14.5

GUIDELINES for doing the Project Work:

1. Candidates can do their thesis work within the department or in any industry/research organization for one full semester i.e. in the 4th year 2nd semester of their study. In case of project done in an industry/research organization, one advisor (Guide) should be from the department and one advisor (Co-Guide) should be from the industry/research organization.

2. Students should work in teams of 3 to 4 members and submit the thesis on the project work done by them.

Format for Preparation of Project Thesis For B. Tech (CSE):

1. Arrangement Of Contents: The sequence in which the project report material should be arranged and bound should be as follows:

1. Cover Page & TitlePage
2. BonafideCertificate
3. Abstract
4. Table ofContents
5. List ofTables
6. List of Figures
7. List of Symbols, Abbreviations andNomenclature
8. Chapters
9. Appendices
10. References

Appendix "V" Item No.41

M.Tech. (Electrical Engineering) Specialization: Control Systems Engineering (CSE)

SYLLABUS FOR M.Tech.(CONTROL SYSTEMS ENGINEERING)

EECS 1.3(b)ADVANCED CONTROL SYSTEMS

Credits : 4 Lectures per week : 4

Theory, Univ. Exam. Marks : 70 Sessional Marks : 30 Total Marks : 100

State-Space Representation :: Introduction, Concept of State, State Equation , Output Equation, State model, Time-Invariance and Linearity, Non-uniqueness of State Model, State Diagrams for continuous-time systems. State Models For Continuous-Time Systems.

State-Space Representation Using Phase Variables, State-Space Representation Using Canonical Variables, Derivation of Transfer function from state model, Diagonalization, Eigenvalues, Eigenvectors, Canonical-Form Representation of Linear Operators, Generalized Eigenvector, Jordan Canonical Form.

Solution of State Equation, Properties of State-Transition matrix, Computation of State Transition matrix, Solutions of Linear Time-Varying continuous-time state equations , Homogeneous Solution, Non-homogeneous Solution.

Concepts of Controllability and Observability , Kalman test and Gilberts Test, Controllability Grammian, Observability Grammians, Controllable and Observable Companion forms for SISO and MIMO systems.

Control Systems Design in State-Space:: Pole-placement , Necessary and Sufficient Condition for Arbitrary Pole Placement, Determination of State-Feedback gain matrix , State Observers, Full-order Observer, Minimum order Observer, Design of observer gain matrix.

Stability :: Introduction Equilibrium Points
Stability in the sense of Lyapunov BIBO Stability,
Stability of LTISystem, Equilibrium Stability of Nonlinear Continuous -
Time Autonomous Systems,
The Direct Method of Lyapunov and the Linear Continuous
Time Autonomous Systems,
Finding Lyapunov Functions for Nonlinear Continuous -
Time Autonomous Systems Krasovskii and Variable Gradient Method.

(1) M. Gopal, Modern Control Systems Theory , New-Age International Publishers.

(2) I. J. Nagrath, M. Gopal, Control Systems Engineering , New-Age International Publishers.

(3) Katsuhiko Ogata, Modern Control Engineering , PHI learning Private Limited.

Appendix " W " Item No. 45

Computer Science and Systems Engineering
AU College of Engineering (Autonomous)

M.Tech

Artificial Intelligence & Machine Learning

Course Structure and Scheme of Valuation w.e.f. 2021-2022

I-SEMESTER

Code	Name of the subject	Periods/week		Max. Marks		Total Credits	
		Theory	Lab	Ext.	Int.		
MTAIML11	Mathematics for Machine Learning	3	-	70	30	100	3
MTAIML12	Artificial Intelligence	3	-	70	30	100	3
MTAIML13	Elective-I	3	-	70	30	100	3
MTAIML14	Elective-II	3	-	70	30	100	3
MTCST15	Research Methodology & IPR	3	-	70	30	100	2
MTCST16 0	Organizational Behavior(Audit Course)		3	-	70	30	100
MTAIML17	Artificial Intelligence Lab	-	3	50	50	100	2
MTAIML18	Data mining Lab using Python	-	3	50	50	100	2
Total		18	6	520	280	800	18

Elective-I: **Data Mining/Cloud Computing/Evolutionary Computing**

Elective II: **Big Data Analytics/Internet of Things/Pattern Recognition**

II-SEMESTER

Code	Name of the subject	Periods/week		Max. Marks		Total Credits	
		Theory	Lab	Ext.	Int.		
MTAIML21	Machine Learning	3	-	70	30	100	3
MTAIML22	Soft Computing	3	-	70	30	100	3
MTAIML23	Elective-III	3	-	70	30	100	3
MTAIML24	Elective-IV	3	-	70	30	100	3
MTCST25	Entrepreneurship (Audit Course)	3	-	70	30	100	0
MTAIML26	Machine Learning Lab	-	3	50	50	100	2
MTAIML27	Soft Computing Lab	-	3	50	50	100	2
MTAIML28	Mini Project With Seminar	-	3	-	100	100	2
Total		15	9	450	350	800	18

Elective-III: Computer Vision/Natural Language Processing/Recommender Systems

Elective-IV: Robotics and Intelligent Systems/Reinforcement Learning/NoSQL Databases

III-SEMESTER

Code	Name of the subject	Periods/week		Max. Marks		Total Credits	
		Theory	Lab	Ext.	Int.		
MTAIMLR31	Elective-V	3	-	70	30	100	3
MTAIMLR32	Open Elective	3	-	70	30	100	3
MTAIMLR33	Dissertation-I / Industrial project		-	100	-	100	10
Total		6	-	240	60	300	16

Elective V : Deep Learning/Expert Systems/High Performance Computing

Open Elective :Business Analytics/Operations Research/Social Media Analytics

IVSEMESTER

Code	Name of the subject	Periods/week		Max. Marks		Total Credits	
		Theory	Lab	Ext.	Int.		
MTCSTAIR41 16	Dissertation - II		-	-	100	-	100
Total		-	-	100	-	100	16

Detailed Syllabus for M.Tech (AI&ML) First Semester

MTAIML11 MATHEMATICAL FOR MACHINE LEARNING

Instruction: 3Periods/week Time:3Hours Credits:3

Internal: 30Marks External:70Marks Total: 100Marks

Course Objectives:

- Gain foundation in mathematical concepts related to Linear algebra necessary for ML
- Understands the concepts related to Orthogonality and rotations
- Learns different forms of matrix decompositions
- Understands the concepts of differentiation for finding gradients and curvatures
- Learns various optimization methods

Course Outcomes: At the end of the course, student will be able to

- Attains the capability to solve linear equations and define mappings
- Extract latent orthogonal features from the set of examples using PCA / SVD

- Estimate the gradients of matrices to apply back propagation and other techniques for parameter update
- Capable of estimating the summary statistics of datasets and select appropriate model to fit the data

UNIT-I : Linear Algebra: Systems of Linear Equations, Matrices, Solving Systems of Linear Equations, Vector Spaces, Linear Independence, Basis and Rank, Linear Mappings, Affine Spaces

UNIT-II : Analytic Geometry: Norms, Inner Products, Lengths and Distances, Angles and Orthogonality, Orthonormal Basis, Orthogonal Complement, Inner Product of Functions, Orthogonal Projections, Rotations

UNIT-III : Matrix Decompositions: Determinant and Trace, Eigen values and Eigen vectors, Cholesky Decomposition, Eigen decomposition and Diagonalization, Singular Value Decomposition, Matrix Approximation, Matrix Phylogeny

UNIT-IV : Vector Calculus : Differentiation of Univariate Functions, Partial Differentiation and Gradients, Gradients of Vector-Valued Functions, Gradients of Matrices, Useful Identities for Computing Gradients, Backpropagation and Automatic Differentiation, Higher-Order Derivatives, Linearization and Multivariate Taylor Series

UNIT-V : Probability and Distributions: Construction of a Probability Space, Discrete and Continuous Probabilities, Sum Rule, Product Rule, and Bayes' Theorem, Summary Statistics and Independence, Gaussian Distribution, Conjugacy and the Exponential Family, Change of Variables/Inverse Transform

UNIT-VI : Continuous Optimization: Optimization Using Gradient Descent, Constrained Optimization and Lagrange Multipliers, Convex Optimization

Text Books:

1. "Mathematics for Machine Learning", Marc Peter Deisenroth, A. Aldo Faisal and Cheng Soon Ong, Cambridge University Press.
2. The Elements of Statistical Learning: Data Mining, Inference, and Prediction, 2nd Edition, Trevor Hastie, Robert Tibshirani, Jerome Friedman, Springer 2017.

Reference Books:

1. Machine Learning: An Applied Mathematics Introduction, Paul Wilmott, Panda Ohana Publishing 2019.

MTAIML12 ARTIFICIAL INTELLIGENCE

Instruction: 3Periods/week Time:3Hours Credits:3

Internal: 30Marks External:70Marks Total: 100Marks

Course Objectives:

- Gain a historical perspective of Artificial Intelligence (AI) and its foundations.
- Become familiar with basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning.
- Investigate applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
- Experience AI development tools such as an 'AI language', expert system shell, and/or data mining tool. Experiment with a machine learning model for simulation and analysis.
- Explore the current scope, potential, limitations, and implications of intelligent systems.

Course Outcomes (COs): At the end of the course, student will be able to

- Demonstrate knowledge of the building blocks of AI as presented in terms of intelligent agents.
- Analyze and formalize the problem as a state space, graph, design heuristics and select amongst different search or game based techniques to solve them.
- Develop intelligent algorithms for constraint satisfaction problems and also design intelligent systems for Game Playing.
- Attain the capability to represent various real life problem domains using logic based techniques and use this to perform inference or planning.
- Solve problems with uncertain information using Bayesian approaches.

UNIT-I: Introduction to artificial intelligence: Introduction, history, intelligent systems, Turing Test, Role of Knowledge, AI applications, tic-tac-tie game playing, current trends in AI,

Problem solving: state-space search and control strategies: Introduction, general problem solving, characteristics of problem, AI problem solving as state space search, exhaustive searches, heuristic search techniques, Hill climbing , A* algorithms,

UNIT-II: Logic and Theorem Proving concepts: Introduction, propositional calculus, propositional logic, natural deduction system, axiomatic system, semantic tableau system in propositional logic, resolution refutation in propositional logic, predicate logic

UNIT-III: Problem reduction and game playing: Introduction to problem reduction, AO* algorithm, constraint satisfaction algorithm, Cryptarithmic Problem solving, Means Ends analysis, game playing, Min-Max algorithm for game playing, alpha-beta pruning, iterative-deepening, two-player perfect information games,

UNIT-IV : Representation of Knowledge with Rules: Production System, Forward versus Backward chaining, Rule Matching and chain control, Non-Monotonic reasoning, Truth maintenance systems,

UNIT-V: Uncertain Reasoning: Probability theory: Introduction, probability theory, Bayes theorem, Bayesian belief networks, certainty factor theory, Dempster-Shafer theory, Statistical Inference

UNIT-VI: Knowledge representation: Introduction, approaches to knowledge representation, knowledge representation using semantic network, extended semantic networks for KR, knowledge representation using frames, advanced knowledge representation techniques: Introduction, conceptual dependency theory, script structure, cyc theory, case grammars, semantic web.

UNIT-VII: Planning: Overview, Blocks world as example, components of planning system, Goal stack planning, Nonlinear planning, Hierarchical planning, Reactive Systems

Expert Systems: Representing and using Domain knowledge, examples of expert systems, Expert system Architectures, Components, Building an expert system, Expert system shells

Text Books:

1. Artificial intelligence, A modern Approach, 2nded, Stuart Russel, Peter Norvig, Prentice Hall
2. Artificial Intelligence- 3rd Edition, Rich, Kevin Knight, Shiv Shankar B Nair, TMH
3. Introduction To Artificial Intelligence And Expert Systems, 1st Edition, Patterson, Pearson India, 2015

Reference Books:

1. Artificial intelligence, structures and Strategies for Complex problem solving, 5th Edition, George F Luger, PEA
2. Introduction to Artificial Intelligence, Ertel, Wolf Gang, Springer, 2017
3. Artificial Intelligence, SarojKaushik, 1st Edition, CENGAGE Learning, 2011

MTAIML13 ELECTIVE-I DATA MINING

Instruction: 3Periods/week Time:3Hours Credits:3

Internal: 30Marks External:70Marks Total: 100Marks

Course Outcomes:

After the completion of the course, student will be able to:

- Compare types of data, quality of data, suitable measures required to perform data analysis. (UNIT-I)
- Choose appropriate classification technique to perform classification, model building and evaluation (UNIT-II)
- Make use of association rule mining techniques on categorical and continuous data (UNIT III)
- Identify and apply clustering algorithm (with open source tools), interpret, evaluate and report the result (UNIT IV)
- Analyze and Compare anomaly detection techniques (UNI-V)

Unit I: Introduction to Data mining, types of Data, Data Quality, Data Processing, Measures of Similarity and Dissimilarity, Exploring Data: Data Set, Summary Statistics, Visualization, OLAP and multi-dimensional data analysis.

Unit II: Classification: Basic Concepts, Decision Trees and model evaluation: General approach for solving a classification problem, Decision Tree induction, Model over fitting: due to presence of noise, due to lack of representation samples, Evaluating the performance of classifier

Unit III : Nearest Neighborhood classifier, Bayesian Classifier, Support vector Machines: Linear SVM, Separable and Non Separable case.

Unit IV: Association Analysis: Problem Definition, Frequent Item-set generation, a priori Algorithm, rule generation, compact representation of frequent item sets, FP-Growth Algorithms.

Unit-V: Handling Categorical, Continuous attributes, Concept hierarchy, Multi-dimensional Association Rules, Sequential pattern mining, Sub graph pattern mining algorithms

Unit VI : Clustering: Over view, K-means, Agglomerative Hierarchical clustering, DBSCAN, Cluster evaluation: overview, Unsupervised Cluster Evaluation using cohesion and separation, using proximity matrix, Scalable Clustering algorithm

Unit VII: Anomaly Detection: Characteristics of Anomaly Detection Problems and Methods, Statistical Approaches, Proximity-based Approaches, Clustering-based Approaches and Reconstruction-based Approaches

Text Books:

1. Introduction to Data Mining: Pang-Ning Tan; Michael Steinbach; AnujKarpatne; Vipin Kumar, 2nd edition.
2. Data Mining, Concepts and Techniques, 2nd edition, Jiawei Han, MichelineKamber, Elsevier, 2006.

Reference Books:

1. Fundamentals of data warehouses, 2nd edition, Jarke, Lenzerini, Vassiliou, Vassiliadis, Springer.

Suggested NPTEL Course and other Useful Websites:

1. <https://nptel.ac.in/courses/106105174/>
2. <http://cse20-iiith.vlabs.ac.in/>

MTAIML13 ELECTIVE-I CLOUD COMPUTING

Instruction: 3Periods/week Time:3Hours Credits:3

Internal: 30Marks External:70Marks Total: 100Marks

Course Objectives:

- To implement Virtualization
- To implement Task Scheduling algorithms.
- Apply Map-Reduce concept to applications.
- To build Private Cloud.
- Broadly educate to know the impact of engineering on legal and societal issues involved.

Course Outcomes: At the end of the course, student will be able to

- Interpret the key dimensions of the challenge of Cloud Computing
- Examine the economics, financial, and technological implications for selecting cloud computing for own organization.
- Assessing the financial, technological, and organizational capacity of employer's for actively initiating and installing cloud-based applications
- Evaluate own organizations' needs for capacity building and training in cloud computing-related IT areas.
- Illustrate Virtualization for Data-Center Automation.

UNIT I: Introduction: Network centric computing, Network centric content, peer-to-peer systems, cloud computing delivery models and services, Ethical issues, Vulnerabilities, Major challenges for cloud computing. Parallel and Distributed Systems: Introduction, architecture, distributed systems, communication protocols, logical clocks, message delivery rules, concurrency, model concurrency with Petri Nets.

UNIT II: Cloud Infrastructure: At Amazon, The Google Perspective, Microsoft Windows Azure, Open Source Software Platforms, Cloud storage diversity, Inter cloud, energy use and ecological impact, responsibility sharing, user experience, Software licensing,

UNIT-III : Cloud Computing :Applications and Paradigms: Challenges for cloud, existing cloud applications and new opportunities, architectural styles, workflows, The Zookeeper, The Map Reduce Program model, HPC on cloud, biological research.

UNIT IV: Cloud Resource virtualization: Virtualization, layering and virtualization, virtual machine monitors, virtual machines, virtualization- full and para, performance and security isolation, hardware support for virtualization, Case Study: Xen, vBlades,

UNIT-V : Cloud Resource Management and Scheduling: Policies and Mechanisms, Applications of control theory to task scheduling, Stability of a two-level resource allocation architecture, feedback control based on dynamic thresholds, coordination, resource bundling, scheduling algorithms, fair queuing, start time fair queuing, cloud scheduling subject to deadlines, Scheduling Map Reduce applications, Resource management and dynamic application scaling.

UNIT VI: Storage Systems: Evolution of storage technology, storage models, file systems and database, distributed file systems, general parallel file systems. Google file system. Apache Hadoop, Big Table, Megastore (text book 1), Amazon Simple Storage Service(S3) (Text book 2), Cloud Security: Cloud security risks, security – a top concern for cloud users, privacy and privacy impact assessment, trust, OS security, Virtual machine security, Security risks.

UNIT VII: Cloud Application Development: Amazon Web Services : EC2 – instances, connecting clients, security rules, launching, usage of S3 in Java, Installing Simple Notification Service on Ubuntu 10.04, Installing Hadoop on Eclipse, Cloud based simulation of a Distributed trust algorithm, Cloud service for adaptive data streaming (Text Book 1), Google: Google App Engine, Google Web Toolkit (Text Book 2), Microsoft: Azure Services Platform, Windows live, Exchange Online, Share Point Services, Microsoft Dynamics CRM (Text Book2).

Text Books:

1. Cloud Computing, Theory and Practice, Dan C Marinescu, MK Elsevier
2. Cloud Computing, A Practical Approach, Anthony T Velte, Toby J Velte, Robert Elsenpeter, TMH

Reference book:

1. Mastering Cloud Computing, Foundations and Application Programming, Raj Kumar Buyya, Christen vecctiola, S Tammaraiselvi, TMH

MTAIML13 ELECTIVE-I EVOLUTIONARY COMPUTING

Instruction: 3Periods/week Time:3Hours Credits:3

Internal: 30Marks External:70Marks Total: 100Marks

SYLLABUS

1. Problems to Be Solved: Optimisation, Modelling, and Simulation Problems, Search Problems, Optimisation Versus Constraint Satisfaction, The Famous NP Problems.

Evolutionary Computing: The Main Evolutionary Computing Metaphor, The Inspiration from Biology, Evolutionary Computing: Why?

2. Evolutionary Algorithm: Components of Evolutionary Algorithms, An Evolutionary Cycle by Hand, Example Applications, The Operation of an Evolutionary Algorithm, Natural Versus Artificial Evolution, Evolutionary Computing, Global Optimisation, and Other Search Algorithms.

Representation, Mutation, and Recombination: Representation and the Roles of Variation Operators, Binary Representation, Integer Representation, Real-Valued or Floating-Point Representation, Permutation Representation, Tree Representation.

3. Fitness, Selection, and Population Management: Population Management Models, Parent Selection, Survivor Selection, Selection Pressure, Multimodal Problems, Selection, and the Need for Diversity.

Popular Evolutionary Algorithm Variants: Genetic Algorithms, Evolution Strategies, Evolutionary Programming, Genetic Programming, Learning Classifier Systems, Differential Evolution, Particle Swarm Optimisation, Estimation of Distribution Algorithms.

4. Parameters and Parameter Tuning: Evolutionary Algorithm Parameters, EAs and EA Instances, Designing Evolutionary Algorithms, The Tuning Problem, Algorithm Quality: Performance and Robustness, Tuning Methods.

Parameter Control: Introduction, Examples of Changing Parameters, Classification of Control Techniques, Examples of Varying EA Parameters,

5. Working with Evolutionary Algorithms: What Do You Want an EA to Do?, Performance Measures, Test Problems for Experimental Comparisons, Example Applications.

Hybridisation with Other Techniques: Memetic Algorithms, Motivation for Hybridising EAs, Structure of a Memetic Algorithm, Adaptive Memetic Algorithms, Design Issues for Memetic Algorithms, Example Application: Multistage Memetic Timetabling.

6. Nonstationary and Noisy Function Optimisation: Characterisation of Nonstationary Problems, The Effect of Different Sources of Uncertainty, Algorithmic Approaches

Multi-objective Evolutionary Algorithms: Multi-objective Optimisation Problems, Dominance and Pareto Optimality, EA Approaches to Multi-objective Optimisation, Example Application: Distributed Coevolution of Job Shop Schedules.

7. Constraint Handling: Two Main Types of Constraint Handling, Approaches to Handling Constraints, Example Application: Graph Three-Colouring

Interactive Evolutionary Algorithms: Characteristics of Interactive Evolution, Algorithmic Approaches to the Challenges of IEAs, Interactive Evolution as Design vs. Optimisation, Example Application: Automatic Elicitation of User Preferences.

Text book:

Introduction to Evolutionary Computing, A.E. Eiben , J.E. Smith, © Springer-Verlag Berlin Heidelberg 2015

MTAIML14 ELECTIVE-II BIG DATA ANALYTICS

Instruction: 3Periods/week

Time:3Hours

Credits:3

Internal: 30Marks External:70Marks Total: 100Marks

Course Objectives:

This course is aimed at enabling the students to

- Provide an overview of an exciting growing field of big data analytics.
- Introduce the tools required to manage and analyze big data like Hadoop, NoSQL, Map Reduce, HIVE, Cassandra, Spark.
- Teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.
- Optimize business decisions and create competitive advantage with Big Data analytics

Course Outcomes:

After the completion of the course, student will be able to

- Illustrate on big data and its use cases from selected business domains.
- Interpret and summarize on NoSQL, Cassandra
- Analyze the HADOOP and Map Reduce technologies associated with big data analytics and explore on Big Data applications Using Hive.
- Make use of Apache Spark, RDDs etc. to work with datasets.
- Assess real time processing with Spark Streaming.

UNIT I: What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics.

UNIT II: Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases,

schema less databases, materialized views, distribution models, sharding, master-slave replication, peer- peer replication, sharding and replication, consistency, relaxing consistency, version stamps, Working with Cassandra ,Table creation, loading and reading data.

UNIT III: Data formats, analyzing data with Hadoop, scaling out, Architecture of Hadoop distributed file system (HDFS), fault tolerance ,with data replication, High availability, Data locality , Map Reduce Architecture, Process flow, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization.

UNIT-IV: Introduction to Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, Logical joins, Window functions, Optimization, Table partitioning, Bucketing, Indexing, Join strategies.

UNIT V: Apache spark- Advantages over Hadoop, lazy evaluation, In memory processing, DAG, Spark context, Spark Session, RDD, Transformations- Narrow and Wide, Actions, Data frames ,RDD to Data frames, Catalyst optimizer, Data Frame Transformations, Working with Dates and Timestamps, Working with Nulls in Data,

UNIT-VI : Working with Complex Types, Working with JSON, Grouping, Window Functions, Joins, Data Sources, Broadcast Variables, Accumulators, Deploying Spark- On-Premises Cluster Deployments, Cluster Managers- Standalone Mode, Spark on YARN , Spark Logs, The Spark UI- Spark UI History Server, Debugging and Spark First Aid

UNIT VII: Spark-Performance Tuning, Stream Processing Fundamentals, Event-Time and State full Processing - Event Time, State full Processing, Windows on Event Time- Tumbling Windows, Handling Late Data with Watermarks, Dropping Duplicates in a Stream, Structured Streaming Basics - Core Concepts, Structured Streaming in Action, Transformations on Streams, Input and Output.

Text Books:

1. Big Data, Big Analytics: Emerging, Michael Minnelli, Michelle Chambers, and AmbigaDhiraj
2. SPARK: The Definitive Guide, Bill Chambers & Matei Zaharia, O'Reilly, 2018 Edition
3. Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013
4. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World Polyglot Persistence", Addison-Wesley Professional, 2012
5. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilly, 2012

Reference Books:

1. "Hadoop Operations", O'Reilly, Eric Sammer, 2012

2. "Programming Hive", O'Reilly, E. Capriolo, D. Wampler, and J. Rutherglen, 2012

3. "HBase: The Definitive Guide", O'Reilly, Lars George, 2011

4. "Cassandra: The Definitive Guide", O'Reilly, Eben Hewitt, 2010

5. "Programming Pig", O'Reilly, Alan Gates, 2011

MTA1ML14 ELECTIVE-II INTERNET OF THINGS

Instruction: 3 Periods/week

Time: 3 Hours

Credits: 3

Internal: 30 Marks External: 70 Marks Total: 100 Marks

Course Objectives:

- Vision and Introduction to Internet of Things (IoT).
- Understand IoT Market perspective.
- Data and Knowledge Management and use of Devices in IoT Technology.
- Understand State of the Art – IoT Architecture.
- Understand Real World IoT Design Constraints, Industrial Automation and Commercial.

Course Outcomes (COs): At the end of the course, student will be able to

- Explain in a concise manner how the general Internet as well as Internet of Things work.
- Understand constraints and opportunities of wireless and mobile networks for Internet of Things.
- Use basic sensing and measurement and tools to determine the real-time performance of network of devices.
- Develop prototype models for various applications using IoT technology.

UNIT I: The Internet of Things: An Overview of Internet of things, Internet of Things Technology, behind IoTs Sources of the IoTs, M2M Communication, Examples of IoTs, Design Principles For Connected Devices Internet Connectivity Principles, Internet connectivity, Application Layer Protocols: HTTP, HTTPS, FTP, Telnet.

UNIT II: Business Models for Business Processes in the Internet of Things ,IoT/M2M systems LAYERS AND designs standardizations ,Modified OSI Stack for the IoT/M2M Systems ,ETSI M2M domains and High- level capabilities ,Communication Technologies, Data Enrichment and Consolidation and Device Management Gateway Ease of designing and affordability

UNIT III: Design Principles for the Web Connectivity for connected- Devices, Web Communication protocols for Connected Devices, Message

Communication protocols for Connected Devices, Web Connectivity for connected-Devices.

UNIT IV: Data Acquiring, Organizing and Analytics in IoT/M2M, Applications /Services /Business

Processes, IOT/M2M Data Acquiring and Storage, Business Models for Business Processes in the Internet Of Things, Organizing Data, Transactions, Business Processes, Integration and Enterprise Systems.

UNIT V: Data Collection, Storage and Computing Using a Cloud Platform for IoT/M2M Applications/Services, Data Collection, Storage and Computing Using cloud platform Everything as a service and Cloud Service Models, IOT cloud-based services using the Xively (Pachube/COSM), Nimbits and other platforms Sensor, Participatory Sensing, Actuator, Radio Frequency Identification, and Wireless, Sensor Network Technology, Sensors Technology, Sensing the World.

Text Books:

1. Internet of Things: Architecture, Design Principles And Applications, Rajkamal, McGraw Hill Higher Education
2. Internet of Things, A.Bahgya and V.Madisetti, Univesity Press,2015

Reference Books:

1. Designing the Internet of Things, Adrian McEwen and Hakim Cassimally,Wiley Getting Started with the Internet of Things,CunoPfister , Oreilly

MTAIML14 ELECTIVE-II PATTERN RECOGNITION

Instruction: 3Periods/week Time:3Hours Credits:3

Internal: 30Marks External:70Marks Total: 100Marks

Course Objectives: From the course the student will learn

- Concepts of Algorithms, Searching and Sorting techniques, Trees, Binary trees, representation, traversal.
- Dictionaries, ADT for List, Stack, Queue, Hash table representation, Hash functions, Priority queues, Priority queues using heaps, Searchtrees.
- AVL trees, operations of AVL trees, Red- Black trees, Splay trees, comparison of searchtrees.

Course Outcomes:

After the completion of the course, student will be able to

- Ability to write and analyze algorithms for algorithm correctness and efficiency
- Master a variety of advanced Abstract Data Type (ADT) and data structures and their Implementation

- Demonstrate various searching, sorting and hash techniques and be able to apply and solve problems of reallife

- Design and implement variety of data structures including linked lists, binary trees, heaps, graphs and search trees

- Ability to compare various search trees and find solutions for IT related problems

UNIT I: Introduction: Overview of Pattern Recognition- Relations of PR with other Systems, PR Applications, Different Approaches to Pattern Recognition- Statistical Approach to PR, Syntactic Approach to PR, Neural Approach to PR, Examples of PR Approaches. Other Approaches to PR.

UNIT II: Structure of PR System: Abstract Representation of PR Mappings, Structure of PR System, Patterns and Feature s, Feature Extraction Examples, Object Description and Classification, Figure Recognition, Numerical Results and Analysis. Feature Vector and Feature Space, training and Learning in PR System.

UNIT III: Statistical Pattern Recognition: Introduction, Gaussian Case and Class Dependency, Discriminate Function, Examples, Classifier Performance

UNIT IV: Training: Parametric Estimation and Supervised Learning, Maximum Likely Hood Estimation, Bayesian Parameter Estimation Approach , Parzen Windows, Direct Classification Using Training set., Unsupervised Learning and Clustering, Clustering for Unsupervised Learning and Classification

UNIT V: Syntactic Pattern Recognition: Overview of Syntactic Pattern Recognition, Grammar Based Approaches and Applications, Examples of String Generation as Pattern Description, 2-D line Drawing Description Grammar, Character Description using PDL, Object Description using Projected Cylinder Models, Block World Description Models, Heuristic Generation of Grammars

UNIT VI: Recognition of Syntactic Description: Recognition by Matching, Recognition by Parsing, CYK Parsing Algorithm, Augmented Transition Nets in Parsing, Graph Based structure representation, Structured Strategy to Compare Attributed Graphs.

UNIT VII: Neural Pattern Recognition: Introduction to Neural Networks,, Neural Network Structure for PR Applications, Physical Neural Networks, ANN Model, NN Based PR Association, Matrix Approaches and Examples

UNIT VIII: Feed Forward Neural Networks: Training by Back Propagation, Hope field Approach to Neural Computing, Other related Neural Approaches and Extensions

Text Book:

1. Pattern Recognition- Statistical, Structural and Neural Approaches, Rober.J. Shelkoff, John Wiley & Sons, NY1992,ISBN0-471-52974-5

Reference Book:

1. Neural Networks for pattern recognition, Christopher M. Bishop Oxford University Press.
2. Pattern Classification, Richard O. Duda, Wiley India Edition

MTA1ML15 RESEARCH METHODOLOGY AND IPR

Common for M.Tech (CST, IT, CN&IS, AI&ML)

Instruction: 3 Periods/week Time: 3 Hours Credits: 2

Internal: 30 Marks External: 70 Marks Total: 100 Marks

Unit 1: Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Unit 2: Effective literature studies approaches, analysis Plagiarism, Research ethics,

Unit 3: Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

Unit 4: Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Unit 5: Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

Unit 6: New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

References:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007.
5. Mayall, "Industrial Design", McGraw Hill, 1992.
6. Niebel, "Product Design", McGraw Hill, 1974.
7. Asimov, "Introduction to Design", Prentice Hall, 1962.

8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.

9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

MTA1ML16 ORGANIZATIONAL BEHAVIOR (AUDIT COURSE)

Common for M.Tech (CST, IT, CN&IS, AI&ML)

Instruction: 3 Periods/week Time: 3 Hours Credits: 0

Internal: 30 Marks External: 70 Marks Total: 100 Marks

UNIT-I Organizational Behavior: Concept of Organization - Concept of Organizational Behavior - Nature of Organizational Behavior - Role of Organizational behavior - Disciplines contributing to Organizational Behavior.

UNIT-II Motivation: Definition - Nature of Motivation - Role of Motivation - Theories of Motivation: Maslow's Need Hierarchy Theory, Herzberg's Motivation Hygiene Theory and McGregor's Theory X and Theory Y.

UNIT -III Group Dynamics: Meaning - Concept of Group - Types of groups - Formal and Informal groups - Group development - Group cohesiveness and factors affecting group cohesiveness.

UNIT-IV Leadership: Concept of Leadership - Difference between Leadership and Management - Importance of Leadership - Leadership styles: Autocratic leadership, Participative leadership and Free Rein leadership.

UNIT-V Communication: Meaning - Communication Process - Forms of communication: Oral, Written and Non- Verbal communication - Direction of communication : Downward, Upward and Horizontal communication.

UNIT-VI Organizational conflicts: Concept of conflict - Reasons for conflict - Types of Conflict: Intrapersonal conflict, Interpersonal conflict, Intragroup conflict, Intergroup conflict, Inter organizational conflict - Conflict management.

UNIT -VII **Organizational Change**: Nature - Factors in Organizational change - Planned change: Process of planned change - Resistance to change: Factors in resistance to change - Overcoming resistance to change.

Text Books:

1. L.M. Prasad: Organizational Behavior, Sultan Chand & Sons, New Delhi - 110002

2. K. Aswathappa: Organizational Behavior, Himalaya Publishing House, New Delhi

Reference Books:

1. Stephen Robbins: Organizational Behavior, Pearsons Education, New Delhi.

MTAIML17 ARTIFICIAL INTELLIGENCE LAB

Instruction: 3Periods/week Time:3Hours Credits:2

Internal: 30Marks External:70Marks Total: 100Marks

Course Objectives:

- * To provide a strong foundation of fundamental concepts in Artificial Intelligence.
- * To provide a basic exposition to the goals and methods of Artificial Intelligence.
- * To apply the techniques in applications which involve perception, reasoning and learning.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

- * Apply the basic principles of AI in problem solving using LISP/PROLOG/ PYTHON
- * Implement different state space search algorithms for Game playing using LISP/PROLOG
- * Develop an Expert System using JESS/PROLOG

List of Experiments

1. Implementation of DFS for water jug problem using LISP/PROLOG/PYTHON
2. Implementation of BFS for tic-tac-toe problem using LISP/PROLOG/Java
3. Implementation of TSP using heuristic approach using Java/LISP/Prolog
4. Implementation of Simulated Annealing Algorithm using LISP/PROLOG/ PYTHON
5. Implementation of Hill-climbing to solve 8- Puzzle Problem using PYTHON/JAVA
6. Implementation of Monkey Banana Problem using LISP/PROLOG/ PYTHON
7. Implementation of A* Algorithm using LISP/PROLOG/ PYTHON
8. Implementation of AO* Algorithm using LISP/PROLOG/ PYTHON
9. Implementation of Min-Max Game playing algorithm using LISP/PROLOG/ PYTHON
10. Implementation Expert System with forward chaining using JESS/CLIPS

11. Implementation Expert System with backward chaining using RVD/PROLOG

MTAIML18 DATA MINING LAB USING PYTHON

Instruction: 3Periods/week Time:3Hours Credits:2

Internal: 30Marks External:70Marks Total: 100Marks

Scope: Lab experiments using R / Python on benchmark datasets

1. Demonstration of pre-processing on some datasets.
2. Demonstration of Data visualization
3. Demonstration of Data dimensionality reduction techniques
4. Demonstration of Classification process using different classifiers
5. Demonstration of Clustering using different clustering methods
6. Demonstration of Association rule extraction using various association algorithms.

I-SEMESTER

Code	Name of the subject	Periods/week		Max. Marks		Total Credits	
		Theory	Lab	Ext.	Int.		
MTAIML21	Machine Learning	3	-	70	30	100	3
MTAIML22	Soft Computing	3	-	70	30	100	3
MTAIML23	Elective-III	3	-	70	30	100	3
MTAIML24	Elective-IV	3	-	70	30	100	3
MTCST25	Entrepreneurship (Audit Course)	3	-	70	30	100	0
MTAIML26	Machine Learning Lab	-	3	50	50	100	2
MTAIML27	Soft Computing Lab	-	3	50	50	100	2
MTAIML28	Mini Project With Seminar	-	3	-	100	100	2
Total		15	9	450	350	800	18

Elective-III: Computer Vision/Natural Language Processing/Recommender Systems

Elective-IV: Robotics and Intelligent Systems/Reinforcement Learning/NoSQL Databases

Detailed Syllabus for M.Tech (AI&ML) Second Semester

MTAIML21 MACHINE LEARNING

Instruction: 3Periods/week Time:3Hours Credits:3

Internal: 30Marks External:70Marks Total: 100Marks

Course Objectives:

Machine Learning course will

- Develop an appreciation for what is involved in learning from data.

- Study a wide variety of learning algorithms.
- Demonstrate how to apply a variety of learning algorithms to data.
- Demonstrate how to perform evaluation of learning algorithms and model selection.

Course Outcomes:

After the completion of the course, student will be able to

- Understand the distribution and diversity of Data
- Extract features useful for building predictive models.
- Gain knowledge on Supervised and unsupervised Learning techniques
 - Analyze Statistical learning techniques and Logistic Regression
 - Select appropriate Support Vector Machines and Perceptron Algorithm
 - Compare the performance of different learning models

UNIT I: Introduction to Machine Learning, Applications of Machine learning, Supervisory Learning: Learning classes from examples, Vapnik-Charvonenkis (VC) Dimension, Probably Approximately Correct(PAC) Learning, noise, learning multiple classes, regression, model selection and generalization, dimensions of supervised machine learning algorithms

UNIT II: Bayesian Decision Theory: Classification, losses and risks, discriminant functions, utility theory, value of information, Parametric Methods: Maximum likelihood estimation, evaluating an estimator with bias and variance, Bayes' estimator, parametric classification, regression, tuning model complexity: bias vs variance dilemma, model selection procedures

UNIT III: Multivariate methods: Multivariate data, parameter estimation, missing value imputation, univariate normal distribution and classification, discrete features, regression, Dimensionality Reduction: Subset selection, PCA, Factor Analysis, multi-dimensional scaling, LDA

UNIT IV: Clustering: Mixture densities, K-means clustering, Expectation Maximization algorithm, mixtures of Latent Variable Models, Supervised learning after clustering, Hierarchical clustering, choosing number of clusters

UNIT V: Non-parametric methods: Non-parametric methods density estimation, generalisation to multivariate data, nonparametric classification, condensed nearest neighbors, non-parametric regression: smoothing models, choosing smoothing parameters

UNIT VI: Decision trees and Linear Discrimination: Univariate classification and regression trees, rule extraction from trees, Multivariate trees, Generalizing linear model, two class and multi-class geometry of linear discriminant, pairwise separation, gradient descent, logistic

discrimination for binary and multi-class problems, discrimination by regression, Support vector machines, optimal separating hyperplane, kernel functions for non-separable spaces, SVM for regression.

UNIT VII: Hidden Markov Models: Discrete Markov processes, Hidden Markov Models, Three basic problems of HMM, Evaluation problem, finding the state sequence, Learning model parameters, continuous observations, Model selection in HMM

Assessing and comparing classification Algorithms: Cross-validation and resampling methods, measuring error, interval estimation, hypothesis testing

Text Book:

1. Introduction to Machine Learning by Ethem Alpaydin, Prentice-Hall of India, 2006

Reference books:

1. Applied Machine Learning, M.Gopal, McGraw Hill Education, 2019
2. Machine Learning: The art and Science of Algorithms that make sense of Data, Peter Flach, Cambridge University Press, 2012
3. Machine Learning, Tom Mitchell, McGraw Hill, 1997

MTAIML22 SOFT COMPUTING

Instruction: 3Periods/week Time:3Hours Credits:3

Internal: 30Marks External:70Marks Total: 100Marks

Course Objectives:

- Aims to provide comprehensive understanding of Soft computing approaches for AI problem solving
- Develops in depth knowledge on concepts related to different types of neural networks
- Provides in depth knowledge on concepts related to Fuzzy logic, membership value assignment and reasoning with fuzzy quantities
- Helps to understand the development of Fuzzy Inference systems and Fuzzy expert systems
- Introduces the concepts related to Genetic algorithms for learning from examples

Course Outcomes

After completion of course, students would be able to:

- Build neural networks to extract patterns from data
- Build fuzzy inference systems and develop fuzzy expert systems
- Write genetic algorithms for learning the hyper parameters for data classification

UNIT-I: Introduction to Soft computing, Artificial Neural Network: An Introduction, Evolution of Neural Networks, Basic Models of Artificial Neural Network, Important Terminologies of ANNs, McCulloch–Pitts Neuron, Linear Separability, Hebb Network.

UNIT-II: Supervised Learning Network, Perceptron Networks, Adaptive Linear Neuron (Adaline), Multiple Adaptive Linear Neurons, Back-Propagation Network, Radial Basis Function Network, Time Delay Neural Network, Associative Memory Networks, Hopfield Networks

UNIT-III : Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets, Classical Relations and Fuzzy Relations, Tolerance and Equivalence Relations, Noninteractive Fuzzy Sets, Membership Function, Features of the Membership Functions, Fuzzification, Methods of Membership Value Assignments, Methods of Membership Value Assignments, Defuzzification

UNIT-IV: Fuzzy Arithmetic and Fuzzy Measures, Measures of Fuzziness, Fuzzy Rule Base and Approximate Reasoning, Fuzzy Propositions, Formation of Rules, Decomposition of Rules (Compound Rules), Aggregation of Fuzzy Rules, Fuzzy Reasoning (Approximate Reasoning), Fuzzy Inference Systems (FIS), Overview of Fuzzy Expert System

UNIT-V : Genetic Algorithm, Introduction, Biological Background, Genetic Algorithm and Search Space, Basic Terminologies in Genetic Algorithm, General Genetic Algorithm, Operators, Stopping Condition for Genetic Algorithm Flow, Constraints, Problem Solving Using Genetic Algorithm, The Schema Theorem, Classification of Genetic Algorithm, Advantages and Limitations of Genetic Algorithm, Applications of Genetic Algorithm.

Text Books:

1. S.N. Sivanandam, S.N. Deepa, Principles of Soft Computing, 3ed, Wiley India.
2. Fakhreddine O. Karray, Clarence W. De Silva, Soft Computing and Intelligent Systems Design: Theory, Tools and Applications, 1e, Pearson.

References:

1. Fundamentals of Neural Networks – Laurene Fauseett, Prentice Hall India, New Delhi, 1994.
2. Timothy J. Ross, Fuzzy Logic with Engineering Applications, 3 ed, Wiley India
3. E – Neuro Fuzzy and Soft computing – Jang J.S.R., Sun C.T and Mizutani, Prentice hall New Jersey, 1998

MTAIML23 ELECTIVE-III COMPUTER VISION

Instruction: 3Periods/week Time:3Hours Credits:3

Internal: 30Marks External:70Marks Total: 100Marks

Course Objective:

To Recognize and describe both the theoretical and practical aspects of computing with images and to Connect issues from Computer Vision to Human Vision

Course Outcomes:

- Provide an introduction to computer vision including fundamentals of image formation
- Enumerate the concepts of Feature detection and Matching
- Discuss about Image Segmentation Techniques
- Discuss applications of Feature based alignment like pose estimation
- Discuss different recognition techniques.

UNIT-I : **Introduction:** What is computer vision, A brief history, Image Formation, Geometric primitives and transformations, Photometric image formation, The digital camera.

UNIT-II : Feature detection and matching: Points and patches, Feature detectors, Feature descriptors, Feature matching, Feature tracking, Application: Performance-driven animation, Edges, Application: Edge editing and enhancement, Lines, Application: Rectangle detection.

UNIT-III : Segmentation: Active contours, Split and merge, Mean shift and mode finding, Normalized cuts, Graph cuts and energy-based methods, Application: Medical image segmentation.

UNIT-IV : Feature-based alignment: 2D and 3D feature-based alignment, Pose estimation, Geometric intrinsic calibration, Calibration patterns, Vanishing points, Application: Single view metrology, Rotational motion, Radial distortion.

UNIT-V : Recognition: Object detection, Face detection, Pedestrian detection, Face recognition, Eigenfaces, Active appearance and 3D shape models, Application: Personal photo collections, Instance recognition, Category recognition, Context and scene understanding.

Text Books:

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer, 2010.
2. Rafael C. Gonzalez "Digital Image Processing", Pearson Education; Fourth edition (2018)

Reference Books:

1. Forsyth/Ponce, "Computer Vision: A Modern Approach", Pearson Education India; 2nd edition (2015)
2. S. Nagabhushana, "Computer Vision and Image Processing", New Age International Pvt Ltd; First edition (2005)

MTAIML23 ELECTIVE-III NATURAL LANGUAGE PROCESSING

Instruction: 3Periods/week Time:3Hours Credits:3

Internal: 30Marks External:70Marks Total: 100Marks

Course Objectives:

This course introduces the fundamental concepts and techniques of natural language processing (NLP).

- Students will gain an in-depth understanding of the computational properties of natural languages and the commonly used algorithms for processing linguistic information.
- The course examines NLP models and algorithms using both the traditional symbolic and the more recent statistical approaches.
- Enable students to be capable to describe the application based on natural language processing and to show the points of syntactic, semantic and pragmatic processing.

Course Outcomes:

After completion of this course

- Demonstrate a given text with basic Language features
- To design an innovative application using NLP components
- Explain a rule based system to tackle morphology/syntax of a language
- To design a tag set to be used for statistical processing for real-time applications
- To compare and contrast the use of different statistical approaches for different types of NLP applications.

UNIT I: INTRODUCTION: Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM – Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance.

UNIT II: WORD LEVEL ANALYSIS: Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.

UNIT III: SYNTACTIC ANALYSIS: Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures

UNIT IV: SEMANTICS AND PRAGMATICS: Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven

Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.

UNIT V: DISCOURSE ANALYSIS AND LEXICAL RESOURCES: Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC).

Text Books:

1. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, 2nd Edition, Daniel Jurafsky, James H. Martin -Pearson Publication, 2014.
2. Natural Language Processing with Python, First Edition, Steven Bird, Ewan Klein and Edward Loper, O'Reilly Media, 2009.

Reference Books:

1. Language Processing with Java and LingPipe Cookbook, 1st Edition, Breck Baldwin, Atlantic Publisher, 2015.
2. Natural Language Processing with Java, 2nd Edition, Richard M Reese, O'Reilly Media, 2015.
3. Handbook of Natural Language Processing, Second, Nitin Indurkha and Fred J. Damerau, Chapman and Hall/CRC Press, 2010. Edition
4. Natural Language Processing and Information Retrieval, 3rd Edition, Tanveer Siddiqui, U.S. Tiwary, Oxford University Press, 2008.

MTAIML23 ELECTIVE-III RECOMMENDER SYSTEMS

Instruction: 3Periods/week Time:3Hours

Credits:3

Internal: 30Marks External:70Marks Total: 100Marks

Course Objectives:

This course covers the basic concepts of recommender systems, including personalization algorithms, evaluation tools, and user experiences

Course Outcomes:

- Describe basic concepts behind recommender systems
- Explain a variety of approaches for building recommender systems
- Describe system evaluation methods from both algorithmic and users' perspectives
- Describe applications of recommender systems in various domains

1. Collaborative recommendations: User-based nearest neighbor recommendation, Item -based nearest neighbor recommendation, About ratings, Model-based and Preprocessing-based approaches, Recent practical approaches and Systems.

2. Content- based recommendation: Content representation and content similarity, Similarity-based retrieval, Other text classification methods.

3. Knowledge-based recommendation: Introduction ,Knowledge representation and reasoning, Interacting with constraint—based recommenders, Interacting with case-based recommenders, Example applications.

4. Hybrid recommendation approaches: Opportunities for hybridization , Monolithic hybridization design, Parallelized hybridization design, Pipelined hybridization design.

5. Evaluating recommender systems: Introduction , General properties of evaluation research, Popular evaluation designs, Evaluation on historical datasets, Alternate evaluation designs.

6. Attacks on collaborative recommender systems: A first example, Attack dimensions , Attack types, Evaluation of effectiveness and countermeasures, Countermeasures, Privacy aspects - distributed collaborative filtering.

7. Online consumer decision making: Introduction , Context effects, Primacy/recency effects, Further effects, Personality and social psychology. Recommender systems and the next-generation web: Trust aware recommender systems, Folksonomies and more, Ontological filtering, Extracting semantics from the web.

Text Book:

1. Recommender Systems: An Introduction by Dietmar Jannach, Markus Zanker, Alexander Felfernig, Gerhard Friedrich, Cambridge University Press.

Reference Book:

1. Recommender Systems: The Textbook by Charu C. Aggarwal, Springer Publications.

MTAIML24 ELECTIVE-IV ROBOTICS AND INTELLIGENT SYSTEMS

Instruction: 3Periods/week Time:3Hours Credits:3

Internal: 30Marks External:70Marks Total: 100Marks

Course Objective:

To understand the use of robotics in building intelligent systems.

Course Outcomes:

· Enumerate the fundamentals of robotics and Artificial Intelligence (AI).

· Demonstrate how to setting up a Robot.

· Discuss about the practical Robot Design Process.

· Discuss Object Recognition Using Neural Networks and Supervised Learning

UNIT-I: Foundation for Advanced Robotics and AI:The basic principle of robotics and AI, What is AI and what is it not, The example problem, Artificial intelligence and advanced robotics techniques, Introducing the robot and our development environment, Software components (ROS, Python, and Linux), Robot control systems and a decision-making framework, The robot control system – a control loop with soft real-time control

UNIT-II: Setting Up Your Robot:Technical requirements, What is a robot, Robot anatomy, Subsumption architecture, Software setup, Hardware, Assembling the tracks,Mounting the tracks, Arm base assembly, Wiring.

UNIT-III: A Concept for a Practical Robot Design Process, A systems engineering-based approach to robotics, Use cases, The problem –put away the toys, Project goals, Decomposing hardware needs, Breaking down software needs.

UNIT-IV: Object Recognition Using Neural Networks and Supervised Learning:Technical requirements, The image recognition process, The image recognition training and deployment process – step by step, The convolution neural network process, Build the toy/not toy detector

UNIT-V: Picking up the Toys:Technical requirements, Task analysis, Summary of robot arm learning process, Teaching the robot arm, Version one – action state reinforcement learning, Adaptive learning rate, Q-learning implementation,Google's SAC-X, Amazon Robotics Challenge

Text Books:

1. Francis X. Govers, Artificial Intelligence for Robotics: Build intelligent robots that perform human tasks using AI techniques, PACKT

2. J. J. Craig, Introduction to Robotics, Addison Wesley Publishers, 2005

Reference Books:

1. M. Negnevitsky, Artificial Intelligence, A guide to intelligent systems Addison-Wesley, 2005

MTAIML24 ELECTIVE-IV REINFORCEMENT LEARNING

Instruction: 3Periods/week Time:3Hours Credits:3

Internal: 30Marks External:70Marks Total: 100Marks

Course Objective:

To provide the fundamentals of Reinforcement learning.

Course Outcomes:

- Enumerate the elements of Reinforcement Learning
- Solve the n-armed Bandit problem
- Compare different Finite Markov Decision Process
- Discuss about Monte Carlo Methods in solving real world problems
- List the Applications and Case Studies of Reinforcement Learning

UNIT-I : **The Reinforcement Learning Problem:** Reinforcement Learning, Examples, Elements of Reinforcement Learning, Limitations and Scope, An Extended Example: Tic-Tac-Toe, Summary, History of Reinforcement Learning.

UNIT-II : Multi-arm Bandits: An n-Armed Bandit Problem, Action-Value Methods, Incremental Implementation, Tracking a Nonstationary Problem, Optimistic Initial Values, Upper-Confidence-Bound Action Selection, Gradient Bandits, Associative Search (Contextual Bandits)

UNIT-III : Finite Markov Decision Processes: The Agent-Environment Interface, Goals and Rewards, Returns, Unified Notation for Episodic and Continuing Tasks, The Markov Property, Markov Decision Processes, Value Functions, Optimal Value Functions, Optimality and Approximation.

UNIT-IV : Monte Carlo Methods: Monte Carlo Prediction, Monte Carlo Estimation of Action Values, Monte Carlo Control, Monte Carlo Control without Exploring Starts, Off-policy Prediction via Importance Sampling, Incremental Implementation, Off-Policy Monte Carlo Control, Importance Sampling on Truncated Returns

UNIT-V : Applications and Case Studies: TD-Gammon, Samuel's Checkers Player, TheAcrobot, Elevator Dispatching, Dynamic Channel Allocation, Job-Shop Scheduling.

Text Books:

1. Richard S. Sutton and Andrew G. Barto, "Reinforcement Learning- An Introduction", 2nd Edition, The MIT Press, 2018
2. Marco Wiering , Martijn van Otterlo Reinforcement Learning: State-of-the-Art (Adaptation, Learning, and Optimization (12)) 2012th Edition

Reference Books:

1. Vincent François-Lavet , Peter Henderson , Riashat Islam, An Introduction to Deep Reinforcement Learning (Foundations and Trends(r) in Machine Learning) , 2019

MTAIML24 ELECTIVE-IV NoSQL DATABASES

Instruction: 3Periods/week Time:3Hours Credits:3

Internal: 30Marks External:70Marks Total: 100Marks

Course Outcomes: On completion of this course, the student will be able to

- Enumerate different features of NOSQL Databases
- Compare different data models
- Design a Key-Value Database for a real world problem
- Design a Document Database for a real world problem
- Design a Graph Database for a real world problem

UNIT-I: Introduction to NoSQL.The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, Standard Model, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL.

Aggregate Data Models, Aggregates, Consequences of Aggregate Orientation, Key-Value and Document Data Models, Column-Family Stores, Summarizing Aggregate-Oriented Databases.

UNIT-II : More Details on Data Models, Relationships, Graph Databases, Schemaless Databases, Materialized Views, Modeling for Data Access, Distribution Models, Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication, Consistency, Update Consistency, Read Consistency, Relaxing Consistency, The CAP Theorem, Relaxing Durability, Quorums

UNIT-III : Key-Value Databases, Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preferences, Shopping Cart Data, When Not to Use, Relationships among Data, Multi operation Transactions, Query by Data, Operations by Sets

UNIT-IV: **Document Databases**, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, E-Commerce Applications, When Not to Use, Complex Transactions Spanning Different Operations, Queries against Varying Aggregate Structure

UNIT-V : **Column-Family Stores**, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Counters. **Graph Databases**, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Connected Data, Routing, Dispatch, and Location-Based Services Recommendation Engines

Text Books:

1. Sadalage, P. & Fowler, M., NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence. (1st Ed.). Upper Saddle River, NJ: Pearson Education, In, 2012.

Reference Books:

1. Gauravvaish, Getting started with NoSQL , PACKT publishing, ISBN: 978184969488
2. Redmond, E. & Wilson, J., Seven Databases in Seven Weeks: A Guide to Modern Databases and the NoSQL Movement (1st Ed.), 2012
3. Raleigh, NC: The Pragmatic Programmers, LLC. ISBN-13: 978-1934356920 ISBN-10: 1934356921

MTAIML25 ENTREPRENEURSHIP (AUDIT COURSE)

Instruction: 3Periods/week Time:3Hours Credits:0

Internal: 30Marks External:70Marks Total: 100Marks

Unit-I : Basic Concepts of Management: Management:-Definition, Nature and Importance; Functions of the Management; Levels of Management; F.W Taylor's Scientific Management; Henry Fayol's Principles of Management.

Unit-II : Forms of Business Organizations: Introduction, Types of Business organizations: Private Sector-Individual Ownership, Partnership, Joint stock companies and Co-Operative organizations; Public sector-Departmental Organizations, Public Corporations and Government Companies; The Joint sector Management.

Unit-III : ProductionandoperationsManagement:Plantlocation-Factorstobconsidered in the selection of Plant location; Break - even analysis- Significance and managerial applications; Importance of Production Planning and Control and its Functions; Human Resource Management and Functions of Human Resource Manager (in brief);Functions of Marketing; Methods of Raising Finance.

Unit-IV : Entrepreneurship: Definition, Characteristics and Skills ,Types of Entrepreneurs, Entrepreneur vs. Professional Managers, , Growth of Entrepreneurs, Nature and Importance of Entrepreneurs, Women Entrepreneurs, Problems of Entrepreneurship.

Unit-V : Entrepreneurial Development and Project Management: Institutions in aid of Entrepreneurship Development, Idea generation: Sources and Techniques;, Stages in Project formulation ;Steps for starting a small enterprise -Incentives for Small Scale Industries by Government.

Text Books:

1. Sharma, S.C, and Banga, T.R.,Industrial Organization & Engineering Economics, Khanna Publishers,Delhi,2000.
2. Vasant Desai,The Dynamics of Entrepreneurial Development and Management (Planning for future Sustainable growth), Hlmalayan Publishing House,2018.

Reference Books:

1. Aryasri , A.R., Management Science,McGraw Hlll Education (India Private Limited , NewDelhi2014.

2. Sheela, P., and JagadeswaraRao, K., Entrepreneurship, Shree Publishing House, Guntur,

MTAIML26 MACHINE LEARNING LAB

Instruction: 3Periods/week Time:3Hours Credits:2

Internal: 30Marks External:70Marks Total: 100Marks

Course Outcomes: On completion of this course, the student will be able to

- Implement machine learning algorithms to real world problems
- Choose appropriate machine learning algorithm for a problem
- Interpret the results of two different machine learning algorithms

List of Experiments:

1. Implement Principal Component Analysis (PCA) on an unsupervised dataset using NumPy.

2. Implement and demonstrate the Singular Value Decomposition (SVD) on a given set of training data samples. Read the training data from a .CSV file and use NumPy.

3. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.

4. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

5. Write a program to implement the **naïveBayesian classifier** for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.

6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your classifier.

7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.

8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.

9. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.

10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

11. Create the following **plots** using Matplotlib, Pandas Visualization, Seaborn on iris dataset, wine reviews datasets.

- Scatter Plot
- Line chart
- Histogram
- Heatmap

Text Books:

1. Hands-On Machine Learning with Scikit-Learn and TensorFlow 2e: Concepts, Tools, and Techniques to Build Intelligent Systems, Aurelien Geron, 2019.

References:

- <https://scikit-learn.org/stable/tutorial/index.html>
- <https://archive.ics.uci.edu/ml/index.php>
- <https://towardsdatascience.com/pca-and-svd-explained-with-numpy-5d13b0d2a4d8>
- <https://towardsdatascience.com/introduction-to-data-visualization-in-python-89a54c97fbed>

MTAIDL27 SOFT COMPUTING LAB

Instruction: 3Periods/week Time:3Hours Credits:2

Internal: 30Marks External:70Marks Total: 100Marks

Course Outcomes: On completion of this course, the student will be able to

- Implement neural networks to solve real world problems
- Choose appropriate pre-trained model to solve real time problem
- Parameter tuning using Genetic algorithms
- Implement Fuzzy Inference

Software Packages required:

- Open source tools for building neural network models, fuzzy logic and genetic algorithms

List of Experiments:

- Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
- Implement multilayer perceptron algorithm for MNIST Hand written Digit Classification.

3. Design a neural network for classifying movie reviews (Binary Classification) using IMDB dataset.

4. Design a neural Network for classifying news wires (Multi class classification) using Reuters dataset.

5. Design a neural network for predicting house prices using Boston Housing Price dataset.

6. Implement fuzzy inference for image segmentation.

7. Implement the house price prediction problem with fuzzy reasoning

8. Implement the Fuzzy C-Means algorithm for clustering

9. Implement the basic concepts of genetic algorithms for learning

10. Implement genetic algorithms for hyper parameter tuning in neural networks for classifying IMDB dataset.

Text Books:

1. Ivan Gridin, "Learning Genetic Algorithms with Python", BPB publishers, 2021

2. Rajasekaran and Pai, "Neural Networks, Fuzzy Logic and Evolutionary Algorithms: Synthesis and Applications, PHI, 2017

III-SEMESTER

Code	Name of the subject	Periods/week		Max. Marks		Total Credits	
		Theory	Lab	Ext.	Int.		
MTAIDL31	Elective-V	3	-	70	30	100	3
MTAIDL32	Open Elective	3	-	70	30	100	3
MTAIDL33	Dissertation-I / Industrial project		-	100	-	100	10
Total		6	-	240	60	300	16

Elective V : **Deep Learning/Expert Systems/High Performance Computing**

Open Elective :Business Analytics/Operations Research/Social Media Analytics

Detailed Syllabus for M.Tech (AI&ML) Third Semester

MTAIDL31 ELECTIVE-V DEEP LEARNING

Instruction: 3Periods/week Time:3Hours Credits:3

Internal: 30Marks External:70Marks Total: 100Marks

Course Objectives:

The objective of this course is to cover the review of ML, fundamentals of feed forward neural networks, regularization methods and optimization in

deep models as well as some advanced topics such as convolutional neural networks, recurrent neural networks, long short term memory cells.

Course Outcomes

After completion of course, students would be able to:

- Explore feed forward networks and Deep Neural networks
 - Mathematically understand the deep learning approaches and paradigms
 - Complex feature extraction with CNN and RNNs
 - Apply the deep learning techniques for various applications
1. Machine Learning Basics: Learning Algorithms, Capacity, Overfitting, and Underfitting, Hyperparameters and Validation Sets, Estimators, Bias and Variance, Maximum Likelihood Estimation, Bayesian Statistics, Supervised and Unsupervised Learning algorithms, Stochastic Gradient Descent, Building a ML algorithm, Challenges and Motivation to Deep learning
 2. Deep forward Networks: Learning XOR, Gradient -based Learning, Hidden Units, Architecture Design, Back-propagation and other Differentiation algorithms
 3. Regularization for Deep Learning:
Parameter Norm Penalties, Norm Penalties as constrained Optimization, Regularization and under -constrained problems, dataset Augmentation, Noise robustness, semi-supervised learning, multitask learning, Early stopping, parameter tying and setting, sparse presentations, bagging and other ensemble methods, dropout
 4. Optimization for Training Deep Models: Difference between learning and pure optimization, Challenges in NN optimization, Basic algorithms, parameter Initialization strategies, Algorithms with adaptive learning rates,
 5. Convolutional Networks: Convolution operation, Motivation, pooling, convolution and pooling as an infinitely strong prior, variants of basic convolution function, structured outputs, data types, efficient convolution algorithms, random or unsupervised features
 6. Sequence Modeling: Recurrent and recursive nets: Unfolding computational graphs, recurrent neural networks, bidirectional RNNs, Encoder-decoder Sequence-to-sequence Architectures, Deep recurrent networks, recursive neural networks, challenge of long-term dependencies, echo state networks, leaky units and other strategies for multiple time scales, Long Short -term Memory (LSTM) and other gated RNNs
 7. Practical methodology and applications: Performance metrics, default baseline models, determining whether to gather more data, selecting

hyperparameters, debugging strategies, multi-digit number recognition, large scale deep learning, applications in computer vision and NLP

Text Book:

1. "Deep Learning", Ian Goodfellow, YoshuaBengio and Aaron Courville, published by MIT Press,UK, 2017 Series
2. Deep Learning with Keras: The Textbook by Antonio Gulli and Sujit Pal, PacktPublishing Ltd, Birmingham, UK, April 2017

Reference Book:

1. Deep Learning with TensorFlow, The Textbook by Giancarlo Zaccane, Md. Rezaul Karim, and Ahmed Menshawy, Packt Publishing Ltd, Birmingham, UK, April 2017.

MTAIML31 ELECTIVE-V EXPERT SYSTEMS

Instruction: 3Periods/week Time:3Hours Credits:3

Internal: 30Marks External:70Marks Total: 100Marks

1. Introduction: Introduction to Expert System, Definitions, Importance of Expert System, Characteristic features of Expert System, Applications of Expert System, Different categories of Expert Systems, Rule Based System Architecture, Neural Network Architecture
2. Knowledge Representations: Components of Knowledge in Expert system, OAV Triplets, Semantic Networks, Frams Representation via Logic Statements, Production Systems, Clause, Properties Rule properties, Rule Conversions, Multiple Conclusions, Neural Networks via Rule Based System
3. Knowledge Acquisition: Introduction Knowledge Acquisition and domain Expert, Selectio of the domain, Selection of the Knowledge Engineers, Selection of the Expert, Meetings an Plans, Organization of Meetings, Documentation, Multiple domain Experts, Knowledge Acquisition –An Example, Knowledge Acquisition using Rule induction, Generating Rules from Trees, ID3 algorithm for Rule Generation
4. Design of Expert System: Introduction, Selecting the appropriate Problem, Stages in the Developing Expert System, Errors in Development stages, Software Engineering and Expert Systems, The Expert System Life Cycle, Expert System Design Examples- Certainty factors, Decision tress
5. Inference Engine: Inference Engine, Insight of Inference Engine, Search Strategies, Forward Chaining Algorithm, Algorithms for forward Chaining- Baseline Version, Backward Chaining Algorithm, Algorithms for Back word Chaining-Baseline Version, Mixed Modes of Chaining, Work sheets for Forward and Back word Chaining.
6. Reasoning Under Uncertainty: Uncertainty, Types of Error, Error and Induction, Classic Probability, Temporal Reasoning and MorcovChines, TMS, Fuzzy Logic and Natural Languages computations, Probabilistic

Reasoning, probabilistic Networks, Bayesian Networks. Use of Probability and Fuzzy logic in Expert System, Rule Induction by Machine Learning

7. Software Tools and Architectures: Overview of Expert System Tools, Expert System Shells, Multiple Paradigm Environments, Abstract architectures, Potential Implementation Problems, Selecting a Software Tool, Implementation Mechanism of tools, Black Board Architecture, Reasoning under uncertainty and Truth Maintenance Systems Case-study :A case-study on Financial planning Expert System, Sale Expert system, DENDRAL and MYCIN

Text Books:

1. Expert System principals and Programming-Giaratano.Rilev.2003
2. Introduction to Expert SystemsV-JamesP.Iginizo.Mc.Graw-Hill.inc
3. Introduction to Expert Systems Peter Jackson, Addison Wesley

MTAIML31 ELECTIVE-V HIGH PERFORMANCE COMPUTING

Instruction: 3Periods/week Time:3Hours Credits:3
Internal: 30Marks External:70Marks Total: 100Marks

Course Objectives:

The objective of the subject is to

- Introduce the basic concepts related to HPC architecture and parallel computing
- Discuss various computational techniques for studying soft matter systems.
- Apply these concepts to examine complex biomolecular/materials systems that generally require large-scale HPC platform with hybrid CPU-GPU architectures

Course Outcomes: After completion of this course

- Design, formulate, solve and implement high performance versions of standard single threaded algorithms.
- Demonstrate the architectural features in the GPU and MIC hardware accelerators.
- Design programs to extract maximum performance in a multicore, shared memory execution environment processor.
- Analyze Symmetric and Distributed architectures.
- Develop and deploy large scale parallel programs on tightly coupled parallel systems using the message passing paradigm.

UNIT I: Graphics Processing Units-Introduction to Heterogeneous Parallel Computing, GPU architecture, Thread hierarchy, GPU Memory Hierarchy.

UNIT II: GPGPU Programming-Vector Addition, Matrix Multiplication algorithms. 1D, 2D, and 3D Stencil Operations, Image Processing algorithms – Image Blur, Gray scaling. Histogramming, Convolution, Scan, Reduction techniques.

UNIT III: Many Integrated Cores-Introduction to Many Integrated Cores. MIC, Xeon Phi architecture. Thread hierarchy. Memory Hierarchy, .Memory Bandwidth and performance considerations.

UNIT IV: Shared Memory Parallel Programming- Symmetric and Distributed architectures, OpenMP Introduction. Thread creation, Parallel regions. Worksharing, Synchronization.

UNIT V: Message Passing Interface-MPI Introduction, Collective communication, Data grouping for communication.

Text Books:

1. Programming Massively Parallel Processors A Hands-on Approach, 3e Wen-Mei W Hwu, David B Kirk, MorgannKaufmann,2013.
2. Using OpenMP, Scientific and Engineering edition, Barbara Chapman, Gabriele Jost, Ruud vander Pas, MIT Press,2008.

Reference Books:

1. Intel Xeon Phi Coprocessor Architecture and Tools, RezaurRahman, Apress Open,2013.
2. Using MPI, Gropp, Lusk, Skjellum, The MIT press,2014.
3. High Performance Computing: Programming and Applications, John Levesque, CRC Press, 2010.

MTAIML32 OPEN ELECTIVE HIGH PERFORMANCE COMPUTING

Instruction: 3Periods/week Time:3Hours Credits:3
Internal: 30Marks External:70Marks Total: 100Marks

Course objectives

1. to introduce students to problem solving with Business Analytics and the use of spreadsheets for descriptive analytics, data queries and visualization
2. to introduce students to statistical sampling, sampling distributions, confidence intervals and statistical inference
3. To familiarize students with various types of regression including simple linear regression and multiple linear regression
4. To introduce students to key concepts in statistical forecasting models for time series data

5. To familiarize students with predictive decision modeling, model analysis and developing spreadsheet applications including building linear optimization models on spreadsheets.

Course outcomes

After completion of the course the student should be able to:

1. Describe data and models used for Business Analytics and apply various descriptive analytic techniques to analyze data
2. Estimating population parameters, interval estimates, construct confidence intervals and perform hypothesis testing
3. Estimate and interpret the parameters of simple linear regression and multiple linear regressions
4. Apply forecasting models for various time series data including stationary time series, time series with linear trend and time series with seasonality

SYLLABUS

1. Foundations of Business Analytics: Evolution of Business Analytics, Scope, data and models for Business Analytics, problem solving with Business Analytics, Analytics on spreadsheets, Excel functions for Database queries, Add-ons for Business Analytics. Descriptive Analytics: Data visualization, creating charts in MS Excel, Data Queries, Tables, sorting and filtering, Data summarization with statistics, Data exploration using Pivot tables
2. Statistical Sampling: methods, estimating population parameters, sampling error, sampling distributions, interval estimates, confidence intervals, using confidence intervals for decision making, prediction intervals Statistical Inference: Hypothesis testing, one-sample Hypothesis testing, two-tailed test of Hypothesis for mean, two-sample Hypothesis testing, Analysis of variance, chi-square test for independence
3. Trendiness and Regression: Modeling Relationships and trends in data, Simple linear regression, least squares regression, regression on analysis of variance, testing hypothesis for regression coefficients, Confidence intervals for regression coefficients, Residual analysis and regression assumptions, Multiple linear regression, building regression models, regression with categorical independent variables with two or more levels, regression with nonlinear terms, advanced techniques for regression modeling
4. Forecasting Techniques: Qualitative and judgmental forecasting, statistical forecasting models, forecasting models for stationary time series, forecasting models for time series with linear trend, forecasting models for time series with seasonality, selecting appropriate time-series-based

forecasting models, regression forecasting with casual variables, practice of forecasting

5. Spreadsheet modeling and Analysis: Strategies for predictive decision modelling, Implementing models on spreadsheet, spreadsheet applications in Business analytics, Model assumptions, complexity and realism, developing user-friendly applications, analyzing uncertainty and model assumptions, model analysis using analytics solver platform

6. Linear Optimization & Applications: Building Linear Optimization Models on spreadsheets, solving Linear Optimization models, Graphical interpretation of linear optimization, Using optimization models of prediction and insight, Types of constraints in optimization models, process selection models, Blending Models, Portfolio Investment models

Text Book

1. "Business Analytics: Methods, Models, and Decisions" James R. Evans, Pearson Publications, Second edition

Reference Book

1. "Business Analytics: The Science of Data-Driven Decision Making", U.Dinesh Kumar, Wiley Publications

MTA1ML32 OPEN ELECTIVE OPERATIONS RESEARCH

Instruction: 3Periods/week

Time:3Hours

Credits:3

Internal: 30Marks External:70Marks Total: 100Marks

UNIT I: Overview of Operations Research, Types of OR Models , Phases of Operations Research– OR Techniques, Introduction to Linear Programming, Formulation of Linear Programming Problem, Graphical Solution; Graphical Sensitivity Analysis

UNIT II: Standard Form of LPP, Basic Feasible Solutions , Unrestricted Variables, Simplex Algorithm , Artificial Variables, Big M Method , Two Phase Simplex Method, Degeneracy, Alternative Optimal, Unbounded Solutions, Infeasible Solutions, Primal And Dual Problems And Their Relations, Dual Simplex Method

UNIT III: Transportation Problem as LPP, Initial Solutions, North West Corner Rule, Lowest Cost Method, Vogels Approximation Method, Optimum Solutions of TPP, Degeneracy in Transportation, Transportation Algorithms

UNIT IV: Assignment Problem , Assignment Problem as LPP, Hungarian Method, Travelling Salesman Problem, Solutions Of TSP, Sequencing Problems, N-Jobs Two Machine Problems, N-Jobs K Machines Problems, Two-Jobs M- Machine Problems, Crew Scheduling Problems

UNITV: Network Representation of A Project, CPM and PERT , Critical Path Calculations, Time – Cost Optimizations, PERT Analysis and Probability Considerations, Resource Analysis in Network Scheduling.

UNIT VI: Replacement Problems-Individual And Group Replacement Policy, Reliability & System Failure Problems, Inventory-Factors Effecting Inventory-EOQ, Inventory Problems With and Without Shortages, Inventory Problems With Price Breakups, Multi Item Deterministic Problems. Probabilistic Inventory Problems

UNIT VII: Game Theory : Two Person Zero Sum Games , Mixed Strategy Games and Their Algorithms.

Text Books:

1. Operations Research, KantiSwaroop, P.K. Gupta, Man Mohan, Sulthan Chand& Sons Education

2. Operations Research–An Introduction, HandyATaha–PearsonEducation.

MTA1ML32 OPEN ELECTIVE SOCIAL MEDIA ANALYTICS

Instruction: 3Periods/week Time:3Hours Credits:3

Internal: 30Marks External:70Marks Total: 100Marks

1. Introduction: Analyzing social web, tools used, Basics of network structure, representing social networks, different network structures and properties, describing nodes and edges with centrality, describing networks, degree distribution, density, connectivity, centralization

2. Network Visualization: graph layoutgrid layout, visualizing network features, scale issues

Tie strength: measuring tie strength, tie strength and network structure, tie strength and network propagation

3. Trust: defining trust, naunces of trust, measuring trust, trust in social media, inferring trust, network-based inference, and similarity based trust inference

Understanding Structure through user attributes and behavior: Analyzing attributes and behavior, analyzing content, identifying user roles

4. Building Networks: Modeling networks, Sampling methods, egocentric network analysis

Entity Resolution and Link Prediction: Link prediction, Entity resolution, Incorporating network data, case study for link prediction and entity resolution

5. Propagation in Networks: Epidemic models, Threshold models, firefighter problem, stochastic models, applications of epidemic models to social media

Community-Maintained Resources: Supporting technologies for community- maintained resources, Wikies, message boards, repositories, user motivations

6. Location-based Social Interaction: Location technology, mobile location sharing, location-based social media analysis, privacy and location - based social media

Social Information Filtering: Social sharing and social filtering, automated recommender systems, case study of trusty based movie recommendations

7. Social Media in Public Sector: Analyzing public-sector social media, case studies of congressional use of twitter, predicting elections and astroturfing

Privacy: Privacy policies and settings, aggregation and data mining, deanonymization, inferring data, data ownership and maintaining privacy online, respecting privacy in social media analysis

Text Book:

1. “Analyzing the Social Web”, Jennifer Golbeck Morgan Kaufmann publishers, 2013

M.Tech. Computer Networks& Information Security

Course Structure and Scheme of Valuation w.e.f. 2021-22

I-SEMESTER

Code	Name of the subject	Periods/week		Max. Marks		Total Credits	
		Theory	Lab	Ext.	Int.		
MTCNIS11	Mathematical Foundations For Cryptography	3	-	70	30	100	3
MTCNIS12	TCP/IP	3	-	70	30	100	3
MTCNIS13	Elective-I	3	-	70	30	100	3
MTCNIS14	Elective-II	3	-	70	30	100	3
MTCST15	Research Methodology &IPR	3	-	70	30	100	2
MTCST16	Organizational Behavior(Audit Course)	3	-	70	30	100	0
MTCNIS17	TCP/IP Lab		3	50	50	100	2
MTCNIS18	Network Simulation & IoT Lab		3	50	50	100	2
Total		18	6	520	280	800	18

Elective-I: Virtual Private Networks/Machine Learning/Unix Network Programming

Elective II: Cloud Computing/ Distributed Operating Systems /IoT

II-SEMESTER

Code	Name of the subject	Periods/week		Max. Marks		Total Credits	
		Theory	Lab	Ext.	Int.		
MTCNIS21	Mobile-Adhoc Networks	3	-	70	30	100	3

MTCNIS22	Computer Security	3	-	70	30	100	3
MTCNIS23	Elective-III	3	-	70	30	100	3
MTCNIS24	Elective-IV	3	-	70	30	100	3
MTCST25	Entrepreneurship (Audit Course)	3	-	70	30	100	0
MTCNIS26	Wireless Networks Lab	-	3	50	50	100	2
MTCNIS27	Application Security Lab	-	3	50	50	100	2
MTCNIS28	Mini Project With Seminar	-	3	-	100	100	2
Total		15	9	450	350	800	18

Elective III: Web Application Security/Android-IoS Security/IoT Security

Elective IV: Digital Forensics/Sensor Networks/Intrusion Detection System(IDS)

III-SEMESTER

Code	Name of the subject	Periods/week		Max. Marks		Total Credits	
		Theory	Lab	Ext.	Int.		
MTCNIS 31	Elective-V	3	-	70	30	100	3
MTCNIS 32	Open Elective	3	-	70	30	100	3
MTCNIS33	Dissertation-I / Industrial project	-	-	100	-	100	10
Total		6	-	240	60	300	16

Elective V: Malware Analysis/Block chain Technologies/Software Defined Networks

Open Elective: Business Analytics /4G-5G Mobile Communication Networks/ Operation Research

IV-SEMESTER

Code	Name of the subject	Periods/week		Max. Marks		Total Credits	
		Theory	Lab	Ext.	Int.		
MTCNIS41	Dissertation - II	-	-	100	-	100	16
Total		-	-	100	-	100	16

Detailed Syllabus for M.Tech (CN & IS) First Semester

MTCNIS11 MATHEMATICAL FOUNDATIONS FOR CRYPTOGRAPHY

Instruction: 3Periods/week Time:3Hours Credits:3

Internal: 30Marks External:70Marks Total: 100Marks

UNIT I: Introduction and classical cryptography : Overview of Cryptography and Security(Text Book, Reference 1) , Cryptographic Attacks, services and mechanisms, Mathematics of Cryptography (Reference 2)

UNIT II: Secret key cryptography Mathematics for Symmetric Key Cryptography (Reference 2), Encryption, Stream ciphers, Block ciphers, Chosen plaintext attacks (Text Book)

UNIT III: Integrity and Hashing Message integrity, Message integrity from universal hashing, Message integrity from collision resistant hashing, Authenticated encryption (Text Book)

UNIT IV: Public key cryptography Mathematics for Asymmetric Cryptography (Reference2), Public key tools, Public key encryption, Chosen ciphertext secure public-key encryption, Digital signatures (Text Book)

UNIT V: Modern Cryptographic methods Fast signatures from one-way functions, Elliptic curve cryptography and pairings, Post-quantum cryptography: lattices and isogenies, Analysis of number theoretic assumptions (Text Book)

UNIT VI: Protocols Protocols for identification and login, Identification and signatures from sigma protocols (Text Book)

UNIT VI: Cryptographic Proofs Proving properties in zero-knowledge, Modern proof systems, Authenticated key exchange, Two-party and multi-party secure computation (Text Book)

Text Book:

A Graduate Course in Applied Cryptography (V 0.5) by D. Boneh and V. Shoup, available free online.

References:

Introduction to Modern Cryptography (3rd edition), Jonathan Katz and Yehuda Lindell

Cryptography and Network Security 3/e, Behrouz A. Forouzan, Debdeep Mukhopadhyay

MTCNIS12 TCP/IP

Instruction: 3Periods/week Time:3Hours Credits:3

Internal: 30Marks External:70Marks Total: 100Marks

UNIT I: Review Of Important Networking Concepts: Networking and architectures of TCP/IP and OSI reference models

UNIT II: Address Resolution Protocol (ARP) and RARP, IP Protocol, IP addresses, Over view of ICMP, PING and Trace route, BOOTP and DHCP, IP Forwarding, Congestion Control in the NW layer

UNIT III: Dynamic Routing Protocols: RIP,OSPF

UNIT IV: Transport Protocols: TCP and UDP- Connection Management, Flow Control and Congestion Control

UNIT V: LAN Switching, NAT, DHCP

UNIT VI: Domain Name System, IP Multicasting, SNMP, IPV6, MPLS, MOBILE IP,TCP/IP SECURITY

UNIT VII: Introduction to FINGER Protocol, WHOIS Protocol

UNIT VIII: Other Protocols: WAIS, GOPHER, VERONICA, TCPDUMP

TEXT BOOKS:

1. Computer Networks, Andrews S Tanenbaum,, Edition 5, PHI
2. TCP/IP illustrated, Volume 1: The Protocols, W. Richard Stevens, W. Richard Stevens, Pearson Education Asia, 2002
3. TCP/IP Tutorial and Technical Overview, A.Rodriguez, J. Gatrell, J. Karas, R.Peschke,IBMRedbook(Available on net forfree)

REFERENCE BOOKS:

1. Internetworking with TCP/IP Vol.1: Principles, Protocols, and Architecture (4thEdition) by Douglas E. Comer ,Pearson EducationAsia,2000
2. Internetworking with TCP/IP, Vol. III: Client-Server Programming and Applications, Linux/Posix Sockets Version, Douglas E. Comer, David L. Stevens, Michael Evangelista , Pearson EducationAsia,2000

MTCNIS13 ELECTIVE-I VIRTUAL PRIVATE NETWORK

Instruction: 3Periods/week Time:3Hours Credits:3

Internal: 30Marks External:70Marks Total: 100Marks

UNIT 1 : Introduction to VPN TCP/IP overview: Layering, Encapsulation, Addressing, IP, UDP,TCP,ICMP, NAT and Private IP Addresses, IPv6, Routing

UNIT 2 : VPN Security What is VPN, VPN Components, VPN Workflow ,Tunneling, Intranet, Extranet, Remote Access Types of VPN's, VPN Architecture, Advantages & Disadvantages

UNIT 3 : Tunnels Introduction, IP-in-IP tunnels , PPPoE, GRE, PPTP, L2TP, MPLS

UNIT 4 : SSL & SSH SSL-Introduction, SSL Protocol, SSL on wire, Open SSL, SSL Security SSH-Introduction, SSH V1, SSH V2, Building VPN's with SSH

UNIT 5 : Light weight VPN Introduction, VTun, CIPE, Tinc, Open VPN

UNIT 6 : IPsec IPsec Architecture, Protocols, IPsec Modes, Security Associations AH- AH Header, Sequence Numbers, AH Processing, Tunnel mode, AH with IPV6 ESP-Header, Tunnel Mode, ESP with IPV6

UNIT 7 : Applications of VPN Applications of VPN, Application of VPN in industries and business

References:

1. VPN's Illustrated Tunnels, VPN's and IPsec by Jon.c,Snader
2. Virtual Private Networks O'Reilly 2 nd Edition Charlie Scott, Paul Wolfe & Mike Erwin

MTCNIS13 ELECTIVE-I MACHINE LEARNING

Instruction: 3Periods/week Time:3Hours Credits:3

Internal: 30Marks External:70Marks Total: 100Marks

UNIT 1: Introduction: Introduction to Machine Learning, learning task-illustration, Approaches to Machine Learning, Machine Learning algorithms-Theory, Experiment in biology and Psychology.

UNIT 2: Concept Learning: Introduction, Concept Learning Task-Notation, Concept Learning Search, Version spaces, Candidate Elimination Algorithm, Inductive Bias, Biased hypothesis Space, Unbiased Learner, Bias-free Learning, Active queries, Mistake bound/PAC model – basic results. Overview of issues regarding data sources, success criteria

UNIT 3: Decision Tree Learning: Decision Tree Representation, Basic decision Tree Learning, Inductive bias in Decision tree Learning, Issues in Decision Tree Learning, Minimum Description Length Principle, Occam's razor, Learning with active queries

UNIT 4: Neural Network Learning: Neural Network Representation, Problems for Neural Network Learning, Perceptions and gradient descent, Multi-Layer Network and Back propagation Algorithm, Illustrative Example of Back Propagation Algorithm- Face Recognition, Advanced Topics in ANN.

UNIT 5: Bayesian Approaches: Basics of Bayes Theorem and Concept Learning, Expectation Maximization, Minimum Description Length Principle, Navie Bayes Classifier, Bayesian Belief Networks, EM Algorithm, K-Means Algorithm, Hidden Markov Models Instance-Based Techniques; Lazy vs. eager generalization, k nearest neighbor, Locally Weight Representation, Case-based Reasoning

UNIT 6: Analytical Learning: Inductive and Analytical Learning problems, Learning with perfect Domain Theory, Explanation Based Learning, Inductive Bias in EBL, Search Control Knowledge with EBL, Inductive- Analytical Approaches to Learning, Using prior Knowledge for Initialize the Hypothesis, and Altering Search objective, FOCL Algorithm.

UNIT 7: Genetic Algorithms: Representation of Hypothesis as GA,, Genetic Operators, Fitness function and Selection, Hypothesis Space search, Genetic Programming, Models of Evolution and Learning, Parallelizing GA, Different search methods for induction

Text Books:

1. Machine Learning, Tom Mitchell , McGraw Hill,1997
2. The Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani & Jerome Friedman, Springer Verlag, 2001

Reference Books:

1. Pattern Classification, Richard O. Duda, Peter E. Hart and David G. Stork, John Wiley & Sons Inc.,2001

2. Neural Networks for Pattern Recognition, Chris Bishop, Oxford University Press,

MTCNIS13 ELECTIVE-I UNIX NETWORK PROGRAMMING

Instruction: 3Periods/week Time:3Hours Credits:3

Internal: 30Marks External:70Marks Total: 100Marks

Course Objectives

1. To understand inter process and inter-system communication.
2. To understand socket programming in its entirety.
3. To understand usage of TCP/UDP / Raw sockets.
4. To understand how to build network applications.

Course Outcomes:

1. To write socket API based programs.
2. To design and implement client-server applications using TCP and UDP sockets.
3. To analyse network programs.

UNIT - I Introduction to Network Programming: UNIX standards, OSI model, TCP and UDP & TCP connection establishment and Format, Buffer sizes and limitation, standard internet services, Protocol usage by common internet application.

UNIT – II Socket: Elementary sockets introduction, Address structures, value – result arguments, Byte ordering and manipulation function and related functions.

Elementary TCP sockets – Introduction, Socket, connect, bind, listen, accept, fork and exec functions, concurrent servers. Close function, getsockname and getpeername functions.

UNIT - III : TCP Client/Server: Introduction, TCP Echo server functions, Normal start up, Normal termination and POSIX signal handling, Termination of server process, Crashing and Rebooting of server host, shutdown of server host.

I/O Multiplexing: Introduction, I/O Models, select function, Batch input and buffering, shutdown function, poll function, TCP Echo server.

Socket options: introduction, getsockopt and setsockopt functions. Socket states, Generic socket option, IPV6 socket option, ICMPV6 socket option, IPV6 socket option and TCP socket options.

UNIT – IV : Elementary UDP sockets: Introduction, UDP Echo server functions, lost datagram, summary of UDP example, Lack of flow control with UDP, determining outgoing interface with UDP. Name and Address conversions: DNS, gethost by Name function, Re-entrant function, obsolete IPV6 Address lookup functions, and other networking information.

UNIT - V : Daemon Processes and inetd Superserver – Introduction, syslogd Daemon, syslog Function, daemon_init Function, inetd Daemon, daemon inetd Function. Advanced I/O Functions-Introduction, Socket Timeouts, recv and send Functions, readv and writev Functions, recvmsg and sendmsg Functions, Ancillary Data, How Much Data Is Queued? , Sockets and Standard I/O, Advanced Polling.

UNIT - VI : Broadcasting- Introduction, Broadcast Addresses, Unicast versus Broadcast, dg_cli Function Using Broadcasting, Race Conditions.

Multicasting- Introduction, Multicast Addresses, Multicasting versus Broadcasting on A LAN, Multicasting on a WAN, Multicast Socket Options, mcast join and Related Functions, dg_cli Function Using Multicasting, Receiving IP Multicast Infrastructure Session Announcements, Sending and Receiving, SNTP: Simple Network Time Protocol.

UNIT – VII : Raw Sockets-Introduction, Raw Socket Creation, Raw Socket Output, Raw Socket Input, Ping Program, Traceroute Program, An ICMP Message Daemon,

Data link Access- Introduction, BPF: BSD Packet Filter, DLPI: Data Link Provider Interface, Linux: SOCK_PACKET and PF packet, libpcap: Packet Capture Library, Examining the UDP Checksum Field.

Text Book:

UNIX Network Programming, by W. Richard Stevens, Bill Fenner, Andrew M. Rudoff, Pearson Education.

References:

1. UNIX Systems Programming using C++ T CHAN, PHI.
2. UNIX for Programmers and Users, 3rd Edition Graham GLASS, King abls, Pearson Education.
3. Advanced UNIX Programming 2nd Edition M. J. ROCHKIND, Pearson Education.
4. Red Hat Linux networking & Systems Administration, Terry Collings & Kurtwall, Wiley publications.

MTCNIS14 ELECTIVE-II CLOUD COMPUTING

Instruction: 3Periods/week Time:3Hours Credits:3

Internal: 30Marks External:70Marks Total: 100Marks

Course objectives:

1. To import fundamental concepts in the area of cloud computing.
2. To understand the concept of Virtualization and cloud data storage.
3. To learn cloud Application Development and cloud Governance.
4. To gain competence in Map Reduce and Hadoop Overview.

Course Outcomes:

1. Identify the architecture and infrastructure of cloud computing.

2. Develop applications for cloud computing.
3. Design and Implement a novel cloud computing application.

SYLLABUS

UNIT 1: Introduction to cloud computing: Cloud computing components, Infrastructure services, storage applications, database services – introduction to SaaS, PaaS, IaaS, IDaaS, data storage in cloud

UNIT 2: Virtualization: enabling technologies, types of virtualization, server virtualization, desktop virtualization, memory virtualization, application and storage virtualization-tools and products available for virtualization

UNIT 3: SAAS and PAAS: Getting started with SaaS, SaaS solutions, SOA, PaaS and benefits.

UNIT 4: IaaS and Cloud data storage: understanding IaaS, improving performance for load balancing, server types within IaaS, utilizing cloud based NAS devices, cloud based data storage, and backup services, cloud based block storage and database services

UNIT 5: Cloud Application development: Client server distributed architecture for cloud designing cloud based solutions, coding cloud based applications, traditional Apps vs cloud Apps, client side programming, server side programming overview-fundamental treatment of web application frameworks.

UNIT 6: Cloud Governance and economics: Securing the cloud, disaster recovery and business continuity in the cloud, Managing the cloud, migrating to the cloud, governing and evaluating the cloud's business impact and economics,

UNIT 7: Inside Cloud: Introduction to MapReduce and Hadoop-over view of big data and its impact on cloud

Text Books:

1. Cloud Computing: SaaS, PaaS, IaaS, Virtualization, Business Models, Mobile, Security and More, Kris Jamsa, Jones & Bartlett Publishers, Paper back edition, 2013

2. Hadoop Map Reduce cookbook, Srinath Perera and Thilina Gunarathne, Packt publishing

Reference Book:

1. Cloud Computing: A Practical Approach, Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, Tata McGraw Hill Edition

MTCNIS14 ELECTIVE-II DISTRIBUTED OPERATING SYSTEMS

Instruction: 3Periods/week Time: 3 Hours Credits:3

Internal: 30Marks External: 70 Marks Total: 100Marks

Unit-1: Introduction to Distributed Systems, What is a Distributed System?, Hardware concepts, Software concepts, Design issues.

Unit-2: Communication in Distributed Systems Layered Protocols, ATM networks, The Client – server model, Remote Procedure call, Group communication.

Unit-3- Synchronization in Distributed System, Clock Synchronization, Mutual Exclusion, Election algorithms, Atomic transactions, Deadlocks in Distributed Systems.

Unit-4-Process and processors in Distributed System threads, System Models, Processors allocation, Scheduling in Distributed System, Fault tolerance, Real time Distributed System.

Unit-5-Distributed File Systems, Distributed File System Design, Distributed File System implementation, Trends in Distributed File System.

Unit-6: Distributed Shared Memory, Introduction, What is Shared memory?, Consistency models, Page based Distributed Shared memory, Shared – variable Distributed Shared memory, Object based Distributed Shared Memory.

Text Book:

Distributed Operating Systems, Andrew S. Tanenbaum

Reference Book:

Advanced Concepts in Operating Systems, Makes Singhal and Niranjana G. Shivaratna

MTCNIS14 ELECTIVE-II INTERNET OF THINGS

Instruction: 3Periods/week Time: 3 Hours Credits:3

Internal: 30Marks External: 70 Marks Total: 100Marks

UNIT 1: Introduction to the internet of things. IoT Architecture: History of IoT, M2M–Machine to Machine, Web of Things, IoT protocols The Architecture The Layering concepts, IoT Communication Pattern, IoT protocol Architecture, The 6LoWPAN

UNIT 2: Prototyping connected objects. Open-source prototyping platforms.

UNIT 3: Integrating internet services. XML and JSON. HTTP APIs for accessing popular Internet services (Facebook, Twitter, and others). Practical activities. IoT Application Development: Application Protocols MQTT, REST/HTTP, CoAP, MySQL

UNIT 4: Overview of IoT supported Hardware platforms such as: Raspberry pi, ARM Cortex Processors, Arduino and Intel Galileo boards.

UNIT 5: Ubiquitous computing, applications of IoT, Virtualization of network resources and physical devices in IoT.

UNIT 6: Internet of Things Standardization M2M Service Layer Standardization OGC Sensor Web for IoT

Text Book:

Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems author. Marina Ruggieri H, River Publishers Series In Communications

MTCNIS15 RESEARCH METHODOLOGY AND IPR

Common for M.Tech (CST, IT, CN&IS, AI&ML)

Instruction: 3Periods/week Time: 3 Hours Credits: 2

Internal: 30Marks External: 70 Marks Total: 100Marks

Unit 1: Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Unit 2: Effective literature studies approaches, analysis Plagiarism, Research ethics,

Unit 3: Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

Unit 4: Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Unit 5: Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

Unit 6: New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

References:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science& engineering students"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2 ndEdition, "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd,2007.
5. Mayall, "Industrial Design", McGraw Hill, 1992.
6. Niebel, "Product Design", McGraw Hill, 1974.
7. Asimov, "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.

9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

MTCNIS16 ORGANIZATIONAL BEHAVIOR (Audit Course)

Common for M.Tech (CST, IT, CN&IS, AI&ML)

Instruction: 3Periods/week Time: 3 Hours Credits:0

Internal: 30Marks External: 70 Marks Total: 100Marks

UNIT I: Organizational Behavior: Concept of Organization - Concept of Organizational Behavior - Nature of Organizational Behavior - Role of Organizational behavior - Disciplines contributing to Organizational Behavior.

UNIT II: Motivation: Definition - Nature of Motivation - Role of Motivation - Theories of Motivation: Maslow's Need Hierarchy Theory, Herzberg's Motivation Hygiene Theory and McGregor's Theory X and Theory Y.

UNIT III: Group Dynamics: Meaning - Concept of Group - Types of groups -Formal and Informal groups - Group development - Group cohesiveness and factors affecting group cohesiveness.

UNIT IV: Leadership: Concept of Leadership - Difference between Leadership and Management - Importance of Leadership - Leadership styles: Autocratic leadership, Participative leadership and Free Rein leadership.

UNIT V: Communication: Meaning - Communication Process - Forms of communication: Oral, Written and Non- Verbal communication - Direction of communication: Downward, Upward and Horizontal communication.

UNIT VI: Organizational conflicts: Concept of conflict - Reasons for conflict - Types of Conflict: Intrapersonal conflict, Interpersonal conflict, Intragroup conflict, Intergroup conflict, Interorganizational conflict - Conflict management.

UNIT VII: Organizational Change: Nature - Factors inOrganizational change -Planned change: Process of planned change - Resistance to change: Factors in resistance to change - Overcoming resistance to change.

Text Books:

1.L.M.Prasad: Organizational Behavior, Sultan Chand & Sons, New Delhi -110002

2.K. Aswathappa: Organizational Behavior, Himalaya Publishing House, New Delhi

Reference Books:

Stephen Robbins: Organizational Behavior, Pearsons Education, New Delhi.

MTCNIS17 TCP/IP LAB

Instruction: 3Periods/week Time: 3 Hours

Credits:2

Internal: 30Marks External: 70 Marks Total: 100Marks

Name of practical:

1. To implement allocation of IP address.
2. To configure internet IP address
3. To assign IP address using CIDR
4. To configure APACHE server
5. To decode header fields of IP datagram
6. To decode header fields of TCP header.
7. To configure a DNS server
8. Identify, download & install open source tools related to TCP/IP.
9. Compile and test TTCP

MTCNIS18 NETWORK SIMULATION & IOT LAB

Instruction: 3Periods/week Time: 3 Hours Credits:2

Internal: 30Marks External: 70 Marks Total: 100Marks

Network Simulation Lab:

1. Performance Analysis of AODV using OPNET
2. Performance Analysis of DSR using NS2
3. Performance Analysis of ZRP using NS3
4. Performance Analysis of WiMax Using OPNET
5. Performance Analysis of Wireless Local Area Network using OPNET
6. Performance Analysis of MAC Protocols using OPNET

Internet of Things Lab:

1. Performance Analysis of QoS Metrics of IEEE 802.15.4 protocol using Cooja Simulator
2. Performance Analysis of QoS Metrics 6LoWPAN protocol using Cooja Simulator
3. Performance Analysis of QoS Metrics RPL protocol using Cooja Simulator
4. Performance Analysis of QoS Metrics MQTT protocol using Cooja Simulator
5. Performance Analysis of QoS Metrics AMQP protocol using Cooja Simulator
6. Performance Analysis of QoS Metrics CoAP protocol using Cooja Simulator

Detailed Syllabus for M.Tech (CN & IS) Second Semester

MTCNIS21 MOBILE-ADHOC NETWORKS

Instruction: 3Periods/week Time: 3 Hours Credits:3

Internal: 30Marks External: 70 Marks Total: 100Marks

UNIT 1: Introduction: Introduction to Wireless Networks, Various Generations of Wireless Networks, Virtual Private Networks- Wireless Data Services, Common Channel Signaling, Various Networks for Connecting to the Internet, Blue tooth Technology, Wifi-Wi Max- Radio Propagation mechanism, Pathloss Modeling and Signal Coverage

UNIT 2: Wireless Local Area Networks: Introduction-WLAN topologies- IEEE 802.11 Standards , MAC Protocols, Comparison of 802.11 a,b,g and n Standards, HIPER LAN , ZigBee 802.15.4, Wireless Local Loop

UNIT 3: Wireless Adhoc Networks: Basics of Wireless Networks, Infrastructure Versus Infrastructure less Networks – Properties of Wireless, Ad hoc Networks, Types of Ad Hoc Networks, Challenges in AD Hoc Networks – Applications of Wireless AD Hoc Networks , Routing Protocols for Ad Hoc Networks: Introduction-Proactive Routing Protocols- Reactive Routing protocols-Hybrid Routing Protocols-QoS Metrics-Energy impact issues in Routing.

UNIT 4: Mobile Communications: Introduction to cellular concept, Frequency Reuse, Handoff, GSM: Mobile services, System architecture, Radio interface, Protocols, Localization and calling, Handover, Security, and New data services, Introduction to mobile computing, novel applications, limitations, and architecture.

UNIT 5: Mobile Data Networks: Location/mobility management, Mobile IP, Dynamic routing protocols, Location-based protocols, Emerging topics: sensor networking, Data-Oriented CDPD network, GPRS and higher data rates, Short messaging service in GSM.

UNIT 6: Mobile Ad Hoc Networks (MANETs): Overview, Properties of A MANET, Spectrum of MANET Applications, Routing and Various Routing Algorithms.

UNIT 7: Other Wireless Technologies: Introduction, IEEE 802.15.4 and Zigbee, General Architecture, Physical Layer, MAC layer, Zigbee, WiMAX and IEEE 802.16, Layers and Architecture, Physical Layer, OFDM Physical layer.

UNIT 8: Security in Ad Hoc Networks: Introduction- Security Attacks, Intrusion Detection System, Intrusion Prevention system, Intrusion Response system, Wired Equivalent Privacy(WEP) -A Security Protocol for Wireless Local Area Networks (WLANs), Security in MANETs.

Text Books:

1. Principles of Wireless Networks , KavethPahlavan, K. Prasanth Krishnamurthy, Pearson Publications, Asia,2002

2. Mobile Cellular Communications, G.Sasibhusan Rao, PearsonPublications.

References:

1. Guide to Wireless Ad Hoc Networks: Series: Computer Communications and Networks,

2. Misra, Sudip; Woungang, Isaac; Misra, Subhas Chandra, 2009, Springer

MTCNIS22 COMPUTER SECURITY

Instruction: 3Periods/week Time: 3 Hours Credits:3

Internal: 30Marks External: 70 Marks Total: 100Marks

UNIT 1: User Authentication and Database Security Digital User Authentication Principles, Password-Based Authentication, Token-Based Authentication, Biometric Authentication, Remote User Authentication, and Security Issues for User Authentication, Practical Application: An Iris Biometric System, Case Study: Security Problems for ATM Systems

The Need for Database Security, Database Management Systems, Relational Databases, SQL Injection Attacks, Database Access Control, Inference, Database Encryption, Data Center Security

UNIT 2: Access Control Access Control Principles, Subjects, Objects, and Access Rights, Discretionary Access Control, Example: UNIX File Access Control, Role-Based Access Control, Attribute-Based Access Control, Identity, Credential, and Access Management, Trust Frameworks, Case Study: RBAC System for a Bank

UNIT 3: Malicious Software Types of Malicious Software, Advanced Persistent Threat, Propagation — Infected Content – Viruses, Propagation — Vulnerability Exploit – Worms, Propagation — Social Engineering — SPAM E-Mail, Trojans, Payload — System Corruption, Payload — Attack Agent — Zombie, Bot, Payload — Information Theft — Keyloggers, Phishing, Spyware, Payload — Stealthing — Backdoors, Rootkits, Countermeasures

UNIT 4: Network Attacks and Prevention Denial-of-Service Attacks, Distributed Denial-of-Service Attacks, Application-Based Bandwidth Attacks, Defenses Against Denial-of-Service Attacks, Responding to a Denial-of-Service Attack Intruders, Intrusion Detection, Analysis Approaches, Host-Based Intrusion Detection, Network-Based Intrusion Detection, Honeypots, Snort, Need for firewalls, types of firewalls, IPS

UNIT 5: Software and OS Security Stack Overflows, Defending Against Buffer Overflows, Other Forms of Overflow Attacks, Software Security Issues, Handling Program Input, Writing Safe Program Code, Interacting

with the Operating System and Other Programs, Handling Program Input, OS Security, System Security Planning, Operating Systems Hardening, Application Security, Security Maintenance, Linux/UNIX Security, Windows Security, Virtualization Security

UNIT 6: Security Management issues IT security management and Risk Management, IT Security Controls, plans and procedures, Physical and Infrastructure Security

UNIT 7: Security Auditing, legal and ethical aspects Security auditing architecture, Security audit trail, implementing the logging function, audit trail analysis, security information and event management, Cybercrime and computer crime, intellectual property, privacy and ethical issues

Text Book:

1. Computer Security: Principles and Practice, William Stallings, Lawrie Brown, Pearson

Reference Book

2. Cryptography and Network Security, William Stallings, Pearson

MTCNIS23 ELECTIVE-III WEB APPLICATION SECURITY

Instruction: 3Periods/week Time: 3 Hours Credits:3

Internal: 30Marks External: 70 Marks Total: 100Marks

Unit 1: Web Application Security and Core Defense mechanisms, Evolution of Web Applications, Web Application Security, Core Defense Mechanisms: Handling User access, Handling User Input, Handling Attackers

Unit 2: Web Application Technologies and mapping applications, HTTP Protocol, Web functionality, Encoding Schemes, Mapping the Application: Enumerate the content and Functionality, Analysing the application

Unit 3: Client side and Authentication Attacks Bypassing, Client-side controls: Transmitting data via the client, Capturing the user data- HTML Forms and Browser extensions, Handling client side data securely Attacking Authentication: Authentication Technologies, Design flaws in authentication, Implementation flaws in authentication, securing authentication.

Unit 4: Session management attacks and Access, Controls Session States, weaknesses in Token generation and Session Token handling, Securing session management Common vulnerabilities and attacking access controls, securing access controls.

Unit 5: Attacking Data stores and Back end components, Bypassing logging, Injecting into SQL: Exploiting Basic Vulnerability, Injecting into different statement types, Finding SQL Injection Bugs, Fingerprinting the database, The UNION Operator, Extracting data, Bypassing filters, Second order SQL Injection, Attack escalation, SQL exploitation tools, preventing

SQL Injection, Injecting OS commands, manipulating file paths, Injecting into backend HTTP requests

Unit 6: Attacking Users XSS- reflected, stored and DOM, XSS attack payloads and delivery mechanisms. Finding and exploiting XSS vulnerabilities and preventing, CSRF basic examples, Client side injection attacks like HTTP header injection, Cookie Injection attacks, Attacking Browsers: logging keystrokes, stealing browser history and search queries, enumerating currently used applications, port scanning, exploiting browser bugs, DNS rebinding, browser exploitation and Man in the middle attacks.

Unit 7: Attacking Application Server and architecture Attacking Application Architecture, Attacking the application server, Approaches to code review, Signatures of common vulnerabilities

Text Book:

The Web Application Hacker's Handbook, 2nd Edition, Dafydd Stuttard, Marcus Pinto

Reference:

1. Bryan and Vincent, "Web Application Security, A Beginners Guide", McGraw-Hill, 2011
2. Web Security Basics, by Shweta Bhasin, Prima Tech

MTCNIS23 ELECTIVE-III ANDROID-IOS SECURITY

Instruction: 3Periods/week Time: 3 Hours Credits:3

Internal: 30Marks External: 70 Marks Total: 100Marks

Course Objectives:

This course Describes different components of Android applications and iOS Applications

- 1) Identifies possible vulnerabilities and Security issues in both the platforms
- 2) Identifies and helps in practising defensive programming techniques to protect the users of Android and iOS applications from the common attacks.
- 3) Secure coding examples

Course Outcomes: At the end of this course Students will

- 1) Identify various risks related to Android and iOS applications.
- 2) Understand the structure of Android and iOS files.
- 3) Understand the Android security model and the protections provided by the Android OS.
- 4) Understand the iOS security model and the protections provided by the iOS.

Part-I Android Security

1. Introduction to Android App Development About Android, Why Android, Downloading Android studio, Types of Mobile Apps -Hybrid Apps, Native Apps, Cross-Platform Apps, Mobile Platforms, Progressive Web Apps, Classification of Mobile Security Threats

2. Android Architecture and packet Management Android's Architecture, Android Framework Libraries, Android's Security Model, Android Application Package Format, Code Signing, APK Install Process, Package Verification

3. Device Security& NFC Controlling OS Boot-Up and Installation, Disk Encryption, Screen Security, Secure USB Debugging, Android Backup, NFC Overview, Android NFC Support, Secure Elements, Software Card Emulation

Part -II - iOS Security 4. The iOS Fundamentals & Security Model The iOS Security Model, Secure Boot, App Sandbox, Data Protection and Full-Disk Encryption, The Encryption Key Hierarchy, The Keychain and Data Protection API, Native Code Exploit Mitigations, Jailbreak Detection, Dynamic Patching

5. iOS Application Anatomy Dealing with plist Files, Device Directories, The Bundle Directory, The Data Directory, The Shared Directory.

6. iOS Security testing Suggested Testing Devices, Testing with a Device vs. Using a Simulator, Network and Proxy Setup.

7. Mobile Privacy Concerns Dangers of Unique Device Identifiers, Solutions from Apple, Rules for Working with Unique Identifiers, Mobile Safari and Do Not Track Header, Cookie Acceptance Policy, Monitoring Location and Movement, Managing Health and Motion Information, Managing Health and Motion Information.

Text Book:

1. Android Security Internals- An In-Depth Guide to Android's Security Architecture Author : Nikolay Elenkov, no starch press(Chapters 1,2,3,10,11 from text book) (For Part 1-Chapters 1,2, 3 from Syllabus)

2. iOS Application Security- The Definitive Guide for Hackers and Developers, Authors : David Thiel, no starch press (Chapters 1,3, 4, 14 from text book) (For Part II - Chapters 4,5,6,7 from Syllabus)

Reference:

1) Hacking Exposed Mobile: Security Secrets & Solutions 1st Edition by Neil Bergman (Author), Mike Stanfield (Author) et al, McGraw Hill

MTCNIS23 ELECTIVE-III IoT SECURITY

Instruction: 3Periods/week Time: 3 Hours Credits:3

Internal: 30Marks External: 70 Marks Total: 100Marks

UNIT 1: Introduction: Securing the Internet of Things, security requirements in IoT architecture, security in enabling technologies, security concerns in IoT applications.

UNIT 2: Security Architecture in the Internet of Things: Security Requirements in IoT, Insufficient Authentication/Authorization, Insecure Access Control, Threats to Access Control, Privacy, And Availability, Attacks Specific to IoT.

UNIT 3: Security and Vulnerability in the Internet of Things: Secrecy And Secret-Key Capacity, Authentication/Authorization For Smart Devices, Transport Encryption, Secure Cloud/Web Interface, Secure Software/Firmware, Physical Layer Security.

UNIT 4: Identity and Access Management Solutions for the IoT: Identity and Access Management Solutions for the IoT, An introduction to IAM for the IoT, The identity life cycle, Authentication credentials, IoT IAM infrastructure, Authorization and access control

UNIT 5: Mitigating IoT Privacy Concerns: Mitigating IoT Privacy Concerns, Privacy challenges introduced by the IoT, Guide to performing an IoT PIA, Privacy by design, Privacy engineering recommendations.

UNIT 6: Cloud Security for the IoT: Cloud Security for the IoT, The role of the cloud in IoT systems , The concept of the fog, Threats to cloud IoT services, Cloud-based security services for the IoT.

UNIT 7: IoT Incident Response and Forensic Analysis: IoT Incident Response and Forensic Analysis, Threats to both safety and security, Defining, planning, and executing an IoT incident response, Detection and analysis, IoT forensics

Textbooks:

1. Securing the Internet of Things, Shancang Li and Li Da Xu, 2017, Syngress Elsevier.
2. Practical Internet of Things Security - Brian Russell , Drew Van Duren, Orielly Publication.

References:

1. Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations, Fei Hu, CRC Press,2020
2. The IoT Architect's Guide to Attainable Security and Privacy, Damilare D. Fagbemi, David M.Auerbach Publications, 2019

MTCNIS24 ELECTIVE-IV DIGITAL FORENSICS

Instruction: 3Periods/week Time: 3 Hours Credits:3

Internal: 30Marks External: 70 Marks Total: 100Marks

Unit 1 Introduction : Introduction of Cybercrime: Types, The Internet spawns crime, Worms versus viruses, Computer's roles in crimes,

Introduction to digital forensics, Introduction to Incident - Incident Response Methodology

Unit 2 Initial Response and Forensic Duplication : Initial Response & Volatile Data Collection from Windows system - Initial Response & Volatile Data Collection from Unix system - Forensic Duplication: Forensic Duplicates as Admissible Evidence, Forensic Duplication Tool Requirements, Creating a Forensic. Duplicate/Qualified Forensic Duplicate of a Hard Drive.

Unit 3 Preserving and Recovering Digital Evidence File Systems: FAT, NTFS - Forensic Analysis of File Systems, Storage Fundamentals: Storage Layer, Hard Drives

Unit 4 Evidence Handling Types of Evidence, Challenges in evidence handling, Overview of evidence handling procedure.

Unit 5 Network Forensics Intrusion detection; Different Attacks in network, analysis Collecting Network Based Evidence - Investigating Routers - Network Protocols - Email Tracing- Internet Fraud.

Unit 6 System Investigation Data Analysis Techniques - Investigating Live Systems (Windows & Unix) Investigating, Hacker Tools - Ethical Issues – Cybercrime.

Unit 7 Cyber Laws and Global and Indian Contexts Constitutional law, Criminal law, Civil law, Administrative regulations, Local laws, State laws, Federal laws, International laws, Criminal versus civil cases ,Vicarious liability, Computer related laws CFAA, DMCA, CAN Spam

Text Books

1. Digital Forensics: The Fascinating World of Digital Evidences, Neelakshi Jain, D.R Kalbande, Wiley Books
2. Digital Forensics and Incident Response: A practical guide to deploying digital forensic techniques in response to cyber security incidents : Gerard Jhansen, Packt Publishers

Reference Books

1. Learn Computer Forensics: A beginner's guide to searching, analyzing, and securing digital evidence by William Oettinger , Pckt Publishers

2. Cyber Forensics by Deje and Murugan, Oxford University Press

MTCNIS24 ELECTIVE-IV SENSOR NETWORKS

Instruction: 3Periods/week Time: 3 Hours Credits:3

Internal: 30Marks External: 70 Marks Total: 100Marks

UNIT 1: Introduction: The vision of Ambient Intelligence, Application examples, Types of applications, Challenges for Wireless Sensor Networks(WSNs), Sensor networks vs Enabling Technologies for WSNs,

Single node architecture: Hardware components, Energy consumption of sensor nodes, Some examples of sensor nodes, Operating systems and execution environments

UNIT 2: Network architecture: Sensor network scenarios, Optimization goals and figures of merit, Design principles for WSNs,

UNIT 3: Physical layer and transceiver design considerations in WSNs: MAC Protocols: Fundamentals of (wireless) MAC protocols, Low duty cycle protocols and wakeup concepts, Contention-based protocols, Schedule-based protocols, The IEEE 802.15.4 MAC protocol, How about IEEE 802.11 and Bluetooth

UNIT 4: Link layer protocols: Fundamentals: tasks and requirements, Error control, Framing, Link management

UNIT 5: Naming and addressing: Fundamentals, Address and name management in wireless sensor networks, Assignment of MAC addresses, Content-based and geographic addressing

UNIT 6: Routing protocols: The many faces of forwarding and routing, Energy-efficient unicast, Broadcast and multicast, Geographic routing.

UNIT 7: Data-centric and content-based networking : Introduction, Data-centric routing, Data aggregation, Data-centric storage

UNIT 8: Transport layer and Quality of Service: The transport layer and QoS in wireless sensor networks, Coverage and deployment, Reliable data transport, Single packet delivery, Block delivery, Congestion control and rate control

TEXT BOOK:

1. Protocols and Architectures for Wireless Sensor Networks, Holger Karl, Andreas Willig., John Wiley & Sons Ltd, 2005

2. Network Management Fundamentals, Alexander Clemn CISCIPress2007

MTCNIS24 ELECTIVE-IV INTRUSION DETECTION SYSTEM (IDS)

Instruction: 3Periods/week Time: 3 Hours Credits:3

Internal: 30Marks External: 70 Marks Total: 100Marks

Course Objectives:

1. Understand when, where, how, and why to apply Intrusion Detection tools and techniques in order to improve the security posture of an enterprise.
2. Apply knowledge of the fundamentals and history of Intrusion Detection in order to avoid common pitfalls in the creation and evaluation of new Intrusion Detection Systems

3. Analyze intrusion detection alerts and logs to distinguish attack types from false alarms

4. Apply the knowledge to the architecture, configuration, and analysis of specific intrusion detection systems

Course Outcomes

- Understand modern concepts related to Intrusion Detection System.
- Compare alternative tools and approaches for Intrusion Detection through quantitative analysis to determine the best tool or approach to reduce risk from intrusion
- Identify and describe the parts of all intrusion detection systems and characterize new and emerging

Unit 1. Introduction : Basic Concepts of Security, Introduction to Intrusions, Need of Intrusion Detection, Classification of Intrusion Detection Systems, Sources of Vulnerabilities, Attacks against various security objectives, Countermeasures of attacks.

Unit II. Intrusion Detection and Prevention Technologies: Host-based intrusion detection system (HIDS), Network-based IDS, Information Sources for IDS, Host and Network Vulnerabilities and Countermeasures. Intrusion detection techniques, misuse detection: pattern matching, rule-based and state-based anomaly detection: statistical based, machine learning based, data mining based hybrid detection.

Unit III. IDS and IPS Architecture: Tiered architectures, Single-tiered, Multi-tiered, Peer-to-Peer. Sensor: sensor functions, sensor deployment and security. Agents: agent functions, agent deployment and security. Manager component: manager functions, manager deployment and security. Information flow in IDS and IPS, defending IDS/IPS, Case study on commercial and open-source IDS.

Unit IV. Alert Management and Correlation Data fusion: Alert correlation, Pre-process, Correlation Techniques, Post-process, Alert Correlation architectures. Cooperative Intrusion Detection, Cooperative Discovery of Intrusion chain, Abstraction-based Intrusion Detection, Interest-based communication and cooperation, agent-based cooperation.

Text Book:

C. Endorf, E. Schultz and J. Mellander, Intrusion Detection & Prevention, McGraw-Hill/Osborne , 2004

Ali A. Ghorbani, Network intrusion detection and prevention concepts and techniques, Springer, 2010

References

J. M. Kizza, Computer Network Security, Springer, 2005. Chris Sanders and Jason Smith, Applied Network Security Monitoring: Collection, Detection, and Analysis, Syngress, 2013

MTCNIS25 ENTREPRENEURSHIP (AUDIT COURSE)

Instruction: 3Periods/week Time: 3 Hours Credits:0

Internal: 30Marks External: 70 Marks Total: 100Marks

UNIT 1: Basic Concepts of Management: Management:-Definition, Nature and Importance; Functions of the Management; Levels of Management; F.W Taylor's Scientific Management; Henry Fayol's Principles of Management.

UNIT 2: Forms of Business Organizations: Introduction, Types of Business organizations: Private Sector- Individual Ownership, Partnership, Joint stock companies and Co-Operative organizations; Public sector- Departmental Organizations, Public Corporations and Government Companies; The Joint sector Management.

UNIT 3: Production and operations Management : Plantlocation-Factors to be considered in the selection of Plant location; Break - even analysis- Significance and managerial applications; Importanceof Production Planning and Control and its Functions; Human Resource Management and Functions of Human Resource Manager (in brief); Functions of Marketing; Methods of Raising Finance.

UNIT 4: Entrepreneurship: Definition, Characteristics and Skills, Types of Entrepreneurs, Entrepreneur vs. Professional Managers, , Growth of Entrepreneurs, Nature and Importance of Entrepreneurs, Women Entrepreneurs, Problems of Entrepreneurship.

UNIT 5: Entrepreneurial Development and Project Management: Institutions in aid of Entrepreneurship Development, Idea generation: Sources and Techniques;, Stages in Project formulation ;Steps for starting a small enterprise -Incentives for Small Scale Industries by Government.

Textbooks:

1. Sharma,S.C, and Banga,T.R.,Industrial Organization & Engineering Economics, KhannaPublishers,Delhi,2000.

2. VasantDesai,The Dynamics of Entrepreneurial Development and Management (Planning for future Sustainable growth), Himalayan PublishingHouse,2018.

Reference Books:

1. Aryasri , A.R., Management Science, McGraw Hill Education (India Private Limited , NewDelhi2014.

2. Sheela,P., and JagadeswaraRao,K., Entrepreneurship, Shree Publishing House, Guntur,

MTCNIS26 WIRELESS NETWORKS LAB

Instruction: 3Periods/week Time: 3 Hours Credits:2

Internal: 30Marks External: 70 Marks Total: 100Marks

Experiment 1: Installation of One Simulator.

Experiment 2: Implementing Epeidemic Routing

Experiment 3: Performing Average Hop Count of various Routing Protocols

Experiment 4: Performing the delivery probability of various Routing protocols

Experiment 5: Switching the LED on/off in octabrix LED

Experiment 6: Understanding working of octabrix in light conditions

Experiment 7: Implementing LED color patterns in Octabrix

Experiment 8: Implementing cloud integration with Octabrix

Experiment 9: To study the behavior AODV Routing Protocol

Experiment 10: To study the behavior DSR Routing Protocol

Experiment 11: To study the behavior OLSR Routing Protocol

Experiment 12: To study the behavior GRP Routing Protocol

MTCNIS27 APPLICATION SECURITY LAB

Instruction: 3Periods/week Time: 3 Hours Credits:2

Internal: 30Marks External: 70 Marks Total: 100Marks

LAB Exercises limited to the following scope

Cycle 1:

1. Install Kali Linux and study the use of burpsuite and metasploit
2. Learn about NMAP and scan open ports in a target server
3. Find the softwares and their version details in the open ports
4. Find vulnerabilities in any one of the softwares installed in the target server system.
5. Learn about the wireshark tool and analyse the packets in a given interface.

Cycle 2:

1. Visit OWASP and learn more about web based vulnerabilities.
2. Implement SQL Injection Attacks
3. Implement Cross site Request Forgery Attack
4. Implement Cross site Scripting Attack
5. Implement Command Injection Attacks

III-SEMESTER

Code	Name of the subject	Periods/week		Max. Marks		Total Credits	
		Theory	Lab	Ext.	Int.		
MTCNIS 31	Elective-V	3	-	70	30	100	3

MTCNIS 32 Open Elective	3	-	70	30	100	3
MTCNIS33 Dissertation-I / Industrial project		-	100	-	100	10
Total	6	-	240	60	300	16

Elective V: Malware Analysis/Block chain Technologies/Software Defined Networks

Open Elective: Business Analytics/4G-5G Mobile Communication Networks/ Operation Research

Detailed Syllabus for M.Tech (CN & IS) Third Semester

MTCNIS31 ELECTIVE-V MALWARE ANALYSIS

Instruction: 3Periods/week Time: 3 Hours Credits:3

Internal: 30Marks External: 70 Marks Total: 100Marks

UNIT 1: Introduction : Introduction to malware, OS security concepts, malware threats, evolution of malware, malware types viruses, worms, rootkits, Trojans, bots, spyware, adware, logic bombs, malware analysis, static malware analysis, dynamic malware analysis.

UNIT 2: Static Analysis : X86 Architecture- Main Memory, Instructions, Opcodes and Endianness, Operands, Registers, Simple Instructions, The Stack, Conditionals, Branching, Rep Instructions, C Main Method and Offsets. Antivirus Scanning, Fingerprint for Malware, Portable Executable File Format, The PE File Headers and Sections, The Structure of a Virtual Machine.

UNIT 3: Dynamic Analysis Live malware analysis, dead malware analysis, analyzing traces of malware- system-calls, apicalls, registries, network activities.

UNIT 4: Anti-dynamic analysis Analysis techniques anti-VM, runtime-evasion techniques, , Malware Sandbox, Monitoring with Process Monitor, Packet Sniffing with Wireshark.

UNIT 5: Attack mechanisms Downloader, Backdoors, Credential Stealers, Persistence Mechanisms, Privilege Escalation, Covert malware launching- Launchers, Process Injection, Process Replacement, Hook Injection, Detours, APC injection.

UNIT 6: Malware Detection Techniques Signature-based techniques: malware signatures, packed malware signature, metamorphic and polymorphic malware signature Non-signature based techniques: similarity-based techniques, machine-learning methods, invariant inferences.

UNIT 7: kernels and Rootkits Intro to Kernel – Kernel basics, Windows Kernel API, Windows Drivers, Kernel Debugging - , Rootkit Techniques- Hooking, Patching, Kernel Object Manipulation ,Rootkit Anti-forensics

TEXT BOOK:

1. Michael Sikorski and Andrew Honig, “ Practical Malware Analysis”, No Starch Press,2012

2. Learning Malware Analysis: Explore the Concepts, Tools, and Techniques to Analyze and Investigate Windows Malware by Monnappa K A

REFERENCES

1. Jamie Butler and Greg Hoglund, “Rootkits: Subverting the Windows Kernel”, Addison-Wesley, 2005

MTCNIS31 ELECTIVE-V BLOCK CHAIN TECHNOLOGIES

Instruction: 3Periods/week Time: 3 Hours Credits:3

Internal: 30Marks External: 70 Marks Total: 100Marks

Course Objectives:

1: To understand the basic concepts block chain technology and to explore the driving force behind the crypto currency Bitcoin.

2: To understand about the different methods of Decentralization using Block Chain and different Bitcoins and Alternative Coins.

3: To understand about Ethereum and applications using Smart contracts and Block Chain Applications

Course Outcomes:

At the end of the course the student will be able to:

1. Understand the types, benefits and limitation of block chain.
2. Explore the block chain decentralization and cryptography concepts.
3. Enumerate the Bitcoin features and its alternative options.
4. Describe and deploy the smart contracts

SYLLABUS

UNIT 1: BlockChain and its History: History of blockchain, Types of blockchain, Blockchain Components – Permissioned Blockchain Permission less Blockchain – Consortium Blockchain – basics of Consensus Algorithms, Architecture & Properties of Blockchain.

UNIT 2:Decentralization and Consensus Algorithms : Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Decentralized organizations, Distributed systems, Distributed ledger, Merkle tree, structure of a block, Consensus

Algorithms- Proof of Work, Proof of Stack, Proof of Burn, Proof of Elapsed Time, Proof of Activity, Proof of Concept.

UNIT 3: Bitcoin and Alternative Coins : Bitcoin, Transactions, Bitcoin payments , Bitcoin properties – Transaction life cycle – creation of coin – sending payments – double spending using blockchain – bitcoin anonymity – Ether: Ethereum properties, Alternative Coins, Bitcoin limitations, Namecoin, Litecoin, Primecoin, Zcash

UNIT 4: Ethereum and smart contracts: Ethereum Architecture, solidity programming basics, Smart Contract, Deploying Smart Contracts, Integration with UI.

UNIT 5: Blockchain Applications : Blockchain-Outside of Currencies: Internet of Things, Government, Health, Finance, Media ,Secure Voting and Digital Identity, Real Estate, Education

Textbooks:

1. Mastering Blockchain - Distributed ledgers, decentralization and smart contracts explained, Author- Imran Bashir, Packt Publishing Ltd, Second Edition, ISBN 978-1- 78712-544-5, 2017

2. Bitcoin and Cryptocurrency Technologies, Author- Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder, Princeton University, 2016

3. Blockchain Technology, Author- Chandramouli Subramanian, Asha A George, Abhilash K A, Meena Karthikeyan, University Press (India) Private Limited, 2021

References:

1. Blockchain Basics: A Non-Technical Introduction in 25 Steps, Author- Daniel Drescher, Apress, First Edition, 2017

MTCNIS31 ELECTIVE-V SOFTWARE DEFINED NETWORKS

Instruction: 3Periods/week Time: 3 Hours Credits:3

Internal: 30Marks External: 70 Marks Total: 100Marks

UNIT I: Introduction: Evolution of Switches and Control Planes, SDN Implications for Research and Innovation, Data Center Innovation, Data Center Needs. The Evolution of Networking Technology, Forerunners of SDN, Legacy Mechanisms Evolve Toward SDN, Software Defined Networking Is Born, Sustaining SDN Interoperability, Open Source Contributions, Network Virtualization

UNIT II. Fundamental Characteristics of SDN, SDN Operation, SDN Devices, SDN Controller, SDN Applications, Alternate SDN Method.

UNIT III. The OpenFlow Specification, OpenFlow Overview, OpenFlow 1.0 and OpenFlow Basics, OpenFlow 1.0 to 1.5, Improving OpenFlow Interoperability, Optical Transport Protocol Extensions, OpenFlow Limitations

UNIT IV. Alternative Definitions of SDN: Potential Drawbacks of Open SDN, SDN via APIs, SDN via Hypervisor-Based Overlays, SDN via Opening Up the Device, Network Functions Virtualization and Alternatives Overlap and Ranking.

UNIT V. SDN in the Data Center: Data Center Demands, Tunnelling Technologies for the Data Center, Path Technologies in the Data Center, Ethernet Fabrics in the Data Center, SDN Use Cases in the Data Center,

Comparison of Open SDN, Overlays, and APIs, Real-World Data Center Implementations

UNIT VI: SDN Applications: Application Types, A Brief History of SDN Controllers, Using Floodlight for Training Purposes, A Simple Reactive Java Application, Controller Considerations, Network Device Considerations, 12.9. Creating Network Virtualization Tunnels, Offloading Flows in the Data Center, Access Control for the Campus, Traffic Engineering for Service Providers

UNIT VI. SDN Open Source Landscape, The OpenFlow Open Source Environment, Open Source Licensing Issues, Profiles of SDN Open Source Users, OpenFlow Source Code, Switch Implementations, Controller Implementations, SDN Applications, Orchestration and Network Virtualization, Simulation, Testing, and Tools, Open Source Cloud Software, Example: Applying SDN Open Source.

Text Books:

Software Defined Networks: A Comprehensive Approach by Paul Goransson and Chuck Black, Morgan Kaufmann Publications, 2014 .

Reference :

SDN - Software Defined Networks by Thomas D. Nadeau & Ken Gray, O'Reilly, 2013

Software Defined Networking with OpenFlow By Siamak Azodolmolky, Packt Publishing, 2013

MTCNIS32 OPEN ELECTIVE: BUSINESS ANALYTICS

Instruction: 3Periods/week Time: 3 Hours Credits:3

Internal: 30Marks External: 70 Marks Total: 100Marks

Course objectives:

1. To introduce students to problem solving with Business Analytics and the use of spreadsheets for descriptive analytics, data queries and visualization

2. To introduce students to statistical sampling, sampling distributions, confidence intervals and statistical inference

3. To familiarize students with various types of regression including simple linear regression and multiple linear regression

4. To introduce students to key concepts in statistical forecasting models for time series data

5. To familiarize students with predictive decision modeling, model analysis and developing spreadsheet applications including building linear optimization models on spreadsheets.

Course outcomes:

After completion of the course the student should be able to:

1. Describe data and models used for Business Analytics and apply various descriptive analytic techniques to analyze data
2. Estimating population parameters, interval estimates, construct confidence intervals and perform hypothesis testing
3. Estimate and interpret the parameters of simple linear regression and multiple linear regressions
4. Apply forecasting models for various time series data including stationary time series, time series with linear trend and time series with seasonality
5. Implement models on spreadsheets, develop user-friendly applications and build linear optimization models on spreadsheets.

SYLLABUS

UNIT 1. Foundations of Business Analytics: Evolution of Business Analytics, Scope, data and models for Business Analytics, problem solving with Business Analytics, Analytics on spreadsheets, Excel functions for Database queries, Add-ons for Business Analytics. Descriptive Analytics: Data visualization, creating charts in MS Excel, Data Queries, Tables, sorting and filtering, Data summarization with statistics, Data exploration using Pivot tables

UNIT 2. Statistical Sampling: methods, estimating population parameters, sampling error, sampling distributions, interval estimates, confidence intervals, using confidence intervals for decision making, prediction intervals Statistical Inference: Hypothesis testing, one-sample Hypothesis testing, two-tailed test of Hypothesis for mean, two-sample Hypothesis testing, Analysis of variance, chi-square test for independence

UNIT 3. Trendliness and Regression: Modelling Relationships and trends in data, Simple linear regression, least squares regression, regression on analysis of variance, testing hypothesis for regression coefficients, Confidence intervals for regression coefficients, Residual analysis and regression assumptions, Multiple linear regression, building regression models, regression with categorical independent variables with two or more levels, regression with nonlinear terms, advanced techniques for regression modelling

UNIT 4. Forecasting Techniques: Qualitative and judgemental forecasting, statistical forecasting models, forecasting models for stationery time series, forecasting models for time series with linear trend, forecasting models for time series with seasonality, selecting appropriate time-series-based forecasting models, regression forecasting with casual variables, practice of forecasting

UNIT 5. Spreadsheet modeling and Analysis: Strategies for predictive decision modelling, Implementing models on spreadsheet, spreadsheet applications in Business analytics, Model assumptions, complexity and

realism, developing user-friendly applications, analyzing uncertainty and model assumptions, model analysis using analytics solver platform

UNIT 6. Linear Optimization & Applications: Building Linear Optimization Models on spreadsheets, solving Linear Optimization models, Graphical interpretation of linear optimization, Using optimization models of prediction and insight, Types of constraints in optimization models, process selection models, Blending Models, Portfolio Investment models

Text Book

1. "Business Analytics: Methods, Models, and Decisions" James R. Evans, Pearson Publications, Second edition

Reference Book

1. "Business Analytics: The Science of Data-Driven Decision Making", U.Dinesh Kumar, Wiley Publications

MTCNIS32 OPEN ELECTIVE: OPERATION RESEARCH

Instruction: 3Periods/week Time: 3 Hours Credits:3

Internal: 30Marks External: 70 Marks Total: 100Marks

UNIT I: Overview of Operations Research, Types of OR Models , Phases of Operations Research– OR Techniques, Introduction to Linear Programming, Formulation of Linear Programming Problem, Graphical Solution; Graphical Sensitivity Analysis

UNIT II: Standard Form of LPP, Basic Feasible Solutions , Unrestricted Variables, Simplex Algorithm , Artificial Variables, Big M Method , Two Phase Simplex Method, Degeneracy, Alternative Optimal, Unbounded Solutions, Infeasible Solutions, Primal And Dual Problems And Their Relations, Dual Simplex Method

UNIT III: Transportation Problem as LPP, Initial Solutions, North West Corner Rule, Lowest Cost Method, Vogels Approximation Method, Optimum Solutions of TPP, Degeneracy in Transportation, Transportation Algorithms

UNIT IV: Assignment Problem, Assignment Problem as LPP, Hungarian Method, Travelling Salesman Problem, Solutions of TSP, Sequencing Problems, N-Jobs Two Machine Problems, N-Jobs K Machines Problems, Two-Jobs M- Machine Problems, Crew Scheduling Problems

UNITV: Network Representation of A Project, CPM and PERT , Critical Path Calculations, Time – Cost Optimizations, PERT Analysis and Probability Considerations, Resource Analysis in Network Scheduling.

UNIT VI: Replacement Problems-Individual And Group Replacement Policy, Reliability & System Failure Problems, Inventory-Factors Effecting Inventory-EOQ, Inventory Problems With and Without Shortages, Inventory

Problems With Price Breakups, Multi Item Deterministic Problems. Probabilistic Inventory Problems

UNIT VII: Game Theory: Two Person Zero Sum Games , Mixed Strategy Games and Their Algorithms.

Text Books:

1. Operations Research, KantiSwaroop, P.K. Gupta, Man Mohan, Sulthan Chand&SonsEducation

2. Operations Research–AnIntroduction, HandyATaha–PearsonEducation.

MTCNIS32 OPEN ELECTIVE: 4G-5G MOBILE COMMUNICATION NETWORKS

Instruction: 3Periods/week Time: 3 Hours Credits:3

Internal: 30Marks External: 70 Marks Total: 100Marks

Unit-1: Introduction 1G and2G-voice centric technologies, 3G and 4G-mobile broadband, 5G-beyond mobile broadband-networked society, Spectrum regulation and standardization from 3G to 5G: Overview, ITU-R activities from 3G to 5G, Spectrum for mobile systems and 5G, GPP standardization.

Unit-2: Emerging Technologies for 4G Multi antenna Technologies: MIMO; Adaptive Multiple Antenna Techniques; Radio Resource Management - QoS Requirements; Software Defined Radio (SDR) Communication Systems - Advantages of SDR - Problems & Applications in SDR Communication Systems; IP Network Issues - Mobility Management - Mobile IP & its Evolution; Mobile Relay Types/Deployment Concepts - Cooperative Mobile Relaying; Other Enabling Technologies; Overview of 4G Research Initiatives and Developments.

Unit 3: Multi-gigabit wireless networks Next generation (5G) wireless technologies- Upper Gigahertz and Terahertz wireless Communications: Millimeter wave networking- Directionality and beam forming- Mobility and signal blockage- IEEE 802.11ad (60 GHz WLAN) MAC and PHY overview: Visible light communication- High-speed networking using LEDs - IEEE 802.15.7 PHY and MAC overview Sensing through visible light- Visible light indoor localization and positioning

Unit 4: Indoor localization and RF sensing Smartphone localization - WiFi fingerprinting - protocols and challenges - Non-WiFi localization - Device-free sensing with radio frequency - Mining wireless PHY channel state information- Device free localization and indoor human tracking - Activity and gesture recognition through RF.

Unit 5: Low-power networking Backscatter communication - Radio Frequency Identification (RFID) technology overview – Energy harvesting

tags and applications- Internet-of-Things (IoT) - IoT protocol overview - CoAP and MQTT - IPv6 networking in low-power PANs (6LoWPAN)

Unit 6: Future mobile networks Drone networking - Multi-UAV networks, architectures and civilian applications-Communication challenges and protocols for micro UAVs- Connected and autonomous cars - Wireless technologies for Vehicle-to-Infrastructure (V2I) and Vehicle-to-Vehicle (V2V) communications – Automotive surrounding sensing with GHz and THz signals.

Unit 7: Instructional Activities Survey minimum of four 5G wireless networks for wireless communication and carry out simulation of those networks.

Text Books:

1. 4G: LTE advanced pro and the road to 5G-by Erik Dahlman, Stefan Parkvall and Johan Skold, 3rd Edition, Elsevier Publications

2. 5G NR: The Next Generation Wireless Access Technology-by Erik Dahlman, Stefan Parkvall, Elsevier Publications

3. Zhang, Yin, Chen, Min, "Cloud Based 5G Wireless Networks , Springer, 2016

4. Jonathan Rodriguez, "Fundamentals of 5G Mobile Networks , Wiley 2015.

References Books:

1. Young Kyun Kim and Ramjee Prasad, 4G Roadmap and Emerging Communication Technologies, Artech House, 2006.

2. Savo G. Glisic, Advanced Wireless Networks: 4G Technologies, John Wiley & Sons, 2006.

3. Wireless Communications: Principles and Practice, by Theodore S. Rappaport, Prentice Hall.

4. 802.11n: A Survival Guide, by Matthew Gast, O'Reilly Media.

5. 802.11ac: A Survival Guide, by Matthew Gast, O'Reilly Media.

6. Wireless Networking Complete, by Pei Zheng et al., Morgan Kaufmann.

Hyperlinks:

1. <https://www.amazon.in/4G-LTE-Advanced-Pro-Road-5G-ebook/dp/B01IUACTDM>

2. <http://ieeexplore.ieee.org/document/7414384/>

3. <https://www.theiet.org/resources/books/telecom/5gwire.cfm?>

4. <http://ieeexplore.ieee.org/document/7794586/>

5. https://www.researchgate.net/publication/311896317_Ultra-reliable_communication_in_a_factory_environment_for_5G_wireless_networks_Link_level_and_deployment_study

6. <https://www.intechopen.com/books/how-to-link/towards-5g-wireless-networks-a-physical-layer-perspective>

Appendix " X " Item No. 49

Intellectual Property Rights: Skill development Course for B.E / B.Tech

(Compulsory for CST and IT, Elective for other Engineering branches)

Instruction: 3 Periods/week, (Theory: 2, Tutorial: 1)

Time: 3Hours, Credit: L-1, T-1, P-0, CR 2 Internal: 30Marks, External: 70Marks, Total: 100Marks

Course Objective:

1. To introduce the students to Intellectual Property Rights (IPR) which is a key component in modern knowledge management processes
2. To create consciousness on IPR in students at an early stage of their education so that they develop an appreciation for ethical and rightful use of existing knowledge
3. To make them understand how to take ownership of knowledge they may develop as a result of their creative innovations, take ownership and either drive themselves in becoming entrepreneurs or become responsible knowledge users in society
4. To expose students some of the recent debates on the societal implications of IPR and its role in national/international trade and socio-economic development.

Course outcome:

Learners will be able to

1. identify the types of intellectual property protection available for their research outcome
2. conduct patent search and analyze patentability of the invention
3. understand the basic structure of Patent document
4. understand the registration and prosecution of different IPs
5. understand the basics of IP commercialization and techno/commercial/legal issues in IPR commercialization

SYLLABUS

1. Unit I: Introduction : Concept of property, Intellectual Property (IP) and Intellectual Property Rights (IPR), Importance of IP, Value creation

through IP, Advantages of IP protection, Competitive advantage, Promotion of social good, Prevention of duplicates, counterfeit products and IP

2. Unit II: Evolution of IP system : Historical view of IP system in India and abroad, Legal basis and rationale behind development of IP system, WTO and TRIPS agreement, Role of WIPO

3. Unit III: Types of IPR : Major forms of IP in India and globally, Acts enacted in India related to IP

4. Unit IV: Patent Concept, Life of patent, Rights of Patentee, Criteria of patentability- novelty, non- obviousness, and utility, Non-patentable inventions

5. Unit V: Patent filing and prosecution : Prior art search, Process of obtaining a patent in India, Provisional and complete specification, Convention application, Patent Cooperation Treaty (PCT), Patent Infringement and Enforcement

6. Unit VI: Trademark : Types of trademarks, Trademark and Brand, Trademark Registration, Trademark Infringement

7. Unit VII: Copyright Copyrights and related rights, Copyright registration, Copyright infringement, Section 52 of Indian Copyright Act

8. Unit VIII: Industrial Design What is Industrial design, Design registration, Design infringement

9. Unit IX: Trade Secret What are Trade Secrets, How trade secrets are maintained in trade and business

10. Unit X: Other forms of IP Semiconductor Integrated Circuits Layout Design, Geographical Indications, Protection of Plant Varieties & Farmers' right, Traditional knowledge

11. Unit XI: IP commercialization Licensing & Royalty; Technology Transfer; IP assignment, Compulsory License

12. Unit XII: Emerging areas Patinformatics, IP and bank loan, IP insurance, IP audit, IP valuation, IP management, Use of artificial intelligence in IP enforcement, Open innovation

Text Books

1. Ganguli Prabuddha, Gearing up for Patents The Indian Scenario", Universities Press (1998)

2. Ganguli Prahuddha "Intellectual Property Rights-Unleashing the Knowledge Economy". Tata McGraw Hill (2001)

3. Geographical Indications of Goods Act 1990 Ganguli Piabaddha "Geographical Indications-its evolving contours accessible in [http ips.nminsoda/files/2012/05/main book pdf](http://ips.nminsoda/files/2012/05/main%20book%20pdf) (2009)

Reference Books

1. Ganguli Prabuddha and Jahade Siddharth, "Nanotechnology Intellectual Property Rights Research, Design, and Commercialisation", CRC Press, Taylor and Francis Group, USA (2012)

2. Beyond Intellectual Property: Toward Traditional Resource Rights for Indigenous Peoples and Local Communities [Paperback J,Darrell A. Posey and Graham Dotfield, IDRC Books; annotated edition (June (1996)

3. Netancl Neil Weinstock, Copyright's Paradox, Oxford University Press (2010)

4. The Indian Patents Act 1970 (as amended in 2005)

5. The Indian Copyright Act 1950 as amended in 2017)

6. Indian Trademarks Act 1999

7. The Indian Industrial Designs Act 2000

8. The Protection of Plant Varieties and Farmers' Right Act 2001

9. Inventing the Future: An Introduction to Patents for small and medium sized enterprises, WIPO publication No 917 www.wipo.int/ebookshop

10. Looking Good: An Introduction to Industrial Designs for Small and Medium sized Enterprises; WIPO publication No.498 www.wipo.int/ebookshop

Appendix "Y " Item No.52

B.Tech. (Chemical Engineering)

Effective from 2021-22 Batch

Group - A

(For the branches of Civil Engg., **Chemical Engg**,Biotechnology, Computer Science Engg and Information Technology)

B.Tech. Ist Year - I Semester

Course Credits	Category code	Course Title	Hours per week	Internal Marks	External Marks	Total Marks
			L T P			

CH-1101	BS	Mathematics – I	3	0	0	30	70	100	3
CH-1102	BS	Chemistry	3	0	0	30	70	100	3
CH-1103	HSS	English	3	0	0	30	70	100	3
CH-1104	ES	CPNM	3	0	3	30	70	100	3
CH-1105	ES	Basic Electrical Engineering	3	0	0	30	70	100	3
CH-1106	HSS	English Language Lab	0	0	2	50	50	100	1.5
CH-1107	BS	Chemistry Lab	0	0	3	50	50	100	1.5
CH-1108	ES	CPNM Lab	0	0	3	50	50	100	1.5
Total Credits								19.5	

B.Tech. Ist Year - II Semester

Course Category	Course Title	Hours per	Internal	External	Total				
Credits	code			week	Marks				
Marks									
		L	T	P					
CH-1101	BS	Mathematics – I	3	0	0	30	70	100	3
CH-1201	BS	Mathematics – II	3	0	0	30	70	100	3
CH-1202	BS	Physics	3	0	0	30	70	100	3
CH-1203	ES	Engineering Graphics	1	0	4	30	70	100	3
CH-1204	ES	Material Science & Engineering	3	0	0	30	70	100	3
CH-1205	ES	Mechanical Engineering	3	0	0	30	70	100	3
CH-1206	ES	Workshop Lab	0	0	3	50	50	100	1.5
CH-1207	BS	Physics Lab	0	0	3	50	50	100	1.5
CH-1208	ES	General Engineering Lab. (Mechanical Engineering/ Electrical Engineering)	0	0	3	50	50	100	1.5
Total Credits									19.5

B.Tech. IInd Year - I Semester

Course Category		Course Title	Hours per			Internal	External	Total	Marks
Credits	code		L	T	P				
Marks							week	Marks	
CH-2101	BS	Maths-III	3	0	0	30	70	100	3
CH-2102	ES	Solid Mechanics	3	0	0	30	70	100	3
CH-2103	HSS	Managerial Economics	3	0	0	30	70	100	3
CH-2104	PC	Organic Chemistry	3	0	0	30	70	100	3
CH-2105	PC	Particle and Fluid Particle Processing	3	0	0	30	70	100	3
CH-2106	PC	Organic Chemistry lab	0	0	3	50	50	100	1.5

CH-2107	PC	Particle and Fluid Particle Processing lab	0	0	3	50	50	100	1.5
CH-2108	SC	MATLAB (software training)	1	0	2	50	50	100	2
CH-2109	MC	Environmental Science	0	0	0	-	100	100	0
Total Credits								20	

B.Tech. IInd Year - I Semester

Course Category	Credits	Course Title	Hours per	Internal	External	Total	
code	Marks		L	T	P	week	Marks
CH-2201	BS	Maths-IV	3	0	0	30	70
CH-2202	PC	Material and Energy Balances	3	0	0	30	70
CH-2203	PC	Heat Transfer	3	0	0	30	70
CH-2204	PC	Fluid Mechanics	3	0	0	30	70
CH-2205	HSS	Industrial Management & Entrepreneurship	3	0	0	30	70
CH-2206	PC	Heat Transfer lab	0	0	3	50	50
CH-2207	PC	Fluid Mechanics lab	0	0	3	50	50
CH-2208	SC	ASPEN PLUS (Process design)	1	0	2	50	50
CH-2209	MC	Professional Ethics and Human Values	0	0	0	-	100
Total Credits							20

Summer Internship (Community Service)

B.Tech. IIIrd Year - I Semester

Course Category	Credits	Course Title	Hours per	Internal	External	Total			
code	Marks		L	T	P	week	MarksMarks		
CH-3101	PC	Chemical Engineering Thermodynamics	3	0	0	30	70	100	3
CH-3102	PC	Mass Transfer-I	3	0	0	30	70	100	3
CH-3103	PC	Chemical Reaction Engineering - I	3	0	0	30	70	100	3
CH-3104	OE	Open Elective- I	2	0	2	30	70	100	3
CH-3105	PC	Core Elective -I	3	0	0	30	70	100	3
CH-3106	PC	Mass Transfer-I lab	0	0	3	50	50	100	1.5
CH-3107	PC	Chemical Technology lab	0	0	3	50	50	100	1.5
CH-3108	SC	Seminar/ Minor project	1	0	2	50	50	100	2
CH-3109	MC	Indian Constitution	2	0	0	0	100	100	0

CH-3110	MC	Summer internship 2 months (Mandatory after second year) to be evaluated during V semester-	-	-	100	0	100	2

Total Credits **22**

* General Chemical Technology Lab for B.Tech. (Chemical Engg.) / Petroleum Engg., Lab., for B.Tech., (Chemical Engg. with Petroleum Engg. as elective) / Ceramic Technology Lab for B.Tech., (Chemical Engg. with Ceramic Technology as elective)

Core Elective-I (CH 3105) For Chemical Engineering

- A. General Chemical Technology
- B. Petroleum Refinery Engineering
- C. Ceramic Raw Materials
- D. Fuel Cell Technology
- E. Polymer Technology

For Chemical Engineering with petroleum Engineering as elective:

- C. Petroleum Refinery Engineering.

For Chemical Engineering with Ceramic Technology as elective:

- D. Ceramic Raw Materials

Open Elective-I (CH 3104)

- Corrosion Engineering

B.Tech III Year - II Semester

Course	Category	Course Title	Hours per	Internal	External	Total			
Credits	code		L	T	P	week	Marks		
Marks							Marks		
CH-3201	PC	Mass transfer-II	3	1	0	30	70	100	3
CH-3202	PC	Chemical Reaction Engineering-II	3	0	0	30	70	100	3
CH-3203	PC	Process Instrumentation and Control	3	0	0	30	70	100	3
CH-3204	PC	Core elective- II	3	0	0	30	70	100	3
CH-3205	OE	Open Elective – II	2	0	2	30	70	100	3
CH-3206	PC	Mass transfer –II lab	0	0	3	50	50	100	1.5
CH-3207	PC	Chemical Reaction Engineering lab	0	0	3	50	50	100	1.5
CH-3208	PC	Process Instrumentation and Control lab	0	0	3	50	50	100	1.5

CH-3209	SC	Intellectual Property Rights	3	0	0	30	70	100	2
CH-3210	MC	Essence of Indian Traditional Knowledge	2	0	0	-	100	100	0
Total Credits									21.5

SUMMER INTERNSHIP (2 MONTHS)

Core Elective-II: (CH 3204)

For Chemical Engineering

- Process Modeling and Simulation
- Petrochemicals
- White Ware and Heavy Clayware
- Computational Fluid Dynamics
- Multi Component Separation Processes
- Chemical Engineering Mathematics

For Chemical Engineering with petroleum Engineering as elective:

- Petrochemicals

For Chemical Engineering with Ceramic Technology as elective:

- White ware and heavy clayware

Open Elective-II (CH 3205)

- Nano Science & Technology
- Industrial Safety and Management
- Environmental Pollution Control Engineering

B.Tech. IV Year - I Semester

Course	Category	Course Title	Hours per	Internal	External	Total	
Credits	code				week	Marks	Marks
Marks			L T P				
CH-4101	PC	Transport Phenomena	3	1	0	30	70 100 3
CH-4102	PC	Process Engineering Economics	3	0	0	30	70 100 3
CH-4103	PC	Chemical Process Equipment Design	3	0	0	30	70 100 3
CH-4104	PC	Core Elective -III	3	0	0	30	70 100 3
CH-4105	OE	MOOCS	3	0	0	30	70 100 3
CH-4106	OE	MOOCS	2	0	2	30	70 100 3

CH-4107	PC	Chemical Process Equipment Design Lab	0	0	3	50	50	100	1.5
CH-4108	SC	Sustainable Process Engineering	3	0	0	30	70	100	2
CH-4109	MC	Summer internship 2 months (Mandatory after third year) to be evaluated during VII semester	-	-	-	100	-	100	2
Total Credits									23.5

Core Elective-III (CH 4104)

- Computer Aided Design
- Industrial Pollution Control Engineering
- Process Optimization
- Reservoir Engineering
- Fuels, Refractories and Furnaces
- Biochemical Engineering
- Paper Technology

Open Elective-III (CH 4105) & Open elective -IV (CH 4106) are MOOCS courses.

(To be specified/approved by BOS)

B.Tech IV Year - II Semester

Course	Category	Course Title	Internal	External	Total	Credits
		Marks	Marks	Marks		
CH-4201	Major Project	Project work	50	50	100	14
(6 Months Internship in industry) Total credits						14

MINOR REQUIREMENTS IN CHEMICAL ENGINEERING

Total Credit requirement : 20

Student must have acquired a minimum of 8 SGPA up to the end of 2nd semester without backlogs. In case after declaration 3rd semester results if student fails to score required minimum of 8 SGPA his/her registration for Minor programme stands canceled and he/she shall continue with regular programme. Of the 20 additional credits to be acquired, 16 Credits shall be earned by selecting courses one from each of the following pools and 4 credits through MOOCS with two courses of minimum 8 weeks duration.

Subject	L-T-P	Credit
POOL 1		
Fluid Mechanics (CH-2204)	3-1-0	4

Heat Transfer (CH-2203)	3-1-0	4
Material and Energy Balances (CH-2202)	3-1-0	4

POOL 2

General Chemical Technology (CH-3105)	3-1-0	4
Mass Transfer-I (CH 3102)	3-1-0	4
Chemical Engg. Thermodynamics (CH-3101)	3-1-0	4
Material Science and Engineering (CH-1204)	4-0-0	4

POOL 3

Chemical Reaction Engineering-I (CH-3103)	3-1-0	4
Process Instrumentation and Control (CH-3203)	3-1-0	4
Process Engineering Economics (CH-4102)	3-1-0	4

POOL 4

Industrial Pollution Control Engineering (CH-4104B)	4-0-0	4
Process Optimization (CH-4104C)	4-0-0	4
Particle and Fluid Processing (CH-2105)	4-0-0	4

B.Tech. (Honors) in Chemical Engineering

(Total Credits: 180)

20 additional credits are to be acquired for Honors.

Student must have acquired a minimum of 8 SGPA up to the end of 2nd semester without backlogs. In case after declaration 3rd semester results if student fails to score required minimum of 8 SGPA his/her registration for Honors programme stands canceled and he/she shall continue with regular programme. Of the 20 additional credits to be acquired, 16 credits shall be earned by undergoing specified courses listed below with four courses each carrying 4 credits. The remaining 4 credits must be acquired through MOOCS, which shall be domain specific, each with 2 credits and with minimum duration of 12 weeks as recommended by board of studies

The courses that are offered for B.Tech. (Hons) in Chemical Engineering are:

Fluid Mechanics (CH-2204)	3-1-0	4

Subject		L-T-P	Credit
POOL 1			
CHH-1001	Process Modeling and Simulation	3-1-0	4
CHH-1002	Advanced Mass Transfer	3-1-0	4

CHH-1003	Pollution Control	3-1-0	4
CHH-1004	Corrosion Engineering	3-1-0	4
CHH-1005	Petroleum Refinery Engineering	3-1-0	4
CHH-1006	Energy Engineering	3-1-0	4
CHH-1007	Transport Phenomena-II	3-1-0	4
CHH-1008	Chemical Reaction Engineering-III	3-1-0	4
CHH-1009	Advanced Process Control	3-1-0	4
CHH-1010	Analytical Techniques	4-0-0	4

CH-1101

MATHEMATICS-I

Course Objectives:

- To transmit the knowledge of Partial differentiation.
- To know of getting maxima and minima of function of two variables and finding errors and approximations.
- To evaluate double and triple integrals, volumes of solids and area of curved surfaces.
- To expand a periodical function as Fourier series and half-range Fourier series.

Course Outcomes:

At the end of the course, the student will be able to

- Find the partial derivatives of functions of two or more variables.
- Evaluate maxima and minima, errors and approximations.
- Evaluate double and triple integrals, volumes of solids and area of curved surfaces.
- To expand a periodical function as Fourier series and half-range Fourier series.
- Have a fundamental understanding of Fourier series and be able to give Fourier expansions of a given function.

SYLLABUS

(Partial Differentiation)

Introduction - Functions of two or more variables - Partial derivatives - Homogeneous functions – Euler's theorem - Total derivative - Change of variables – Jacobins. Mean value Theorems (without proofs)

(Applications of Partial Differentiation)

Geometrical interpretation -Tangent plane and Normal to a surface - Taylor's theorem for functions of two variables - Errors and approximations -

Total differential. Maxima and Minima of functions of two variables - Lagrange's method of undetermined multipliers - Differentiation under the integral Sign - Leibnitz's rule.

(Multiple Integrals)

Introduction - Double Integrals - Change of Order of Integration - Double Integrals in Polar Coordinates - Triple Integrals - Change of Variables.

(Multiple Integrals-Applications)

Area enclosed by plane curves - Volumes of solids - Area of a curved surface - Calculation of Mass - Center of gravity - Moment of inertia - product of inertia – principal axes- Beta Function - Gamma Function - Relation between Beta and Gamma Functions. Error Function or Probability Integral.

(Fourier Series)

Introduction - Euler's Formulae - Conditions for a Fourier Expansion - Functions having points of discontinuity - Change of Interval - Odd and Even Functions - Expansions of Odd or Even Periodic Functions, Half-Range Series - Parseval's Formula. Practical Harmonic analysis.

TEXT BOOK :

Scope and Treatment as in "Higher Engineering Mathematics", by Dr. B.S. Grewal, 43rd Edition, Khanna publishers.

REFERENCE BOOKS:

1. Graduate Engineering Mathematics by V B Kumar Vatti., I.K.International publishing house Pvt. Ltd.
2. Advanced Engineering Mathematics by Erwin Kreyszig.
3. A text book of Engineering Mathematics, by N.P. Bali and Dr. Manish Goyal, Lakshmi Publications.
4. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.
5. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.
6. Higher Engineering Mathematics by Dr. M.K.Venkataraman.

CH-1102 : CHEMISTRY

Course Objectives:

- To apply the basic knowledge of Chemistry to the Engineering Discipline.
- To develop knowledge about water and its treatment for industrial and potable purposes.
- To develop understanding in the areas of Polymers, Mechanism of Corrosion of Metals and Corrosion Control Methods, Fuels, Lubricants

and Nanomaterials for of conducting polymers, bio-degradable polymers and fiber reinforced plastics and apply the knowledge for solving existing challenges faced in various engineering and societal areas.

Course outcomes :

At the end of the course, the student will be able to

- This course applies the basic concepts and principles studied in Chemistry to Engineering.
- It provides an application of chemistry to different branches of Engg.
 - The students will be able acquire knowledge in the areas of Water Chemistry, Polymers, Corrosion, Fuels and Lubricants and nanomaterials and suggest innovative solutions for existing challenges in these areas.

SYLLABUS

Water Chemistry :

Sources of Water – Impurities and their influence of living systems – WHO Limits – Hardness and its Determination – Boiler Troubles and their removal – Water Softening Methods – Lime-Soda, Zeolite and Ion Exchange - Municipal Water Treatment-Break Point Chlorination – Desalination of Sea Water – Reverse Osmosis Method, Electro-dialysis.

Polymers and Plastics :

Polymers: Definition – Types of Polymerization (Addition & Condensation) – Mechanisms of Addition Polymerization – Radical and Ionic – Thermodynamics of Polymerization Process. **Plastics:** Thermosetting and Thermoplastics – Effect of Polymer Structure on Properties of Cellulose Derivatives – Vinyl Resins – Nylon (6,6), Reinforced Plastics – Conducting Polymers.

Corrosion :

Corrosion: Origin and Theory – Types of Corrosion: Chemical and Electrochemical; Pitting, Inter granular, Waterline, Stress – Galvanic Series – Factors Effecting Corrosion.

Corrosion Controlling Methods: Protective Coatings: Metallic Coatings, Electroplating and Electroless Plating – Chemical conversion Coatings – Phosphate, Chromate, Anodized, Organic Coatings – Paints and Special Paints.

Fuels and Lubricants :

Solid Fuels: Wood and Coal, Ranking of Coal – Analysis (Proximate and Ultimate) Coke Manufacture – Otto Hoffmann's Process – Applications; Liquid Fuels: Petroleum Refining – Motor Fuels – Petrol and Diesel Oil – Knocking – Octane number – Cetane Number; Gaseous Fuels: Biogas, LPG and CNG – Characteristics – Applications; Rocket Fuels: Propellants – Classification – Characteristics. Lubricants: Classification – Mechanism –

Properties of Lubricating Oils – Selection of Lubricants for Engineering Applications.

Nanomaterials :

Nanomaterials, Properties and application of fullerenes, fullerols, Carbon nanotubes and nanowires. Synthesis - Top-down and Bottom-up approaches - Nanocomposites - Nanoelectronics- Applications of nanomaterials in catalysis, telecommunication and medicine.

TEXT BOOKS:

1. Engineering Chemistry – PC Jain and M. Jain – Dhanpath Rai and Sons, New Delhi.
2. A Text book of Engineering Chemistry – S. S. Dara – S. Chand & Co. New Delhi.

REFERENCE BOOKS:

1. Engineering Chemistry – B. K. Sharma – Krishna Prakashan – Meerut.
2. Introduction to Nanoscience - S. M. Lindsay - Oxford University Press
3. Engineering Chemistry - B. L. Tembe, Kamaluddin and M. S. Krishnan, (NPTEL).

CH-1103: ENGLISH

Course Objectives:

- To make students understand the explicit and implicit meanings of a text/topic;
- To give exposure to new words and phrases, and aid to use them in different contexts;
- To apply relevant writing formats to draft essays, letters, emails and presentations; and
- To adapt oneself to a given situation and develop a functional approach to finding solutions: adaptability and problem solving.

Course Outcomes:

- At the end of the course, the student will be able to
- Students will be able to analyse a given text and discover the various aspects related to language and literature;
 - Learn the various language structures, parts of speech and figures of speech;
 - Develop one's reading and writing abilities for enhanced communication; and

- Learn to apply the topics in real-life situations for creative and critical use.

SYLLABUS

On the conduct of life: William Hazlitt

Life skills: Values and Ethics

If: Rudyard Kipling

The Brook: Alfred Tennyson

Life skills: Self-Improvement

How I Became a Public Speaker: George Bernard Shaw

The Death Trap: Saki

Life skills: Time Management

On saving Time: Seneca

ChinduYellama

Life skills: Innovation

Muhammad Yunus

Politics and the English Language: George Orwell

Life skills: Motivation

Dancer with a White Parasol: Ranjana Dave.

Grammar:

Prepositions – Articles – Noun-Pronoun Agreement, Subject-Verb Agreement – Misplaced Modifiers – Clichés, Redundancies.

Vocabulary:

Introduction to Word Formation – Root Words from other Languages – Prefixes and Suffixes – Synonyms, Antonyms – Common Abbreviations

Writing:

Clauses and Sentences – Punctuation – Principles of Good Writing – Essay Writing – Writing a Summary

Writing: Essay Writing

Life skills: Innovation

Muhammad Yunus.

TEXTBOOK:

1. *Language and Life: A Skills Approach* Board of Editors, Orient Blackswan Publishers, India. 2018.

REFERENCEBOOKS :

1. *Practical English Usage*, Michael Swan. OUP. 1995.

2. *Remedial English Grammar*, F.T. Wood. Macmillan.2007
3. *On Writing Well*, William Zinsser. Harper Resource Book. 2001
4. *Study Writing*, Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
5. *Communication Skills*, Sanjay Kumar and PushpLata. Oxford University Press. 2011.
6. *Exercises in Spoken English*, Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

CH-1104 : CPNM

Course Objectives:

- The course is designed to provide complete knowledge of C language.
- To provide students with understanding of code organization and functional hierarchical decomposition with using complex data types.
- To provide knowledge to the Students to develop logics which will help them to create programs, applications in C.
- This course aims to identify tasks in which the numerical techniques learned are applicable and apply them to write programs, and hence use computers effectively to solve the task.
- This course provides the fundamental knowledge which is useful in understanding the other programming languages.

Course Outcomes:

At the end of the course, the student will be able to

- Identify basic elements of C programming structures like data types, expressions, control statements, various simple functions and **Apply** them in problem solving.
- Apply various operations on derived data types like arrays and strings in problem solving.
- Design and Implement of modular Programming and memory management using Functions, pointers.
- Apply Structure, Unions and File handling techniques to Design and Solve different engineering programs with minimal complexity.
- Apply Numerical methods to Solve the complex Engineering problems.

Syllabus :

Introduction to C: Basic structure of C program, Constants, Variables and data types, Operators and Expressions, Arithmetic Precedence and

associativity, Type Conversions. Managing Input and Output Operations Formatted Input, Formatted Output.

Decision Making, Branching, Looping, Arrays & Strings: Decision making with if statement, Simple if statement, The if...else statement, Nesting of if...else statement, the else..if ladder, switch statement, the (?:) operator, the GOTO statement., The while statement, the do statement, The for statement, Jumps in Loops ,One, Two-dimensional Arrays, Character Arrays. Declaration and initialization of Strings, reading and writing of strings, String handling functions, Table of strings.

Functions: Definition of Functions, Return Values and their Types, Function Calls, Function Declaration, Category of Functions: No Arguments and no Return Values, Arguments but no Return Values, Arguments with Return Values, No Argument but Returns a Value, Functions that Return Multiple Values. Nesting of functions, recursion, passing arrays to functions, passing strings to functions, the scope, visibility and lifetime of variables.

Pointers: Accessing the address of a variable, declaring pointer variables, initializing of pointer variables, accessing variables using pointers, chain of pointers, pointer expressions, pointers and arrays, pointers and character strings, array of pointers, pointers as function arguments, functions returning pointers, pointers to functions, pointers to structures-Program Applications

Structure and Unions: Defining a structure, declaring structure variables, accessing structure members, structure initialization, copying and comparing structure variables, arrays of structures, arrays within structures, structures within structures, structures and functions and unions, size of structures and bit-fields- Program applications.

File handling: Defining and opening a file, closing a file, Input/ Output operations on files, Error handling during I/O operations, random access to files and Command Line Arguments- Program Applications

Numerical Methods: Solutions of Algebraic and Transcendental Equations, Bisection Method, Newton Raphson Method. Newton's forward and backward Interpolation, Lagrange's Interpolation in unequal intervals. Numerical Integration: Trapezoidal rule, Simpson's 1/3 rules. Solutions of Ordinary First Order Differential Equations: Euler's Method, Modified Euler's Method and Runge-Kutta Method.

TEXT BOOKS:

1. Programming in ANSI C, E Balagurusamy, 6th Edition. McGraw Hill Education (India) Private Limited.
2. Introduction to Numerical Methods, SS Sastry, Prentice Hall.

REFERENCE BOOKS:

1. Let Us C ,YashwantKanetkar, BPB Publications, 5th Edition.

2. Computer Science, A structured programming approach using C", B.A.Forouzan and R.F.Gilberg, " 3rd Edition, Thomson, 2007.

3. The C-Programming Language' B.W. Kernighan, Dennis M.Ritchie, PHI.

4. Scientific Programming: C-Language, Algorithms and Models in Science, Luciano M. Barone (Author), Enzo Marinari (Author), Giovanni Organtini, World Scientific.

CH-1105 : BASIC ELECTRICAL ENGINEERING

Course Objectives:

- An understanding of basic EE abstractions depends on analysis and design of electric and magnetic circuits and its elements.
- To provide the students with knowledge of fundamental laws in electrical engineering
- To develop the ability of the students to analyze electrical and magnetic circuits using the basic laws of electrical engineering
- To expose the students to the concepts of various types of electrical machines and application of electrical machines.
- To inculcate the understanding about the AC fundamentals
- To prepare the students to have a basic knowledge of transformers
- To acknowledge about three phase induction motor and its operating principle
- To know about the fundamentals of synchronous motors and its working principle

Course Outcomes:

At the end of the course, the student will be able to

- Predict the behavior of any electrical and magnetic circuits.
- State and explain the basic laws of electromagnetic induction.
- Understand Constructional details, principle of operation, types of Electrical Machines performance Characteristics ,speed control methods and its applications
- Ability to conduct experiments on Ac Machines to find its characteristics.
- Calculate performance characteristics of transformer like regulation and efficiency
- Formulate and then analyze the working of synchronous motors
- Solve simple problems on synchronous motors.

SYLLABUS

Magnetic circuits: Definitions of magnetic circuit, reluctance, magneto motive force (mmf), magnetic flux, simple problems on magnetic circuits, hysteresis loss (chapter 8, page nos. 155-175),

Electromagnetic induction: Faraday's laws of electromagnetic induction, induced E.M.F., dynamically induced E.M.F, statistically induced EMF, self inductance, mutual inductance (Chapter 9, page nos. 176-190),

D.C. generators: D.C generator principle, construction of D.C generator, E.M.F equation of D.C generator, types of D.C generators, armature reaction, losses in D.C generator, efficiency, characteristics of D.C generators, applications of D.C generators (chapter 10, 11, pages 208-238),

D.C. motors: D.C motor principle, working of D.C motors, significance of back, E.M.F, torque equation of D.C motors, types of D.C motors, characteristics of D.C motors, speed control methods of D.C motors, applications of D.C motor, testing of D.C machines, losses and efficiency, direct load test and Swinburne's test (Chapter 12, 13, page Nos. 239-269).

A.C. circuits: Introduction to steady state analysis of A.C circuits, single and balanced 3 phase circuits (chapter 16, page nos. 323-348).

Transformers: Transformer principle, EMF-equation of transformer, transformer on load, equivalent circuit of transformer, voltage regulation of transformer, losses in a transformer, calculation of efficiency and regulation by open circuit and short circuit tests (Chapter 20, page Nos. 423-455).

Three phase inductance motor: Induction motor working principle, construction of 3-phase induction motor, principle of operation, types of 3-phase induction motor, torque equation of induction motor, slip-torque characteristics, starting torque, torque under running condition, maximum torque equation, power stages of induction motor, efficiency calculation of induction motor by direct loading (Chapter 21, page nos. 463-489).

Alternator: Alternator working principle, EMF equation of alternator, voltage regulation by Synchronised impedance method (Chapter 23, page nos. 505-515).

Synchronous motor: Synchronous motor principle of operation, construction, methods of starting of synchronous motor, (Chapter- 24, page nos. 516-526).

TEXT BOOK:

1. 'Elements of Electrical Engineering & Electronics' by V.K. Mehta, S.Chand& Co.

REFERENCE BOOK:

1. 'A first course in Electrical Engineering' by Kothari.

CH-1106 : ENGLISH LANGUAGE LAB

Course Objectives:

- To make students recognize the sounds of English through Audio-Visual aids;
- To help students build their confidence and help them to overcome their inhibitions and self-consciousness while speaking in English;
- To familiarize the students with stress and intonation and enable them to speak English effectively; and
- To give learners exposure to and practice in speaking in both formal and informal contexts.

Course Outcomes:

At the end of the course, the student will be able to

- Recognize of English sound patterns and the fluency in their speech will be enhanced;
- Study the communicative items in the laboratory will help students become successful in the competitive world;
- Participate in group activities like roleplays, group discussions and debates; and
- Express themselves fluently and accurately in social as well professional context.

SYLLABUS

Introduction to Phonetics: The Sounds of English (Speech sound – vowels and consonants) - Stress and Intonation - Accent and Rhythm.

Listening Skills: Listening for gist and specific information - listening for Note taking, summarizing and for opinions - Listening to the speeches of eminent personalities.

Speaking Skills: Self-introduction - Conversation Skills (Introducing and taking leave) - Giving and asking for information - Role Play - Just A Minute (JAM) session - Telephone etiquette.

Reading and Writing skills: Reading Comprehension – Précis Writing - E-Mail writing - Punctuation.

Presentation skills: Verbal and non-verbal communication - Body Language - Making a Presentation.

REFERENCE BOOKS:

1. Ashraf Rizvi. *Effective Technical Communication*. Tata McGraw Hill Education Private Limited, New Delhi.
2. *Speak Well*. Orient Blackswan Publishers, Hyderabad.
3. Allan Pease. *Body Language*. Manjul Publishing House, New Delhi.

CH-1107 : CHEMISTRY LAB

Course Objectives:

- To develop the fine skills of quantitative determination of various chemical components through titrimetric analysis
- To prepare and use ionexchange/ zeolite columns for the removal of hardness of water
- To develop the skill of organic synthesis through the preparation of a polymer/ drug

Course Outcomes:

At the end of the course, the student will be able to

- Determine the amount of various chemical species in solutions by titrations and conduct the quantitative determinations with accuracy
- Develop novel materials to be used as zeolite and prepare columns for removal of hardness of water
- Produce a polymer or a drug

SYLLABUS

1. Determination of Sodium Hydroxide with HCl (Na_2CO_3 Primary Standard)
2. Determination of Alkalinity (Carbonate and Hydroxide) of water sample
3. Determination of Fe(II)/Mohr's Salt by Permanganometry
4. Determination of Oxalic Acid by Permanganometry
5. Determination of Chromium (VI) by Mohr's Salt Solution
6. Determination of Zinc by EDTA method
7. Determination of Hardness of Water sample by EDTA method
8. Determination of Chlorine in water by Iodometric Titration
9. Ionexchange/ Zeolite column for removal of hardness of water
10. Synthesis of Polymer/ drug

REFERENCE BOOKS:

1. Vogel's Quantitative Chemical Analysis – V – Edition – Longman.
2. Experiments in Applied Chemistry (For Engineering Students) – Sinita Rattan – S. K.Kataria& Sons, New Delhi.

CH-1108 : CPNM LAB

Course Objectives:

- To impart writing skill of C programming to the students and solving problems.
- To write and execute programs in C to solve problems such as Modularize the problems into small modules and then convert them into programs.,
- To write and execute programs in C to solve problems such as arrays, files, strings, structures and different numerical methods.
- This reference has been prepared for the beginners to help them understand the basic to advanced concepts related to Objective-C Programming languages.

Course Outcomes:

At the end of the course, the student will be able to

- Understand various computer components, Installation of software. C programming development environment, compiling, debugging, and linking and executing a program using the development environment.
- Analyzing the complexity of problems, Modularize the problems into small modules and then convert them into programs.
- Construct programs that demonstrate effective use of C features including arrays, strings, structures, pointers and files.
- Apply and practice logical ability to solve the real world problems.
- Apply Numerical methods to Solve the complex Engineering problems.

SYLLABUS

1. Write a program to read x, y coordinates of 3 points and then calculate the area of a triangle formed by them and print the coordinates of the three points and the area of the triangle. What will be the output from your program if the three given points are in a straight line?
2. Write a program, which generates 100 random integers in the range of 1 to 100. Store them in an array and then print the arrays. Write 3 versions of the program using different loop constructs. (e.g. for, while, and do while).
3. Write a set of string manipulation functions e.g. for getting a substring from a given position, Copying one string to another, Reversing a string, adding one string to another.
4. Write a program which determines the largest and the smallest number that can be stored in different data types like short, int, long, float, and double. What happens when you add 1 to the largest possible integer number that can be stored?

5. Write a program, which generates 100 random real numbers in the range of 10.0 to 20.0, and sort them in descending order.

6. Write a function for transposing a square matrix in place (in place means that you are not allowed to have full temporary matrix).

7. First use an editor to create a file with some integer numbers. Now write a program, which reads these numbers and determines their mean and standard deviation.

8. Given two points on the surface of the sphere, write a program to determine the smallest arc length between them.

9. Implement bisection method to find the square root of a given number to a given accuracy.

10. Implement Newton Raphson method to det. a root of polynomial equation.

11. Given table of x and corresponding f(x) values, Write a program which will determine f(x) value at an intermediate x value by using Lagrange's interpolation/

12. Write a function which will invert a matrix.

13. Implement Simpson's rule for numerical integration.

14. Write a program to solve a set of linear algebraic equations.

CH-1201 : MATHEMATICS – II

Course Objectives:

- The way of obtaining rank, eigen values and eigen vectors of a matrix.
- To know the importance of Cayley-Hamilton theorem and getting canonical form from a given quadratic form.
- To solve the system of equations by using direct and indirect methods.
- To solve first order and higher order differential equations by various methods.
- To obtain the Laplace transforms and inverse Laplace transforms for a given functions and their applications.

Course Outcomes:

At the end of the course, the student will be able to

- Find rank, eigen values and eigen vectors of a matrix and understand the importance of Cayley-Hamilton theorem.
- Reduce quadratic form to canonical forms and solving linear systems by direct and indirect methods.

- Demonstrate solutions to first order differential equations by various methods and solve basic applications problems related to electrical circuits, orthogonal trajectories and Newton's law of cooling
- Discriminate among the structure and procedure of solving higher order differential equations with constant and variable coefficients.
- Understand Laplace transforms and its properties and finding the solution of ordinary differential equations.

SYLLABUS

(Linear Algebra)

Rank of a matrix- Echelon form, Normal Form - Solution of Linear System of Equations - Consistency of Linear System of Equations - Direct & Indirect Methods: Gauss elimination method, LU Factorization method, Gauss Seidal Method. Complex Matrices: Hermitian, Skew-Hermitian and Unitary Matrices and their Properties.

(Eigen Values and Eigen Vectors)

Eigen Values and Eigen Vectors of a Matrix - Cayley-Hamilton theorem - Inverse and Powers of a Matrix using Cayley-Hamilton's theorem and its applications. Diagonalization of a Matrix - Quadratic Forms - Reduction of Quadratic Form to Canonical Form - Nature of a Quadratic Form.

(Ordinary Differential Equations of First Order and its Applications)

Formation of ordinary differential equations (ODEs) - Solution of an ordinary differential equation - Equations of the first order and first degree - Linear differential equation - Bernoulli's equation - Exact differential equations - Equations reducible to exact equations - Orthogonal Trajectories - Simple Electric (LR & CR) Circuits - Newton's Law of Cooling - Law of Natural growth and decay.

(Differential Equations of Higher Order)

Solutions of Linear Ordinary Differential Equations with Constant Coefficients - Rules for finding the complimentary function - Rules for finding the particular integral - Method of variation of parameters - Cauchy's linear equation - Legendre's linear equation - Simultaneous linear differential equations.

(Laplace Transforms)

Introduction - Existence Conditions - Transforms of Elementary Functions - Properties of Laplace Transforms - Transforms of Derivatives - Transforms of Integrals - Multiplication by t^n - Division by t - Evaluation of integrals by Laplace Transforms - Inverse Laplace Transform - Applications of Laplace Transforms to Ordinary Differential Equations - Simultaneous Linear Differential Equations with Constant Coefficients - Second Shifting Theorem - Laplace Transforms of Unit Step Function, Unit Impulse Function and Laplace Transforms of Periodic Functions.

TEXT BOOK:

1. Scope and Treatment as in "Higher Engineering Mathematics", by Dr. B.S. Grewal, 43rd edition, Khanna publishers.

REFERENCE BOOKS:

1. Graduate Engineering Mathematics by V B Kumar Vatti., I.K. International publishing house Pvt. Ltd.
2. Advanced Engineering Mathematics by Erwin Kreyszig.
3. A text book of Engineering Mathematics, by N.P. Bali and Dr. Manish Goyal. Lakshmi Publications.
4. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.
5. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.

CH-1202 : PHYSICS

Course Objectives:

- To impart knowledge in basic concept of physics of Thermodynamics relevant to engineering applications.
- To grasp the concepts of physics for electromagnetism and its application to engineering. Learn production of Ultrasonics and their applications in engineering.
- To Develop understanding of interference, diffraction and polarization: connect it to a few engineering applications.
- To Learn basics of lasers and optical fibers and their use in some applications.
- To Understand concepts and principles in quantum mechanics and Nanopahse Materials. Relate them to some applications.

Course Outcomes:

At the end of the course, the student will be able to

- Understand the fundamentals of Thermodynamics and Laws of thermodynamics. Understand the working of Carnot cycle and concept of entropy.
- Gain Knowledge on the basic concepts of electric and magnetic fields. Understand the concept of the nature of magnetic materials. Gain knowledge on electromagnetic induction and its applications.
- Understand the Theory of Superposition of waves. Understand the formation of Newton's rings and the working of Michelson's interferometer. Remember the basics of diffraction, Evaluate the path difference. Analysis of Fraunhofer Diffraction due to a single slit.

- Understand the interaction of matter with radiation, Characteristics of Lasers, Principle, working schemes of Laser and Principle of Optical Fiber. Realize their role in optical fiber communication.

- Understand the intuitive ideas of the Quantum physics and understand dual nature of matter. Compute Eigen values, Eigen functions, momentum of Atomic and subatomic particles using Time independent one Dimensional Schrodinger's wave equation. Understand the fundamentals and synthesis processes of Nanophase materials.

SYLLABUS

THERMODYNAMICS :

Introduction, Heat and Work, First law of thermodynamics and applications, Reversible and Irreversible process, Carnot cycle and Efficiency, Second law of thermodynamics, Carnot's Theorem, Entropy, Second law in terms of entropy, Entropy and disorder, Third law of thermodynamics (statement only).

ELECTROMAGNETISM

Concept of electric flux, Gauss's law - some applications, Magnetic field - Magnetic force on current, torque on current loop, The Biot-Savart's Law, B near a long wire, B for a circular Current loop, Ampere's law, B for a solenoid, Hall effect, Faraday's law of induction, Lenz's law, Induced magnetic fields, Displacement current, Maxwell's equations (no derivation), Magnetic materials: Classification of magnetic materials and properties.

Ultrasonics :Introduction, Production of Ultrasonics – Piezoelectric and Magnetostriction methods, acoustic grating, applications of ultrasonics

OPTICS

Interference: Principles of superposition – Young's Experiment – Coherence - Interference in thin films (reflected light), Newton's Rings, Michelson Interferometer and its applications.

Diffraction: Introduction, Differences between interference and diffraction, Fresnel and Fraunhofer diffraction, Fraunhofer diffraction at a single slit (Qualitative and quantitative treatment).

Polarisation: Polarisation by reflection, refraction and double refraction in uniaxial crystals, Nicol prism, Quarter and Half wave plate, circular and elliptical polarization.

LASERS and FIBRE OPTICS

Introduction, characteristics of a laser beam, spontaneous and stimulated emission of radiation, population inversion, Ruby laser, He-Ne laser, Semiconductor laser, applications of lasers.

Introduction to optical fibers, principle of propagation of light in optical fibers, Acceptance Angle and cone of a fibre, Numerical aperture, Modes of

propagations, classification of fibers, Fibre optics in communications, Application of optical fibers.

MODERN PHYSICS

Introduction, De Broglie concept of matter waves, Heisenberg uncertainty principle, Schrodinger time independent wave equation, application to a particle in a box. Free electron theory of metals, Kronig - Penney model (qualitative treatment), Origin of energy band formation in solids, Classification of materials into conductors, semi conductors and insulators.

Nanophase Materials

Introduction, properties, Top-down and bottom up approaches, Synthesis - Ball milling, Chemical vapour deposition method, sol-gel methods, Applications of nano materials.

TEXT BOOKS :

1. Physics by David Halliday and Robert Resnick – Part I and Part II - Wiley.
2. A textbook of Engineering Physics, Dr. M. N. Avadhanulu, Dr. P.G. Kshirsagar - S. Chand
3. Engineering Physics by R.K. Gaur and S.L. Gupta –Dhanpat Rai

REFERENCE BOOKS:

1. Modern Engineering Physics by A.S. Vadudeva
2. University Physics by Young and Freedman

CH-1203

ENGINEERING GRAPHICS

Course Objectives:

- Understand the basics of Engineering Graphics and BIS conventions.
- Develop the graphical skills for communication of concepts, ideas and design of engineering products through technical drawings
- Demonstrate and practice the various profiles/curves used in engineering practice through standard procedures.
- Demonstrate and practice the orthographic projections of points, lines, planes, solids and section of solids
- Demonstrate and practice the development of surfaces of simple solids
- Familiarize the basic concept of isometric views clearly.

Course Outcomes:

At the end of the course, the student will be able to

- Develop simple engineering drawings by considering BIS standards.
- Able to draw different engineering curves with standard Procedures
- Comprehend the basics of orthographic projections and deduce orthographic projections of points, lines, planes and solids at different orientations in real life environment.
- Visualize clearly the sections of solids.
- Apply the concepts of development of surfaces while designing/analyzing any product.
- Recognize the significance of isometric drawing to relate 2D environment with 3D environment.

SYLLABUS

Introduction: Lines, Lettering and Dimensioning, Geometrical Constructions, and Scales.

Curves: Conic sections: General construction of ellipse, parabola and hyperbola. Construction of involutes of circle and polygons only. Normal and tangent to curves.

Projections of Points: Principal or Reference Planes, Projections of a point situated in any one of the four quadrants.

Projections of Straight Lines: Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane.

Projections of Straight Line Inclined to Both the Reference Planes: Projections of Planes: Projection of Perpendicular planes: Perpendicular to both reference planes, perpendicular to one reference plane and parallel to other reference plane and perpendicular to one reference plane and inclined to other reference plane. Projection of Oblique planes. Introduction to Auxiliary Planes.

Projections of Solids: Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to other and axes inclined to both the reference planes.

Sections of Solids: Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids (Prism, Pyramid, Cylinder and Cone) in simple position only.

Development of Surfaces: Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.

Isometric Views: Isometric projection, Isometric scale and Isometric view. Isometric view of Prisms, Pyramids, cylinder, cone, and their combinations.

TEXT BOOK:

1. Elementary Engineering Drawing by N.D.Bhatt, Charotar Publishing House.

REFERENCE BOOK:

1. Engineering Graphics by K.L. Narayana and P. Kannaiah, Tata McGraw Hill.

CH-1204

MATERIALS SCIENCE & ENGINEERING

Course Objectives:

Materials science and engineering is an important subject to every engineer to understand about the materials' behavior in different environments. Main objectives of the study are as follows:

- To understand the structure of atoms
- To learn something about the crystalline nature of the materials
- To know about the influence of atoms controlling the properties of materials
- To know the equivalency of the materials for replacement
- To learn to prepare alloys, composites for conventional materials
- To find the relation between arrangement and thermodynamic properties of materials

Course Outcomes:

- The student will be able to
- Analyze the behavior of crystalline materials w.r.t their atomic arrangement.
 - Understand the imperfections in crystalline materials
 - Assess the mechanical behavior of the materials
 - Explain phase transformations of alloys
 - Elaborate the corrosion properties of materials

SYLLABUS

An introduction to materials, classification of engineering materials, brief review of atomic structure, calculation of energy of electron of Bohr's atomic model, Bonds in materials – classification, properties of ionic, covalent and metallic solids, variation in bonding character and properties. Crystal Geometry and crystal structure – solids- crystalline solids and

amorphous solids (non-crystalline), differences between crystalline and non-crystalline materials. Ideal crystal, space Lattice, unit cell, primitive cell, non-primitive cell, lattice co-ordinates, Bravais lattices for crystal systems, crystal systems and their properties, symmetry and elements of symmetry, Atomic packing fraction and packing efficiency (SC, BCC, FCC, Diamond cubic and HCP structures), c/a ratio for HCP structure. Miller indices for directions and linear density calculation, planes in crystals and their representation, planar density calculation, coordination number. Determination of crystal Structure by X-ray diffraction method – Debye method, numerical problems for different cubic structures (SC, BCC and FCC).

Fundamentals of thermodynamics – stability and meta-stability of materials, internal energy (E), enthalpy (H), Gibb's free Energy (G), and thermal entropy and configurational entropy (S). solid solutions-types, crystal imperfections – classification, point defects- classification and estimation of point defects in the crystals; Imperfections (dislocations) – classification (edge and screw); Berger circuits and Burgers Vector, planar defects, volume defects, dislocation reactions, role of dislocations in determining crystal properties; surface defects - types

Mechanical Properties: Stress –types of stresses; Strain-types of strain; true stress and true strain, engineering stress and engineering strain of the materials, relation between engineering strain and true strain, relation between engineering stress and true stress; Hooke's Law; Poisson's Ratio, stress-strain diagram and its uses; different moduli of elasticity – Young's modulus, shear modulus, and bulk modulus; relation between different moduli of elasticity, strain vs stress relationship diagrams for different materials (metals, non-metals, rubbers and plastics and polymers); elastic deformation and plastic deformation and their differences. Critical Resolved shear stress (CRSS). Fracture – types, ductile fracture and its mechanism, brittle fracture and its mechanism (Griffith's criteria), fatigue factors affecting the fatigue, creep and creep failure mechanisms, creep resistance materials. Composite materials – classification, advantages of composite materials over conventional materials, Limitations of composite materials, factors affecting the performance of fibrous composites, factors affecting the performance of matrix in composites,

Phase- time scale for phase changes, Phase diagrams- phase rule, single component systems, Binary phase changes, the lever rule and numerical problems, advantages of phase diagrams, advantages of alloying of metals on the properties of steels, Iron-iron carbide ($\text{Fe-Fe}_3\text{C}$) phase diagram, limitations of plain carbon steels, types of steels used in chemical industries,

Corrosion and prevention: Principles and mechanism of corrosion, types of corrosion cells: composition cell, concentration cell, stress cells, Different forms of corrosion, prevention and control of corrosion: proper

selection of materials, proper design and fabrication procedure, application of protective coatings.

TEXT BOOKS:

1. 'Materials Science & Engineering' by V.Raghavan, Prentice Hall of India Ltd, New Delhi
2. 'Elements of Materials Science & Engineering', 5th Edition, Lawrence H.VanVlack, Addison-Wiley Publishing Company

REFERENCE BOOKS:

1. 'Science of Engineering Materials', Vols.1-3, by Manas Chanda, McMillan Company of India, Delhi
2. 'Principles of Materials Science & Engineering', William F.Smith, McGraw-Hill Publishing Co.
3. 'Essentials of Materials Science' by A.G. Guy.
4. A textbook of Engineering physics, by Dr.M.N.Abadhanulu and Dr.P.G.Kshirsagar; S.Chand and company pvt Ltd. Chapters 26 and 27.
5. An introduction to corrosion science and engineering By Herbert Uhlig and R. Winston Revie, Published by John Wiley and sons, New York.
6. Corrosion Engineering by Mars.G.Fontana, McGraw-Hill, publication

CH-1205

MECHANICAL ENGINEERING

Course Objectives:

- ♣ To be aware of the basics in Thermodynamics
- ♣ To get knowledge on applications of steam tables
- ♣ To understand the principles and applications of IC engines, compressors and turbines
- ♣ To comprehend the principles of belts, chain drives and gears

Course Outcomes:

- At the end of the course, the student will be able to
- To Know the thermodynamic laws and various processes
 - To make out the applications of steam in boilers and turbines
 - To derive the various performance parameters related to IC engines and of air compressors
 - To arrive basic needs of working of belts, chain drives and gears

SYLLABUS

Thermodynamics: Definitions, systems, classification of thermodynamic systems, cycles and zeroth law of thermodynamics, first law of

thermodynamics, closed system, flow processes, open systems with steady flow process, applications of steady flow energy equation to engineering systems.

Second law of thermodynamics: Carnot cycle, inequality of Clausius-reversible Carnot cycle, entropy, relation between heat and entropy, general expression for entropy change, entropy change of a perfect gas during various thermodynamic processes, air standard cycles, Otto, diesel, dual combustion cycles,

Properties of steam and use of steam tables: Boilers, classification steam boilers, simple vertical, Cochran, locomotive boiler, Babcock and Wilcox boiler, steam generation, Rankine cycle.

Impulse and reaction turbine: Classification of steam turbines, velocity diagram and power produced in impulse turbine, performance of steam turbines, reduction of rotor speed,

I C engines: Classification-main composition of IC engines, carburettor, fuel pump injector, cooling systems for IC engines, working of 2-stroke and 4-stroke petrol and diesel engines, power and efficiency of IC engines.

Reciprocating air-compressors: Single stage, work done during cycle, effect of clearance, two stage compressors, condition for minimum work, effect of inter-cooling, efficiency.

Drives: Belts, expression for the ratios of tension on the slack and tight side, power transmitted – V-belts, chain drives, gears – spur, helical, bevel gear, trains simple and compound.

TEXT BOOKS:

1. A Text Book of Thermal Engineering by R.S.Khurmi and J.K.Gupta
2. 'Theory of Machines' by R.S.Khurmi

REFERENCE BOOKS:

1. 'Engineering Thermodynamics' by P.K.Nag
2. 'Engineering Thermodynamics' by J.B.Jones and R.E.Dugar
3. 'Engineering Thermodynamics' by R.K.Rajput
4. 'Theory of Machines' by Balani.

CH-1206 : WORKSHOP LAB

Course Objectives:

- Get hands on experience with the working skills in Carpentry trade.
- Know how to work with Sheet Metal tools.
- Get familiar with the working skills of Metal Fitting operations.
- Get hands on experience with house hold electrical wiring.

Course Outcomes:

At the end of the course, the student will be able to

- Can be able to work with Wood Materials in real time applications.
- Can be able to build various parts with Sheet Metal in day-to-day life.
- Can be able to apply Metal Fitting skills in various applications.
- Can be able to apply this knowledge to basic house electrical wiring and repairs.

SYLLABUS

Carpentry: Any three jobs from – Half lap joint, Mortise and Tenon joint, Half – lap Dovetail joint, Corner Dovetail joint, Central Bridle joint.

Sheet Metal: Any three jobs from – Square tray, Taper tray(sides), Funnel, Elbow pipe joint.

Fitting: Any three jobs from – Square, Hexagon, Rectangular fit, Circular fit and Triangular fit.

House wiring: Any three jobs from – Tube light wiring, Ceiling fan wiring, Stair-case wiring, Corridor wiring.

REFERENCE BOOKS:

1. Elements of workshop technology, Vol.1 by S. K. and H. K. Choudary.
2. Work shop Manual / P.Kannaiah/ K.L.Narayana/ SciTech Publishers.
3. Engineering Practices Lab Manual, Jeyapoovan, Saravana Pandian, 4/e Vikas.

CH-1207 : PHYSICS LAB

Course Objectives:

- To enable the students to acquire skill, technique and utilization of the Instruments
- Draw the relevance between the theoretical knowledge and to imply it in a practical manner with respect to analyze various electronic circuits and its components.
- To impart the practical knowledge in basic concepts of Wave optics, Lasers and Fiber optics.
- To familiarize the handling of basic physical apparatus like Vernier callipers, screw gauge, spectrometers, travelling microscope, laser device, optical fibre, etc.

Course Outcomes:

At the end of the course, the student will be able to

- Design and conduct experiments as well as to analyze and interpret
- Apply experimental skills to determine the physical quantities related to Heat, Electromagnetism and Optics

- Draw the relevance between theoretical knowledge and the means to imply it in a practical manner by performing various relative experiments.

SYLLABUS

1. Determination of Radius of Curvature of a given Convex Lens By forming Newton's Rings.
2. Determination of Wavelength of Spectral Lines in the Mercury Spectrum by Normal Incidence method.
3. Study the Intensity Variation of the Magnetic Field along axis of Current Carrying Circular Coil.
4. Determination of Cauchy's Constants of a Given Material of the Prism using Spectrometer.
5. Determination of Refractive Index of Ordinary ray m_o and Extraordinary m_e ray.
6. Determination of Thickness Given Paper Strip by Wedge Method.
7. Calibration of Low Range Voltmeter.
8. Calibration of Low Range Ammeter.
9. Determination of Magnetic Moment and Horizontal Component of Earth's Magnetic Field.
10. Lees Method - Coefficient of thermal Conductivity of a Bad Conductor.
11. Carey Foster's Bridge – Verification of laws of Resistance and Determination Of Specific Resistance.
12. Melde's Apparatus – Frequency of electrically maintained Tuning Fork.
13. Photoelectric cell-Characteristics.
14. Planks Constants.
15. Laser- Diffraction.

CH-1208 : GENERAL ENGINEERING LABORATORY

MECHANICAL ENGINEERING LABORATORY

Course Objectives:

- To be aware of the viscosity, flash point of oil samples and calorific value of a gas
- To get knowledge on calibration of pressure gauge, flywheel and torsional pendulum
- To understand the principles and applications of Air compressors and IC engines

Course Outcomes:

At the end of the course, the student will be able to

- To determine the viscosity, flash point and calorific value of fluids
- To make out the applications of pressure gauge, flywheel and torsional pendulum
- To derive performance parameters related to IC engines and efficiencies of air compressor

Experiments

1. Find the viscosity of the given sample of oil using Redwood viscometer-1
2. Find the viscosity of the given sample of oil using Redwood viscometer-II
3. Find the flash point of the given sample of oil using Abel's flash point tester
4. To calibrate pressure gauge using standard pressure and standard weights
5. Draw the valve timing diagram of a 4-stroke diesel engine and port timing diagram of a 2-stroke petrol engine
6. Perform load test at full load, half load, $\frac{1}{4}$ th load on a 4-stroke Ruston engine and draw the performance curves
7. Find the volumetric efficiency, isothermal efficiency of the given compressor
8. To determine the moment of inertia of a fly-wheel and shaft experimentally and compare the values with the calculated values
9. To determine experimentally the calorific value of a gaseous fuel by using Junkers gas calorimeter
10. To determine the modulus of rigidity of the material of the wire by torsional oscillators

ELECTRICAL ENGINEERING LABORATORY

Course Objectives

This course provides

- Insight of fundamental laws in electrical engineering.
- Deals with the constructional and operational details of DC and AC machines.
- Analyze electrical and magnetic circuits using basic laws of electrical engineering

Course Outcomes

After the completion of the course, the student should be able to

- Understand the basic laws of electrical and magnetic circuits.
- Analyze the characteristics of DC generator and motors.
- Design of equivalent circuit of transformer.
- Apply the basic knowledge to solve problems on synchronous machines.

Experiments

1. Study and calibration of ammeter
2. Study and calibration of voltmeter
3. Study and calibration of wattmeter
4. Study and calibration of energy meter
5. Measurement of low resistance (armature)
6. Measurement of medium resistance (field)
7. Measurement of insulation resistance
8. Measurement of filament resistance
9. Verification of KCL and KVC
10. Superposition theorem.
11. Parameters of a choke coil
12. OC and SC tests on transformer
13. Load test D.C. shunt machine
14. OC test on DC, separately excited machine
15. Swinburne's test
16. 3-phase induction motor (No load and rotor block tests)
17. Alternator regulation by Syn. impedance method

CH-2101 : MATHEMATICS-III

Course Objectives:

The objectives, in particular are to learn about:

- Differentiation of vector functions of real variables, curves in space, differential operators, the concept of gradient, divergence and curl and their potential applications.
- The concepts of Line-, Surface and Volume integrals and transformation theorems such as **Green's** theorem in the plane, **Stoke's** theorem, **Gauss Divergence** theorem and their applications.
- Formation of Partial Differential Equations and solution of first order first degree linear, non-linear Partial Differential Equations, Homogeneous and Non homogeneous linear partial differential equations with constant coefficients.

- The method of separation of variables and how to use it to find the solution of one dimensional wave (string equation), one-and two-dimensional **Heat flow equations**, **Laplace's equation** in Cartesian and polar coordinates.

- The concept of integral transforms, namely, **Fourier transforms**, **Fourier Sine**, **Cosine** and related **inversetransforms**, and their applications in solving several Physical and Engineering problems.

Course Outcomes:

At the end of the course, the students would be able to:

- Understand differential operations and the concepts of Gradient, Divergence and Curl and their applications.
- Apply the concepts of Line integrals, Surface Integrals, Volume Integrals and their potential applications: work done by a force field, circulation and Flux etc. Also, find out the relation between Line, Surface and Volume integrals: Green's theorem in the plane, Stoke's and Divergence theorems.
- Understand the formation of partial differential equations and the solving Linear and Non linear first order partial differential equations. Also, how to find the solution of Linear Partial Differential Equations with constant coefficients by finding the complementary function and particular integrals.
- Apply the method of separation of variables to solve the important governing equations of one dimensional wave equation, One and Two dimensional heat flow equations, Laplace's equations in Cartesian and polar coordinates.
- Apply the knowledge of Fourier transform techniques in solving several Initial and Boundary value problems of Engineering, such as problems in Conduction of heat / Thermodynamics, Hydraulics transverse vibrations of a string, oscillations of an elastic beam, bending of beams, electrical circuits, free and forced vibrations of a membrane and transmission lines , etc.

SYLLABUS

(Vector Calculus-Differentiation)

Differentiation of vectors, curves in space, velocity and acceleration, relative velocity and relative acceleration, scalar and vector point functions, vector operator $\hat{N}$ applied to scalar point functions- gradient, $\hat{N}$ applied to vector point functions- divergence and curl. Physical interpretation of gradient, divergence and curl (i.e.,), Irrotational and Solenoidal fields, the relations obtained after $\hat{N}$ applied twice to point functions, $\hat{N}$ applied to products of two functions.

(Vector Integration)

Integration of vectors, line integral, circulation, work done, surface integral-flux, Green's theorem in the plane, Stoke's theorem, volume integral, Gauss Divergence theorem. (All theorems without proofs).

Introduction of orthogonal curvilinear coordinates, cylindrical and spherical polar coordinates

(Partial Differential Equations)

Formation of partial differential equations, solutions of partial differential equations- equations solvable by direct integration, linear equations of first order: Lagrange's Linear equation, non-linear equations of first order, Charpit's method. Homogeneous linear equations with constant coefficients-rules for finding the complementary function, rules for finding the particular integral (working procedure), non-homogeneous linear equations.

(Applications of Partial Differential Equations)

Method of separation of variables, One dimensional wave equation-vibrations of a stretched string, one dimensional Heat flow equation, Two dimensional heat flow in steady state - solution of Laplace's equation in Cartesian and polar coordinates (two dimensional).

(Integral Transforms (Fourier Transform))

Introduction, definition, Fourier integral, Sine and Cosine integrals, Complex form of Fourier integral, Fourier transform, Fourier Sine and Cosine transforms, Finite Fourier Sine and Cosine transforms, properties of Fourier transforms.

Convolution theorem for Fourier transforms, Parseval's identity for Fourier transforms, Fourier transforms of the derivatives of a function, simple applications to Boundary value problems.

TEXT BOOK:

1. Scope and treatment as in "Higher Engineering Mathematics", by Dr. B.S.Grewal, 43rd Edition, Khanna Publishers.

REFERENCE BOOKS:

1. Graduate Engineering Mathematics by V B Kumar Vatti, I.K.International publications
2. Advanced Engineering Mathematics by Erwin Kreyszig.
3. A text book of Engineering Mathematics by N.P. Bali and Dr. Manish Goyal, Lakshmi Publications.
4. Mathematical Methods of Science & Engineering aided with MATLAB by Kanti B.Dutta, Cengage Learning India Pvt. Ltd.
5. Higher Engineering Mathematics by B. V. Ramana, Tata McGraw Hill Company.
6. Advanced Engineering Mathematics by H.K.Dass. S.Chand Company.

CH-2102 : SOLID MECHANICS

Course Objectives:

- To impart knowledge about the behaviour of elastic bodies subjected to different types of external forces.
- To impart skills of analysing the statically determinate beams subjected to different types of loads for shear force, bending moment and their corresponding stress distribution.
- To develop skills to analyse shafts, springs and shells for determining the critical stress distribution

Course Outcomes:

- At the end of the course the students will be able to
- Analyse different bodies subjected to different types of loads like axial forces, transverse loads and torsional moment.
 - Analyse the statically determinate beams subjected to loads.
 - Analyse shafts, springs and shells.

SYLLABUS

Axial loads: Simple stress and strain, Hook's law, load extension diagram for mild steel, stress in compound assemblies, thermal stresses,

Transverse loads: Shear force and bending moment diagrams for a) cantilevers, b) simply supported beams and c) over-hanging beams due to concentrated loads and U D L s only,

Theory of simple bending: Relation between i) f and y , ii) M and I , iii) E and R , distribution of shear stress in common shapes of cross-section,

Principal stresses and principal planes, maximum shear stress and its plane, Mohar's circle of stress,

Torsion of solid and hollow circular shafts, transmission of horse power, design of flange coupling, closed coil helical spring i) under axial load and ii) under axial twist, riveted joints, design of lap joints,

Stress in thin cylindrical shells and spherical shells, stress in thick cylinders, compound cylinders, pressure due to shrink-fitting.

TEXT BOOK:

1. 'Strength of Materials' by Ramamrutaham

REFERENCE BOOK:

1. 'Elements of Strength of Materials' by S.P.Timoshenko and D.H.Young, East West Press, New Delhi.

CH-2103 : MANAGERIAL ECONOMICS

Course Objectives:

1. To bring about an awareness about the nature of Managerial Economics and its linkages with other disciplines.
2. To understand the Micro and Macro Environment of Business.
3. To familiarise the prospective engineers with the concepts and tools of Managerial Economics with an objective to understand the real world of business.

Course Outcomes:

Managerial Economics will help the prospective engineers, who are likely to occupy managerial positions in future to understand the various economic activities in business and industry for an effective and efficient running of the organisations.

SYLLABUS

Significance of Economics and Managerial Economics:

Economics: Definitions of Economics- Wealth, Welfare and Scarcity definition Classification of Economics- Micro and Macro Economics.

Managerial Economics: Definition, Nature and Scope of Managerial Economics, Differences between Economics and Managerial Economics, Main areas of Managerial Economics, Managerial Economics with other disciplines.

Demand Analysis :Demand - Definition, Meaning, Nature and types of demand, Demand function, Law of demand - Assumptions and limitations. Exceptional demand curve.

Elasticity of demand - Definition, Measurement of elasticity, Types of Elasticity (Price, Income, Cross and Advertisement), Practical importance of Price elasticity of demand, Role of income elasticity in business decisions, Factors governing Price Elasticity of demand.

Demand Forecasting - Need for Demand forecasting, Factors governing demand forecasting, Methods of demand forecasting: Survey methods- Experts' opinion survey method and consumers Survey methods.

Utility Analysis: Utility- Meaning, Types of Economic Utilities, Cardinal and Ordinal Utility, Total Utility, Marginal Utility, The law of Diminishing Marginal Utility and its Limitations

Theory of Production and Cost analysis:

Production - Meaning, Production function and its assumptions, use of production function in decision making; Law of Variable Proportions: three stages of the law.

Cost analysis - Nature of cost, Classification of costs - Fixed vs. Variable costs, Marginal cost, Controllable vs. Non - Controllable costs, Opportunity cost, Incremental vs. Sunk costs, Explicit vs. Implicit costs,

Replacement costs, Historical costs, Urgent vs. Postponable costs, Escapable vs. unavoidable costs, Economies and Diseconomies of scale.

Market Structures : Definition of Market, Classification of markets; Salient features or conditions of different markets - Perfect Competition, Monopoly, Duopoly , Oligopoly, Importance of kinked demand curve ;Monopolistic Competition.

Pricing Analysis : Pricing - Significance: Different Pricing methods- Cost plus pricing, Target pricing, Marginal cost pricing, Going -rate pricing, Average cost pricing, Peak load pricing , Pricing of joint Products, Pricing over the life cycle of a Product, Skimming pricing Penetration pricing, Mark-up and Mark- down pricing of retailers.

Business cycles, Inflation and Deflation:

Business cycles - Definition , Characteristics , Phases, Causes and Consequences; Measures to solve problems arising from Business cycles

Inflation -Meaning, Types, Demand- pull and Cost push inflation, Effects of Inflation, Anti- inflationary measures.

Deflation- Meaning, Effects of Deflation, Control of Deflation, Choice between Inflation and Deflation.

TEXT BOOKS:

1. Sankaran,S., Managerial Economics, Marghan Publications, 2015, Chennai.
2. Aryasri, A.R., Managerial Economics and Financial Analysis, MC Graw Hill Education, New Delhi,2015.

CH-2104 : ORGANIC CHEMISTRY

Course Objectives:

The student will be able to:

- appreciate the nature and scope of organic chemistry.
- apply key concepts from general chemistry including electronegativity, bonding (ionic and covalent), hybridization of atomic orbitals, and molecular orbital theory to organic systems.
- draw skeletal structures for organic compounds.
- apply acid-base concepts to organic systems; predict ordering of acid or base strength.
- Name alkanes, alkenes, polyenes, alkynes, alkyl halides, aromatic compounds, carbonyl compounds, amines and their various derivatives using systematic (IUPAC) nomenclature.
- draw reaction mechanisms for some key reactions.
- recognize stereochemistry and be able to apply the Cahn-Ingold-Prelog system to designation of stereochemistry (E/Z or R/S).

- learn many of the reactions of alkanes, alkenes, polyenes, alkynes, aromatic, carbonyl, and amine compounds, and close related species. Be able to predict reactions involving these functional groups.

- be able to solve problems employing spectroscopic methods including mass spectrometry, infrared and NMR spectroscopy

- understand the basic chemical and structural features of biomolecules, including lipids, carbohydrates, amino acids and proteins, and nucleic acids

Course Outcomes:

At the end of the course, the student will be able to

- Determine the molecular formula for organic compounds
- Differentiate the structure and properties of biomolecules, polymers and heterocyclic compounds
- Identify the role of chemical engineer in modern drug discovery programs
- Separate the racemic mixtures using resolution methods
- Elucidate the structure of organic compounds (small molecules) using spectroscopic methods.

SYLLABUS

Numerical problems: Determination of percentage composition of carbon, hydrogen and nitrogen, molecular weight determination by depression in freezing point and elevation of boiling point methods, molecular weight of acids by silver salt method; molecular weight of bases by chloroplatinate method, determination of molecular formula of a compound, problems relating to reactions of carboxylic acids, functional derivatives of acids, carbonyl compounds, alcohols, amines, phenols, diazonium salts applications, alkenes and their laboratory tests,

Nomenclature of alkanes, alkenes, alkynes, dienes, cyclic aliphatic hydrocarbons, structure of benzene, nomenclature of benzene derivatives, arenas, industrial preparation of ethylene, acetylene; sp , sp^2 and sp^3 hybridization; preparation and chemical reactions; conformational analysis of ethane, propane and butane, Wurtz reaction, Diels-Alder reaction, aromaticity Morkovinkov rule, Clemmensen and Wulf-Kishner reduction,

Electro-philic and nucleophilic aromatic substitution: Orientation in disubstituted benzenes, mechanism of nitration, halogenation, sulphonation, Friedel-Craft's alkylation and acylation reactions, nomenclature of alkyl halides, preparation and chemical reactions, mechanisms of SN_1 , SN_2 , E_1 , E_2 reactions, nomenclature of aryl halides, preparation and chemical reactions: low reactivity of vinyl and aryl halides, Sandmeyer reaction.

Nomenclature of alcohols; industrial preparation of ethyl alcohol, preparation and chemical reactions, Lucas test, nomenclature of mono, dicarboxylic acids, industrial preparation of formic, acetic, benzoic, phthalic, salicylic acids, preparation and chemical reactions, mechanism of HVZ reaction and Claisen condensation, nomenclature of functional derivatives of acids, preparation and chemical reactions, mechanism of Hoffmann bromamide reaction, acid and base catalyzed hydrolysis of ester, nomenclature of ethers and epoxides, industrial preparation of ether and ethylene oxide, preparation and chemical reactions; Williamson's synthesis.

Nomenclature of aldehydes and ketenes: Industrial preparation of formaldehyde, acetaldehyde, benzaldehyde, salicylaldehyde, acetone; preparation and chemical reactions; mechanisms of Cannizzaro, Aldol, Reformatsky and Wittig reactions, reactions without mechanisms -Perkin, Cope, Knoevenagel and Pinacol-Pinacolone reactions, difference between aldehyde and ketone, nomenclature of phenols, industrial preparation of phenol, preparation and chemical reactions, mechanisms of Fries rearrangement, Kobe reaction, Reimer-Tiemann reaction, classification of carbohydrates, structure of glucose and fructose, reactions of glucose and fructose, Ruff degradation, Wohls degradation, filiani-Fisher synthesis, glucose into fructose, fructose into glucose, glucose to vitamin-C, mechanism of Osazone formation.

Nomenclature of amines, industrial preparation of aniline, preparation and chemical reactions - exhaustive methylation, mechanism of Hoffmann elimination, benzedene rearrangement without mechanism, Hinsberg test, differentiation test using nitrous acid, preparation of diazonium salts and synthetic application, preparation of sulphanilamide, sulphaguanidine, sulphamerazine, sulphapyridine (sulpha drugs), mode of action of sulpha drugs.

Preparation of soaps and detergents: Mode of action of soaps, differences between soaps and detergents; preparation of malonic, acetoacetic ester and their synthetic applications, preparation of Grignard reagents and their synthetic applications, preparation of polyethylene, polystyrene, teflon, PVC, polyvinyl cyanide, rubber-vulcanisation, styrene-butadiene rubber, polychloroprene, bakelite, nylon-6 and nylon 6-6, plexiglas, terylene, Ziegler-Natta polymerization, definition of thermoplastics and thermosetting plastics,

Isomerism: Structural and optical isomerism, geometrical isomerism, E Z configuration, sequence rules, R & S configuration, racemic mixture and their separation, asymmetric synthesis - Fischer projection formula, definitions of axial and equatorial bonds, 1-3- diaxial interaction, enantiomers, diastereomers, mesomers, isomerism in cyclic compounds, chair, boat and

twisted boat structures (1-methylcyclohexane, 1, 2-cyclohexane diol),
sSynthetic applications of - Zn/Hg, Na-NH₃LiAlH₄, NaBH₄, diborane and zinc dust, soda lime, OsO₄, hydroxylamine, acetic anhydride, benzoylchloride and PCl₅.

REFERENCE BOOKS:

1. 'Text Book of Organic Chemistry' by Morrison & Boyd
2. 'Text Book of Organic Chemistry' by Bahl&Tuli
3. 'Text Book of Organic Chemistry' by M.K.Jain
4. 'Text Book of Organic Chemistry' by I.L.Finar (Vols.1&2 as reference books)

CH-2105 : PARTICLE & FLUID PARTICLE PROCESSING

Course Objectives:

Mechanical Operations is one of the core subjects for chemical engineers, where student can learn some of the unit operations necessary for process industry. Main objectives of the inclusion of this subject are:

- To make the students exposed to different geometrical sizes of raw materials used in the industries, area of calculation of the particles w.r.t their sizes
- To get familiarity with the different laws of grinding
- To do the power consumption calculations
- To learn different separation process on their physical properties
- To differentiate between the process such as mixing and agitation
- To know the movement of particles in different liquids (viscous)

Course Outcomes:

At the end of the course, student will be able to

- Select suitable size reduction equipment based on performance and power requirement.
- Analyze particle size distribution of solids
- Evaluate solid-fluid separation equipment
- Determine the power required for agitation, blending and mixing
- Select conveyers for the transportation of materials in the industry

SYLLABUS

Characteristics of solid particles – shape, size, differential and cumulative screen analysis, specific surface area, particle population, different mean diameters for a mixture of particles,

Principles of comminution - Laws of crushing, description and working of size reduction equipment - jaw, gyratory and roll crushers, hammer mills,

revolving mills, attrition mills, fluid energy mill, cutting machines, open and closed circuit grinding, wet and dry grinding, grindability index,

Size separation, screening, industrial screens - grizzly, gyratory and vibratory screens, revolving screens, trammels, capacity and effectiveness of screens, magnetic separation, electrostatic separation, froth flotation,

Filtration - description and working of filtration equipment, plate and frame filter press, shell and leaf filters, rotary drum filter, filter aid, centrifugal filtration, top suspended batch centrifuge, theory of filtration, washing of cakes,

Motion of particles through fluids- drag, free and hindered settling, settling velocities, classification, sink and float methods, differential setting methods - jigging and tabling, cyclone separators,

Batch sedimentation, thickeners, flocculation, centrifugal sedimentation, gravity and centrifugal decanters,

Agitation of liquids, power consumption in agitated vessels, scale up of agitation equipment, mixing equipment for mixing of solids and pastes, mixers for dry powders, mixing index,

Conveying, types of conveyors – mechanical, belt, chain and screw conveyors, elevators, pneumatic conveyors, size enlargement - need and applications.

TEXT BOOK:

1. 'Unit Operations of Chemical Engineering' by W.L. McCabe, J.C. Smith and P.Harriot, McGraw- Hill Book Company

REFERENCE BOOKS:

1. 'Chemical Engineering -Vol.2' by J.H.Coulson and J.F.Richardson, Pergaman press and ELBS
2. 'Chemical Engineer's Hand Book' by R.H.Perry {ed}, McGraw-Hill Book Co.
3. 'Unit Operations' by Brown et al., Asian Publishing House
4. 'Introduction to Chemical Engineering' by Badger and Banchero, McGraw-Hill Book Company.

CH-2106

ORGANIC CHEMISTRY LABORATORY

Course Objectives:

The student will learn to analyze the organic compounds. The students will be exposed to the preparation of various organic chemicals in this laboratory.

Course Outcomes:

At the end of the course, the student will be able to

- Analyze and identify the given organic compound.
- Prepare organic compounds like aspirin, benzanilide, m-dinitrobenzene, benzoic acid, phthalimide, methyl orange, parabenzoquinone and nerolin
- Identify extra elements

List of Experiments:

1. Preparation of aspirin
2. Preparation of benzanilide
3. Preparation of m-dinitrobenzene
4. Preparation of benzoic acid
5. Preparation of phthalimide
6. Preparation of methyl orange
7. Preparation of parabenzoquinone
8. Preparation of nerolin
9. Detection of extra elements
10. Analysis of compound -1
11. Analysis of compound -2
12. Analysis of compound -3
13. Analysis of compound -4
14. Analysis of compound -5
15. Analysis of compound -6

CH-2107 : PARTICLE & FLUID PARTICLE PROCESSING LABORATORY

Course Objectives:

Solid processing is an essential component in process industries. In the present day, when the world is facing the challenge of dealing with depleting mineral resources, this subject assumes high importance to the students of chemical engineering. The student is introduced to the concepts of sampling, processing of solid raw materials. The student also gets hands on training on operating various machines used for processing of solids.

Course Outcomes:

- At the end of the course, the student will be able to
- Select suitable methods for size reduction of minerals or other intermediates
 - Analyze particle size distribution of solids
 - Evaluate suitable mechanical separations of powders, solid-liquid and solid-gas mixtures.

List of Experiments:

1. To take a representative sample from a bulk by two methods, viz. Riffle and cone & quartering and to find out the average size (volume-surface mean diameter) of the samples
2. To determine the grindability index {GI} of coal by hard groove machine
3. To determine the time of grinding in a ball mill for producing a product with 80% passing a given screen
4. To verify the laws of crushing using any size reduction equipment like crushing rolls, ball mill or vibrating mill and to find out the work Index {WI} of the material
5. To compare open circuit and closed circuit grinding by means of a ball mill
6. To determine the optimum time of sieving for a given sample of material
7. To find the effectiveness of hand screening of a given sample by a given screen
8. To find the screen effectiveness of a trommel
9. To separate a mixture of coal into two fractions using sink and float method
10. To separate a mixture of coal into two fractions using froth flotation technique
11. To find the size analysis of a given fine sample using beaker decantation method
12. To separate a mixture of particles by jigging
13. To concentrate a given material by means of tabling
14. To obtain batch sedimentation data and to calculate the minimum thickener area under given conditions
15. To determine the specific cake resistance and filter medium resistance of a slurry in plate and frame filter press.

CH-2108 MATLAB

Course Objectives:

The student will learn to apply the knowledge of *MATLAB* for solving Chemical Engineering problems.

Course Outcomes:

At the end of the course, the student will be able to

- Apply Matlab to create and print arrays and execute function files
- Solve linear equations using Matlab
- Determine the curve fit equation for the given data
- Draw 2D plots and 3D plots for the given data.

SYLLABUS

Introduction, Tutorial lessons: MATLAB session, working with arrays of numbers, creating and printing simple data, saving and executing a script file, creating and executing function files, working with files and directories.

Interactive computation - Matrices and vectors, matrix and array operations, creating and using inline functions, using built in functions and online help, saving and loading data, plotting simple graphs. Script files, function files, language specific features, advanced data objects.

Applications - linear algebra, curve fitting and interpolation, data analysis and statistics, numerical integration, ordinary differential equations, nonlinear algebraic equations.

Basic 2D plots, using subplot to layout multiple graphs. 3-D plots, symbolic Math tool box: two useful tools in symbolic Math tool box, using symbolic Math tool box.

TEXT BOOK:

1. 'Getting started with MATLAB: A quick introduction for scientists and engineers' by Rudra Pratap, Oxford University press.

CH -2109

ENVIRONMENTAL SCIENCE

Course Objectives:

The aim of this course is to make the students better understand the changes in the environment and be given a greater voice and planning conservation through an interdisciplinary environmental science curriculum that is design to enhance scientific enquiry and to strengthen competence.

Course Outcomes:

At the end of the course, the student will be able to

- Understand various types of pollution regulations and their scientific bases.
- Apply knowledge for the protection and improvement of the environment.
- Recognize the major concepts in environmental science and demonstrating in-depth of the environment

SYLLABUS

Introduction: Definition, scope and importance, measuring and defining environmental development – indicators,

Ecosystems: Introduction, types, characteristic features, structure and functions of ecosystems – forest, grassland, desert, aquatic (lakes, rivers and estuaries).

Environmental and natural resources management: Land resources- land as a resource, common property resources, land degradation, soil erosion and desertification, effects of modern agriculture, fertilizer-pesticide problems,

Forest resources- use and over-exploitation, mining and dams –their effects on forest and tribal people,

Water resources – use and over utilization of surface and ground water, floods, droughts, water logging and salinity, dams-benefits and costs, conflicts over water,

Energy resources- Energy needs, renewable and non-renewable energy sources, use of alternate energy sources, impact of energy use on environment,

Bio-diversity and its conservation: Value of bio-diversity- consumptive and productive use, social, ethical, aesthetic and option values, bio-geographical classification of India - India as a mega diversity nation, threats to biodiversity, hot spots, habitat loss, poaching of wild life, loss of species, seeds etc., conservation of biodiversity - in-situ and ex-situ conservation,

Environmental pollution- local and global issues: Causes, effects and control measures of air pollution, indoor air pollution, water pollution, soil pollution, marine pollution, noise pollution, solid waste management, composting, vermiculture, urban and industrial wastes, recycling and re-use, nature of thermal pollution and nuclear hazards, global warming, acid rain , ozone depletion,

Environmental problems in India: Drinking water, sanitation and public health, effects of activities on the quality of environment, urbanization, transportation, industrialization, green revolution, water scarcity and ground water depletion, controversies on major dams – resettlement and rehabilitation of people: problems and concerns, rain water harvesting, cloud seeding and watershed management,

Economy and environment: The economy and environment interaction, economics of development, preservation and conservation, sustainability: theory and practice, limits to growth, equitable use of resources for sustainable lifestyles, environmental impact assessment,

Social issues and the environment: Population growth and environment, environmental education, environment movements, environment versus development,

Institutions and governance: Regulation by Government, monitoring and enforcement of environmental regulation, environmental Acts, water (prevention and control of pollution) act, air (prevention and control of

pollution) act, environment .protection act, wild life protection act, forest conservation act, coastal zone regulations, institutions and policies relating to India, environmental governance,

International conventions: Stockholm conference-1972, Earth summit-1992, World commission for environmental development (WCED),

Case studies: Chipko movement, Narmada bachao andolan, Silent valley project, Madhura refinery and Taj mahal, Industrialization of Pattancheru, Nuclear reactor at Nagarjuna sagar, Tehri dam, Ralegaon siddhi (Anna Hazare), Kolleru lake-aquaculture, Fluorosis in Andhra Pradesh,

Field work: Visit to a local area to document and mapping environmental assets –river/forest/grass land / hill/ mountain, study of local environment-common plants, insects, birds, study of simple ecosystems – pond, river hill, slopes etc, visits to industries- water treatment plants, effluent treatment plants.

TEXT BOOK:

1. Environmental Studies by Anubha Kaushik & C.P. Kaushik, Second Edition, New Age International (P) Limited.

CH-2201 : MATHEMATICS-IV

Course Objectives:

The student should be able to learn the concepts:

- Function of complex variables, differentiation and integration of complex functions. Evaluation of complex integration using Cauchy's theorem and Cauchy's integral formula.
- Conformal mappings, Expansion of complex functions as Taylor's and Laurent's series. Evaluation of some real definite integrals using Cauchy's Residue Theorem.
- -transforms, inverse -transforms and applications of these transforms to solve the difference equations.
- Correlation, Regression and some discrete and continuous distributions.
- Sampling, Testing of hypothesis for large samples and small samples.

Course Outcomes:

At the end of the course, the student will be able to:

- Understand the concepts of function of complex variables, differentiation and integration of complex functions. Evaluation of complex integration using Cauchy's theorem and Cauchy's integral formula.

- know about conformal mappings, Expansion of complex functions in terms of Taylor's and Laurent's series. Evaluation of some real definite integrals using Cauchy's Residue Theorem.

- Understand the concept of difference equations and their formation, solution. Evaluate of -transforms, inverse -transforms and applications of these transforms to solve difference equations.

- Apply the concepts of Correlation, Regression and some discrete and continuous distributions.

- Understand the Sampling theory: Sampling, Testing of hypothesis for large and small samples.

SYLLABUS

(Functions of Complex Variables)

Introduction-Limit and continuity of $f(z)$ - Derivative of $f(z)$, Cauchy-Reimann Equations, Analytic Functions, Harmonic functions, Orthogonal systems, Applications to flow problems, Geometrical representation of $f(z)$.

Integration of complex functions, Cauchy's theorem, Cauchy's integral formula and their applications.

(Conformal Mappings and Contour Integration)

Introduction to Conformal transformation, Bilinear transformation , Series of complex terms -Taylor's and Laurent's series (without proofs), Zero's and Singularities of analytic functions.

Residues and Calculations of residues, Cauchy's Residue Theorem, Evaluation of real definite integrals: Integration around unit circle, semi circle.

(Difference Equations & Z-transforms)

Introduction - Formation of difference equations - Linear difference equations - Rules for finding complementary function - Rules for finding particular integral - simultaneous difference equations with constant coefficients - Applications to deflection of a loaded string.

Introduction to Z-Transforms - Some standard Z-transforms - Linear Property - Damping Rule - Shifting U_n to the right and to the left-multiplication by -Two basic theorems - Some useful Z-transforms - Inverse Z-transformation - Convolution theorem - Convergence of Z-transform - Two sided Z-transform - Evaluation of inverse Z-transform - Application to Difference equations.

(Correlation, Regression and Distributions)

Introduction - correlation - coefficient of correlation -Lines of regression.

Introduction to Discrete and Continuous Random Variables - Distributions: binomial distribution, Poisson distribution, exponential distribution, normal distribution.

(Sampling Theory)

Introduction - Testing of hypothesis - Level of significance - Confidence limits - Test of significance of large samples - comparison of large samples- Test of significance for means of two large samples.

Student t-distribution - Significance test of sample mean - Significance test of difference between sample means - Chi square test - Goodness of fit - F-distribution.

TEXT BOOK:

1. Scope and treatment as in "Higher Engineering Mathematics", by Dr.B.S.Grewal, 43rd Edition, Khanna Publications.

REFERENCE BOOKS:

1. Graduate Engineering Mathematics by V B Kumar Vatti, I.K.International publications
2. Advanced Engineering Mathematics by Erwin Kreyszig.
3. A text book of Engineering Mathematics by N.P. Bali and Dr.Manish Goyal; Lakshmi publications.
4. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.
5. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.
6. Engineering Mathematics series by Chandrica Prasad.

CH-2202 : MATERIAL & ENERGY BALANCES

Course Objectives:

To give intensive quantitative training in the practical applications of the principles of physical chemistry to the solution of complicated industrial problems and in methods of predicting missing physicochemical data from generalized principles.

Course Outcomes:

At the end of the course, the student will be able to

- Convert physico-chemical quantities from one system of units to another
- Identify basis and degrees of freedom
- Perform material and energy balances on single units without and with chemical reactions
- Solve the material and energy balance problems on multi-unit processes with recycle, purge and bypass
- Analyze the ideal and real behavior of gases, vapors and liquids

SYLLABUS

Stoichiometry and composition relationships- the gram-mole and pound-mole, limiting reactant, excess reactant, degree of completion, basis of calculation, weight percent, volume percent and mole percent, density and specific gravity- Baume and API gravity scales,

Behavior of ideal gases- application of the ideal-gas law, Dalton and Amagat laws to gaseous mixtures, composition of gases on dry basis and on wet basis,

Vapor pressures- Effect of temperature on vapor pressure, Antoine equation, reference substance vapor pressure plots, vapor pressure of immiscible liquids, ideal solutions and Raoult's law, non-volatile solutes,

Humidity - Percentage saturation, relative saturation or relative humidity, dew point, vaporization, condensation, wet and dry bulb temperatures, adiabatic vaporization and adiabatic saturation temperature,

Material balances- Tie substance, yield, conversion, processes involving chemical reactions, material balance- calculations involving drying, dissolution, and crystallization, processes involving recycle, bypass and purge,

Heat capacities of gases and gaseous mixtures- effect of temperature on heat capacity of gas, mean heat capacity of gas, Kopp's rule, latent heats, heat of fusion, heat of vaporization, Trouton's rule, Kistyakowsky equation for non-polar liquids, estimation of latent heat of vaporization using Classius-Clayperon equation, enthalpy of humid air and humid heat capacity,

Standard heat of reaction - Standard heat of formation, laws of thermochemistry, standard heat of combustion, calculation of heat of formation from heats of combustion, calculation standard heat of reaction from heats of formation and from heats of combustion, standard integral heat of solution, effect of temperature on heat of reaction, Kirchoff's equation, adiabatic and non-adiabatic reactions, theoretical and actual flame temperatures.

TEXT BOOK:

1. 'Chemical Process Principles, Part-I - Material and Energy balances' by Olaf A Hougen, K.M. Watson and R.A.Ragatz, CBS Publishers and Distributors (1995)

REFERENCE BOOKS:

1. 'Basic principles and Calculations in Chemical Engineering' by David M. Himmelblau, Prentice Hall of India Pvt Ltd, 1995

2. 'Stoichiometry' by B.I. Bhatt and S.M. Vora, 3rd Edition, Tata McGraw Hill Publishing Company Limited, New Delhi (1996)

3. 'Stoichiometry for Chemical Engineers' by Williams and Johnson, McGraw Hill Publishers.

CH-2203 : HEAT TRANSFER

Course Objectives:

- To study the fundamental concepts of heat transfer viz., conduction, convection, radiation
- To use these fundamentals in typical engineering applications (Heat exchanger and Evaporator, boiling and condensation.) and current research.

Course Outcomes:

At the end of the course, the student will be able to

- Analyze problems involving steady state heat conduction in simple geometries
- Develop equations for different types of convection and solve for heat transfer rate by convection in flow through pipes and flow over a flat plate
- Design of shell and tube heat exchangers using LMTD and effectiveness method
- Estimate the rate of radiation heat transfer with and without participating medium and ability to identify the roll of radiation shields
- Estimate steam economy, capacity of single and multiple effect evaporators
- Understand the concepts of boiling and condensation

SYLLABUS

Nature of heat flow: Conduction, convection, natural and forced convection, radiation.

Heat transfer by conduction : Basic laws of conduction, thermal conductivity; Steady-state conduction – compound resistances in series, heat flow through a cylinder; Unsteady-state conduction – one dimensional heat flow with constant surface temperature, heat flow with variable surface temperature, semi-infinite solid;

Heat transfer by convection: Principles of heat flow in fluids – Typical heat exchange equipment, countercurrent and parallel flows, energy balances, heat flux and heat transfer coefficients, overall heat transfer coefficients, integration over total surface, LMTD, individual heat transfer coefficients.

Heat transfer to fluids without phase change : boundary layers, laminar flow heat transfer, correction for heating and cooling, heat transfer in turbulent flow, estimation of wall temperature, cross-sections other than

circular, analogy between transfer of momentum and heat, heat transfer to liquid metals, heating and cooling of fluids outside tubes, natural convection.

Heat transfer to fluids with phase change: heat transfer from condensing vapors, heat transfer to boiling liquids.

Radiation heat transfer: Fundamental facts concerning radiation, emission of radiation, absorption of radiation by opaque solids, radiation between surfaces, radiation to semitransparent materials, combined heat transfer by conduction-convection-radiation.

Heat-exchange equipment: General design of heat exchange equipment, shell and tube heat exchangers, plate-type exchangers, extended surface equipment, heat pipes, scraped-surface exchangers, condensers and vaporizers, heat transfer in agitated vessels, heat transfer in packed beds.

Evaporation: Evaporation, types of evaporators, performance of tubular evaporators, multiple-effect evaporators, methods of feeding, vapor compression.

TEXT BOOK:

1. Unit Operations of Chemical Engineering, 7th Ed. by W. L. McCabe, J. C. Smith and P. Harriot, McGraw Hill International Edition, Singapore (2005).

REFERENCE BOOK:

1. Process Heat Transfer, by D. Q. Kern, Tata McGraw Hill, New Delhi.

CH-2204

FLUID MECHANICS

Course Objectives:

To provide

- Knowledge on pressure distribution in static fluids.
- Knowledge on rheological behavior of fluids, types of fluid flow, boundary layers and basic equations of fluid flow.
- Knowledge of incompressible & compressible fluid flow in pipes
- Knowledge on fluid flowing past solid surfaces
- Knowledge on pipes, fittings, transportation and metering devices.

Course Outcomes:

At the end of the course, the student will be able to

- Derive dimensionless groups by using dimensional analysis.

- Solve problems related to manometers and decanters using the principles of fluid statics.
- Determine the pipe size / flow rate / power requirements under laminar and turbulent flow conditions.
- Solve problems involving motion of particles in fluid, fluid–solid operations in packed beds and fluidized beds.
- Select machinery and measuring devices for fluid flow.

SYLLABUS

Dimensional Analysis: Units and Dimensions, Dimensional Homogeneity, Dimensional Analysis, Buckingham π theorem, Geometric similarity, kinematic similarity, and dynamic similarity.

Fluid statics and applications: Nature of fluids, Hydrostatic Equilibrium, Applications of fluid statics – Manometers, continuous gravity decanter and centrifugal decanter.

Fluid Flow phenomena: Laminar flow, shear rate, shear stress. Rheological properties of fluids – Newtonian fluids, Non Newtonian fluids, time dependent flow, viscoelastic fluids. Viscosity, Reynolds number, Turbulence - nature of turbulence, deviating velocities, intensity and scale of turbulence, Reynolds stresses and eddy viscosity. Boundary layers - boundary layer formation over flat plate, flow in boundary layers, laminar and turbulent flow in boundary layers, boundary layer formation in straight tubes, boundary layer separation and wake formation.

Basic Equations of Fluid Flow: Continuity equation (Mass Balance in a flowing fluid), equation of motion (Differential Momentum Balance), Navier - Stokes equations, Euler's equation, Couette flow, Macroscopic Momentum Balance, layer flow with free surface, Bernoulli equation (Energy equation), corrections for effect of solid boundaries and pump work.

Incompressible flow in pipes and channels : Shear Stress and skin friction in pipes, Relation with skin friction and wall shear, Friction factor, relations between skin friction parameters, equivalent diameter, laminar flow in pipes and channels, velocity distribution, average velocity, Kinetic energy correction factor and momentum correction factor for laminar flow, Hagen-Poiseuille equation, laminar flow of non-Newtonian liquids, laminar flow in annulus. Turbulent flow in pipes and channels, Velocity distribution for turbulent flow, universal velocity distribution equations, its limitations, flow quantities for turbulent flow in smooth round pipes, Reynolds number-friction factor law for smooth tubes, effect of roughness, friction factor chart, drag reduction, friction from changes in velocity or direction – sudden expansion, sudden contraction, pipe fittings, friction losses in Bernoulli equation, velocity heads, separation of boundary layer in diverging channel, minimizing losses.

Flow in compressible fluids: Definitions and basic equations, processes of compressible flow, isentropic flow through nozzles, Adiabatic friction flow, Isothermal friction flow

Flow past immersed objects: Drag and drag coefficients, flow through bed of solids, Motion of particles through fluids - mechanics of particle motion, equation for one-dimensional motion of particles through fluid, terminal velocity, criterion for settling, free and hindered settling. Fluidization – conditions, minimum fluidization velocity, types of fluidizations and its applications.

Transportation and Metering of Fluids: Pipes, fittings, valves. Positive displacement Pumps – reciprocating, rotary and peristaltic pumps. Centrifugal pumps - theory, construction, performance, single and multistage pumps. Fans, Blowers and Compressors. Vacuum pumps – jet ejectors.

Metering of fluids: Full bore meters – Venturi meter, Orifice meter, Rotameters, Vortex-Shedding meters, Magnetic meters and Coriolis meters. Insertion meters – Pitot Tube, Thermal meters, notches and weirs.

TEXT BOOK:

1. "Unit Operations of Chemical Engineering" Seventh Edition, by W.L. McCabe, J C Smith and P Harriot, Mc Graw Hill

REFERENCE BOOKS:

1. "Chemical Engineering" Volume I by Coulson J.M. and Richardson J.F, Elsevier
- "Fluid Mechanics" 2nd edition by Noel de Nevers, Mc Graw Hill

CH-2205

INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP

Course Objectives:

1. To familiarise the students with the concepts of Management.
2. To relate the concepts of Management with Industrial Organisations.
3. To explain the factors affecting productivity and how productivity can be increased with effective utilization of inputs in an industrial undertaking.
4. To set forth a basic framework for understanding Entrepreneurship.

Course Outcomes:

An engineer with his/her fundamental knowledge of Industrial Management, will be in position to take appropriate decisions in the corporate environment. The concepts of Entrepreneurship acts as a motivating factor to launch new enterprises and translate one's dream into reality.

SYLLABUS

Basic Concepts of Management:

Management :- Definition, Nature and Importance ; Functions of the Management; Levels of Management; F.W Taylor's Scientific Management; Henry Fayol's Principles of Management;

Forms of Business Organizations: Introduction, Types of Business organizations:

Private Sector- Individual Ownership , Partnership, Joint stock companies and Co-Operative organizations; Public sector- Departmental Organizations, Public Corporations and Government Companies; The Joint sector Management.

Production and operations Management: Plant location- Factors to be considered in the selection of Plant location; Break - even analysis- Significance and managerial applications; Importance of Production Planning and Control and its Functions; Human Resource Management and Functions of Human Resource Manager (in brief); Functions of Marketing; Methods of Raising Finance.

Entrepreneurship : Definition, Characteristics and Skills , Types of Entrepreneurs, Entrepreneur vs. Professional Managers, , Growth of Entrepreneurs, Nature and Importance of Entrepreneurs, Women Entrepreneurs, Problems of Entrepreneurship.

Entrepreneurial Development and Project Management: Institutions in aid of Entrepreneurship Development, Idea generation: Sources and Techniques;, Stages in Project formulation ; Steps for starting a small enterprise - Incentives for Small Scale Industries by Government.

TEXT BOOKS:

1. Sharma, S.C., and Banga, T.R., Industrial Organization & Engineering Economics, Khanna Publishers, Delhi, 2000.

2. Vasant Desai, The Dynamics of Entrepreneurial Development and Management (Planning for future Sustainable growth), Himalayan Publishing House, 2018.

REFERENCE BOOKS:

1. Aryasri , A.R., Management Science, McGraw Hill Education (India) Private Limited , New Delhi 2014.

2. Sheela, P. , and Jagadeswara Rao, K., Entrepreneurship, Shree Publishing House, Guntur, Andhra Pradesh, 2017.

CH-2206 : HEAT TRANSFER LABORATORY

Course Objectives:

The student will calculate the thermal resistance and calculation of heat transfer coefficients for both natural and forced convection scenarios. The

student will conduct experiments to calculate emissivity of the given plate, radiation constant of the given rod and Stefan Boltzman constant.

Course Outcomes:

At the end of the course, the student will be able to

- Determine thermal conductivity of composite solids and thermal conductivities of lagging material in lagged pipe apparatus
- Determine heat transfer coefficients in forced and natural convection
- Determine the Stefan Boltzman constant and emissivity of the given plate
- Calculate radiation constant for hot rod losing heat to the infinite stagnant ambient
- Analyze the heat exchanger performance (double pipe) for co-current and counter-current flows and determine overall heat transfer coefficient.

List of Experiments:

1. Determination of total thermal resistance and thermal conductivity of composite wall.
2. Determination of total thermal resistance and thermal conductivity of Lagged pipe.
3. Determination of the natural convective heat transfer coefficient for a vertical tube.
4. Determination of forced convective heat transfer coefficient for air flowing through a pipe.
5. Determination of over-all heat transfer coefficient in double pipe heat exchanger.
6. Study of the temperature distribution along the length of a pin fin under natural and forced convection conditions.
7. Estimation of unsteady state film heat transfer coefficient between the medium in which the body is cooled.
8. Determination of Stefan-Boltzmann constant.
9. Determination of emissivity of a given plate at various temperatures.
10. Determination of radiation constant of a given surface.
11. Determination of the thermal conductivity of a metal rod.
12. Determination of critical heat flux point for pool boiling of water

CH-2207: FLUID MECHANICS LABORATORY

Course Objectives:

The student will be exposed to various fluid measuring devices. The pressure drop calculation experimentally across the pipe fittings, valves, packed bed, fluidized bed and annulus will also be dealt in this lab.

Course Outcomes:

At the end of the course, the student will be able to

- Distinguish laminar and turbulent flows.
- Determine the characteristics of flow meters
- Determine the characteristics of packed & fluidized beds and centrifugal pumps
- Calculate pressure drop across a pipe, valves and fittings.

List of Experiments:

1. Identification of laminar and turbulent flows (Reynolds apparatus)
2. Measurement of point velocities (Pitot tube)
3. Verification of Bernoulli equation
4. Calibration of rotameter
5. Variation of orifice coefficient with Reynolds number
6. Determination of venturi coefficient
7. Friction losses in fluid flow in pipes
8. Pressure drop in a packed bed for different fluid velocities
9. Pressure drop and void fraction in a fluidized bed
10. To study the coefficient of contraction for a given open orifice
11. To study the coefficient of discharge in a V - notch
12. To study the characteristics of a centrifugal pump

CH-2208 : ASPEN PLUS (Process Design)

Course Objectives:

- To familiarize students with basic programming skills required for solving chemical engineering problems.
- To analyze the data obtained from simulation with theoretical concepts.
- To compare different thermodynamic property estimation methods and analysing the results.
- To familiarize students with fundamental applications of chemical engineering in ASPEN PLUS.

Course Outcomes:

At the end of the course, the student will be able to

- Carry out thermodynamic property estimations using Aspen
- Simulate Mixer, splitter, pumps, compressors and flash units
- Apply sensitivity, design specification and case study tools in Aspen
- Design heat exchangers, reactors and distillation columns

- Optimize process flowsheets using sequential modular and equation oriented approaches.

SYLLABUS

Solve the following steady state simulation exercises using Aspen:

1. Physical property estimations.
2. Simulation of individual units like, mixers, splitters, heat exchangers, flash columns and reactors
3. Design and rating of heat exchangers
4. Design and rating of distillation columns.
5. Mass and Energy balances.
6. Handling user specifications on output streams – Sensitivity and design Spec tools.
7. Simulation of a flowsheet
8. Simulation exercises using calculator block
9. Optimization Exercises
10. Simulation using equation oriented approach

TEXT BOOKS:

1. Lab manuals / Exercise sheets
2. A.K.Jana, Chemical Process Modelling and Computer Simulation, Prentice Hall India, 3rd Edition, 2018.

CH-2209 : PROFESSIONAL ETHICS AND HUMAN VALUES

Course Objectives:

- To inculcate Ethics and Human Values into the young minds.
- To develop moral responsibility and mould them as best professionals.
- To create ethical vision and achieve harmony in life.

Course Outcomes:

- At the end of the course, the student will be able to
- Understand the importance of ethics and moral values in life and society.

SYLLABUS

Ethics and Human Values: Ethics and Values, Ethical Vision, Ethical Decisions, Human Values – Classification of Values, Universality of Values.

Engineering Ethics: Nature of Engineering Ethics, Profession and Professionalism, Professional Ethics, Code of Ethics, Sample Codes – IEEE, ASCE, ASME and CSI.

Engineering as Social Experimentation: Engineering as social experimentation, Engineering Professionals – life skills, Engineers as Managers, Consultants and Leaders, Role of engineers in promoting ethical climate, balanced outlook on law.

Safety Social Responsibility and Rights: Safety and Risk, moral responsibility of engineers for safety, case studies – Bhopal gas tragedy, Chernobyl disaster, Fukushima Nuclear disaster, Professional rights, Gender discrimination, Sexual harassment at work place.

Global Issues: Globalization and MNCs, Environmental Ethics, Computer Ethics, Cyber Crimes, Ethical living, concept of Harmony in life.

TEXT BOOKS:

1. Govindharajan, M., Natarajan, S. and Senthil Kumar, V.S., Engineering Ethics, Prentice Hall of India, (PHI) Delhi, 2004.
2. Subramainam, R., Professional Ethics, Oxford University Press, New Delhi, 2013.

REFERENCE BOOKS:

1. Charles D, Fleddermann, "Engineering Ethics", Pearson / PHI, New Jersey 2004 (Indian Reprint).

CH-2210

SUMMER INTERNSHIP PROGRAM (2MONTHS)

All the students have to undergo Summer Internship / Community Service for two months in the industries / nearby villages and report the same in the Department.

CH-3101

CHEMICAL ENGINEERING THERMODYNAMICS

Course Objectives:

Knowledge of thermodynamics helps student compute heat and work requirements of a process.

The student would also learn

- how to estimate data in case of absence of experimental data,
- Solution thermodynamics and its applications
- Concept of Phase & Chemical reaction equilibrium.

Course Outcomes:

At the end of the course, the student will be able to

- Apply the first and second laws of thermodynamics to chemical processes and Compute the properties of ideal and real gas mixtures.
- Evaluate heat effects involved in industrial chemical processes

- Evaluate the efficiency of expansion and compression flow processes and analyze refrigeration and liquefaction processes.

- Determine thermodynamic properties of gaseous mixtures and solutions, Estimate Bubble-P & T, Dew-P & T for binary and multi-component systems and Calculate vapor-liquid equilibrium (VLE) composition for ideal and non-ideal systems

- Determine equilibrium constant and composition of product mixture for single and multiple reactions.

SYLLABUS

The first law and other basic concepts Introduction to Basic laws and Terminologies in Thermodynamics- Statement of First law, the steady-state, steady-flow process, the reversible process. Volumetric properties of pure fluids: PVT behavior of pure substances, the ideal gas, virial equations and its applications, cubic equations of state, generalized correlations for gases and liquids.

Heat effects: Latent heats of pure substances, Temperature dependence of heat effects of chemical reactions. The Second law of thermodynamics: Statements of second law- Clausius Inequality- Mathematical Statement of Second law, Third law of thermodynamics. Thermodynamic properties of pure fluids: Property relations for homogeneous phases, residual properties.

Solution Thermodynamics: chemical potential, partial properties, ideal gas mixtures, fugacity and fugacity coefficient for a pure species and species in solution, generalized correlations for the fugacity coefficients, the ideal solution, excess properties. VLE-Duhem's theorem, VLE- qualitative behavior, Raoult's law and modified Raoult's law, dew point and bubble point calculations, flash calculations. VLE for Ideal solutions, Calculation of activity coefficients.

Chemical Reaction Equilibria: Criteria for chemical reaction equilibrium, the standard Gibbs energy change and the equilibrium constant, Effect of temperature, pressure, composition and other factors.

TEXT BOOK:

1. 'Introduction to Chemical Engineering Thermodynamics' by J.M.Smith, H.C.Van Ness and M.M.Abbott., 6th Edition, Tata McGraw-Hill Edition 2003.

REFERENCE BOOKS:

1. 'Chemical Engineering Thermodynamics' by B.F.Dodge, McGraw-Hill Book Co.,
2. 'Schaum Outline of Theory and Problems of Thermodynamics' by Michael M. Abbott and Hendrick C.VanNess, McGraw-Hill International Book Co., Singapore, 1981.

3. 'Chemical Engineering Thermodynamics' by Y.V.C.Rao, University Press (India) Ltd., Hyderabad 1997.

4. K.V.Narayanan, A Textbook of Chemical Engineering Thermodynamics, PHI Learning, 2004.

CH-3102

MASS TRANSFER –I

Course Objectives:

- To explain the students with the basic principles of mass transfer operations and other separation processes with examples.
- To impart knowledge on how certain substances undergo the physical change with diffusion/mass transfer of components from one phase to other phases.
- To describe the students with equipment used in operations involving mass transfer and other separation processes and their advantages and disadvantages.
- To focus on absorption and distillation operations and the process design aspects of the same operations.
- To provide the knowledge on humidification and dehumidification operations and their applications in real situations

Course Outcomes:

At the end of the course, the student will be able to

- Identify diffusion phenomena in various chemical processes
- Determine diffusivity coefficient in gases and liquids.
- Calculate mass transfer coefficients at interfaces of multiphase mass transfer systems
- Understand the VLE concepts and application to different distillations
- Understand the importance of humidification and dehumidification processes and their industrial applications
- Design equipment for gas-liquid mass transfer operations

SYLLABUS

Introduction: Mass transfer Operations.

Molecular diffusion in fluids: Binary solutions, Fick's law, equation of continuity, Steady state equimolar counter current diffusion, Stefan's diffusion, estimation of diffusivity of gases and liquids, application of molecular diffusion.

Mass transfer coefficients: Mass transfer coefficients in turbulent flow, theories of mass transfer, analogy between momentum, heat and mass

transfer in laminar and turbulent flow, correlations for mass transfer coefficients in simple situations, diffusion in solids.

Interphase mass transfer: Concept of equilibrium, diffusion between phases, two resistance theory, material balances in steady state co-current and counter-current stage processes, Murphy stage efficiency.

Equipment for gas-liquid operations: Sparged vessels, mechanically agitated vessels for single phase liquids and gas-liquid mixtures, tray towers, sieve tray for absorption and distillation, venturi scrubbers, spray towers and spray chambers, packed towers for absorption and distillation, tray towers versus packed towers.

Humidification operations: Definition of fundamental terms, Psychrometric charts, theory of adiabatic saturation and wet bulb temperature, Lewis relation, gas-liquid contact operations, water cooling with air, dehumidification of air-water-vapor mixture, cooling towers, evaporative cooling.

Absorption: Solubility's of gases in liquids, two component systems, multi-component systems, ideal and non-ideal solutions, choice of solvent for absorption, single component absorption material balances, counter current multistage operations, dilute gas mixtures, on-isothermal operation, tray efficiency, continuous contact equipment, HETP, HTU, NTU concepts for single operation absorption with chemical reaction.

Distillation: Principles of VLE for binary systems, phase diagrams, relative volatility, ideal solutions, azeotropes, enthalpy concentration diagrams, flash vaporization, partial condensation, differential distillation, steam distillation, continuous distillation, McCabe-Thiele method, Ponchon-Savarit method, tray efficiencies, introduction to multi-component distillation, azeotropic and extractive distillations.

TEXT BOOK:

1. Mass transfer Operations, Robert E. Treybal, 3rd edition, McGraw-Hill Book Co.,

REFERENCE BOOKS:

1. "Unit Operations in Chemical Engineering" by McCabe, W.L., Smith, J.C. and Harriot, P., 5th Edition, McGraw-Hill Book Co.,

2. "Chemical Engineering Hand Book" by J.H. Perry.

CH-3103

CHEMICAL REACTION ENGINEERING – I

Course Objectives:

- To learn principles of rate law and stoichiometry. Isothermal reactors- Batch, plug flow reactor and mixed flow reactor. Design of single and multiple reactors.

- To endow with the knowledge on thermal characteristics of various reactions.

Course Outcomes:

At the end of the course, the student will be able to

- Derive the rate law for non-elementary chemical reactions and determine the kinetics of chemical reaction using integral, differential and fractional life methods.
- Design reactors for homogenous reactions under isothermal conditions for single and multiple reactions.
- Select optimal sequence in multiple reactor systems.

SYLLABUS

Introduction and overview of chemical reaction engineering – Variables affecting a chemical reaction – Kinetics of homogeneous reactions – Concentration dependent term of rate equation – Elementary and nonelementary reactions – Temperature dependent term – Arrhenius law, activation energy, collision theory, transition state theory Searching for a mechanism.

Interpretation of batch reactor data – Methods of analysis, integral, differential and half life methods – Analysis of different types of reactions, irreversible and reversible – Variable volume reactor.

Ideal reactors for a single reaction – Performance equations for batch, mixed flow and plug flow reactors – Space time, space velocity and mean residence time.

Design for single reactions – Size comparison of reactors – Multiple reactor systems – Recycle reactor.

Design for parallel reactions – Qualitative and quantitative discussion about product distribution.

Design for series reactions – Qualitative and quantitative discussion about product distribution.

TEXTBOOK:

1. "Chemical Reaction Engineering", Levenspiel, O. 3rd Edition, John Wiley and Sons.

REFERENCE BOOKS:

1. "Chemical Engineering Kinetics", Smith, J.M, 3rd Edition. McGraw Hill Inc.

2. "Elements of Chemical Reaction Engineering", Fogler, H.S, 3rd Edition, Prentice Hall India Ltd.

CH-3104 : CORROSION ENGINEERING (OPEN ELECTIVE-I)

Course Objectives:

- Basic aspects of electrochemistry relevant to corrosion phenomena,
- Importance and forms of corrosion.
- Knowledge on corrosion rate expressions and measurement techniques.
- Basic knowledge on remedial measures for corrosion.

Course Outcomes:

At the end of the course, the student will be able to

- Identify various forms of corrosion.
- Determine corrosion rates for metals from their polarization curves
- Analyze corrosion rate characteristics from electrochemical impedance spectroscopy
- Select suitable corrosion resistant coatings, oxide layers for various applications

SYLLABUS

Introduction and scope: Corrosion definition, wet and dry corrosion, mechanism, electro-chemical principles and aspects of corrosion, Faradays laws, resistance, specific resistance, conductance, specific conductance, transport numbers, ionic mobility, corrosion rate expressions, calculation of corrosion rates, thermodynamic aspects of corrosion, equilibrium potential, Nernst equation for electrode potential, EMF series, over voltage, application of Nernst equation to corrosion reactions,

Polarisation and corrosion potentials: References electrodes for corrosion measurements, types of polarisation, concentration, activation and resistance polarizations, Tafel constant, Evans diagrams, anodic control, cathodic control, mixed control, Pourbaix-diagram for Fe-H₂O system,

Various forms of corrosion: Uniform attack, galvanic corrosion, crevice corrosion, pitting corrosion, intergranular corrosion, selective leaching (dezincification), cavitation damage, fretting corrosion, erosion corrosion, and stress corrosion and remedial measures,

Prevention techniques: Modification of the material by alloying, appropriate heat treatment, chemical and mechanical methods of surface treatment, metallic, non-metallic linings, inhibitors, passivity, Cathodic protection and anodic protection.

TEXT BOOKS:

1. 'Corrosion Engineering' by Mars G. Fontana, Tata McGraw Hill Publishing Company, New Delhi

2. 'Corosion and Corrosion Control' by H.H.Uhlgl, John Wiley & Sons Inc., America.

REFERENCE BOOKS:

1. 'Electrochemistry' by Samuel Glasstone, Litton Educational Publishing Company
2. 'Electrochemistry, Principles & Applications' by Edmond C.Potter, Cleaver Hume Press Limited.

CH-3105(A) :

GENERAL CHEMICAL TECHNOLOGY (CORE ELECTIVE-I)

Course Objectives:

- To provide the student understanding of importance of chemical process industries over the other manufacturing industries.
- To provide the brief introduction of chemical process equipments, the application of thermodynamics, the chemical process principles, the equipment design and also the corrosion and the safety aspects to consider in the chemical manufacturing processes.
- To provide basic inorganic chemistry background required for the undergraduate students of engineering.
- To provide an overview of chemical properties of inorganic chemicals and the manufacturing processes.
- To provide an overview of applications of materials which the engineers are likely to use during their professional career.

Course Outcomes:

At the end of the course, the student will be able to

- Selection of a process for manufacture of chemicals
- Draw process flow diagrams
- Identify the engineering problems in chemical processes
- List chemical reactions and their mechanism involved

SYLLABUS

Water: Sources of water, hardness, treatment for different end uses, municipal water conditioning, industrial waste water treatment.

Sulphur and sulphuric acid: Sources of sulphur-sulphuric acid, different processes of manufacturing-contact process, DCDA process for sulphuric acid manufacture.

Nitrogen industries: Manufacture of ammonia, nitric acid, urea and ammonium nitrate.

Phosphorous and phosphoric acid industries: Methods for production of phosphorous and phosphoric acid, manufacture of super phosphate and triple super phosphate.

Chloro-alkali industries: - Manufacture of soda ash, caustic soda and chlorine.

Cement: Types of cement, manufacture of ordinary portland cement [opc], slag cement.

Fuel and industrial gases: Production of water gas, producer gas and coke oven gas, production of acetylene, oxygen and nitrogen.

Metallurgy: Manufacture of pig iron, cast iron, methods of making steel, open hearth process, production of aluminium by electrolytic process.

TEXTBOOKS:

1. "Dryden's Outlines of Chemical Technology" by M.Gopala Rao & Marshall Sitting (Editors). Affiliated East West Press Pvt. Ltd.
2. "Shreve's Chemical Process Industries" by G.T.Austin, McGraw Hill Books

REFERENCE BOOKS:

1. "Encyclopedia of Chemical Technology" by R.E.Kirk & D.F.Othmer (Editors)Interscience.

CH-3105(B)

PETROLEUM REFINERY ENGINEERING (CORE ELECTIVE – I)

Course Objectives:

- To introduce the basics of refinery engineering subject for petroleum specialization students to gain knowledge of the overall refinery operations, refinery products and its test methods.
- To learn various primary and secondary cracking process available to produce normal and value added products.
- Further, to learn the treatment process available to remove the impurities in the crude and finished products and its test methods for quality check.

Course Outcomes:

At the end of the course, the student will be able to

- Compare various theories on origin and formation of petroleum, to explain and summarize the composition of crude oil, to prepare a report on the world wide scenario of reserves and deposits and the Indian petroleum refining industry scenario.
- Describe and summarize various petroleum products, to know various analytical tests available for estimating various physico chemical properties and classify the crude into different classes.
- Classify the crude processing methods and describe the treatment process i.e. Desalting and Dehydration and infer the preliminary process i.e. Atmospheric Distillation and Vacuum Distillation Units.

- Summarize and infer various secondary cracking process to produce value added products and to design the equipment in the refining industry.

SYLLABUS

Origin and formation of Petroleum. Reserves and deposits of the world, Composition of crudes, Refinery introduction and Indian petroleum refining industry scenario.

Refinery products and test methods, Evaluation of crudes, Crude pretreatment- Dehydration and desalting, Pipe still heater. Atmospheric and Vacuum distillation of crude oil.

Thermal Conversion Process- Vis Breaking, Delayed Coking.

Catalytic Conversion Process- Fluid Catalytic Cracking, Hydrocracking, Hydrotreating, Alkylation, Isomerization, Polymerization and Reforming.

Lube Oil Process – Solvent deasphalting, solvent Extraction, Solvent Dewaxing and Hydro finishing. Treatment of kerosene, additives, blending of gasoline, Asphalt and air blown asphalt.

TEXTBOOKS:

- Petroleum Refining Technology by Dr. Ram Prasad
- Modern Petroleum Refinery Engineering by B K Bhaskar Rao
- Gary, J.H., Handwerk, G.E. and Kaiser, M.J. (2007) Petroleum Refining: Technology and Economics. 5th Edition, CRC Press, Boca Raton, 488 p.
- Petroleum Refining. Vol. 3 Conversion Processes, Pierre Leprince (Editor).

CH-3105 (C)

CERAMIC RAW MATERIALS (CORE ELECTIVE – I)

Course Objectives:

- To procure knowledge about the earth
- To gain knowledge regarding the rocks which are most useful ores.
- To know about the physical and optical properties of the minerals and ores
- To gain acquaintance with formation of different raw materials.
- To collect information about the different types of clays
- To put on the knowledge regarding other raw materials used in the ceramics
- To get information regarding the distribution of the deposits

Course Outcomes:

At the end of the course, the student will be able to

- Identify the sources/ availability of raw materials for ceramics

- Examine different clays as raw materials for various ceramic products

- Explain the behavior of silicates as ceramic raw materials
- Acquire knowledge about accessory ceramic raw materials.

SYLLABUS

General geology and mineralogy: Formation of rocks, their characteristics, classification into igneous, sedimentary and metamorphic groups, formation of mineral deposits, physical and mineral characteristics of minerals – composition, color, streak, luster, fracture, cleavage, hardness, density and tenacity, elements of optical mineralogy.

Clays: Clay minerals, clay structure – kaolinite and montmorillonite groups, geology of clay deposits, their classification - china clay, ball clay, fire clay, building clay etc., beneficiation of clays, mica chlorite, illite group, talc, pyrophyllite, wollastonite group, chemical properties, physical properties. Fluxes: Soda and potash feldspar, other feldspars, nephelinesyenite, geology of formation, physical and chemical properties, beneficiation.

Silica and silicate materials: Silica, polymorphic modification, silica structure, physical and chemical properties of silica, silicate chemistry, minerals, sillimanite, kyanite, and alusite, availability in India and their uses in ceramic industry.

Other raw materials: Geology of bauxite, magnesite, dolomite, chrome, limestone, rutile, zircon, beryllia minerals, alumina, carbides, nitrides, properties and uses.

TEXTBOOKS:

- 'Fine Ceramics Technology and Applications' by F.H.Norton, McGraw Hill Publishers, New York,
- 'Ceramic Raw Materials' by W.E.Worrall, Pergamon press, New York.

REFERENCE BOOKS:

- 'Forming Minerals' by W.A.Deer, R.A. Howie & J.Rock, Longman Publishers, London
- 'Properties of Ceramic Raw Materials' by W.Ryan, Pergamon press, 2nd Edition
- 'Clay Mineralogy' by M.J.Wilson, Chapman & Hall.

CH-3105(D)

FUEL CELL TECHNOLOGY (CORE ELECTIVE – I)

Course Objectives:

- To provide deeper knowledge, a wider scope and improved understanding of theory, analysis, performance, design and the operational principles of various fuel cell components and systems.

- To provide the design and analysis emphasis on the thermodynamics and heat transfer for all thermal systems of a fuel cell stack.

Course Outcomes:

At the end of the course, the student will be able to

- Understand fuel cell fundamentals.
- Analyze the performance of a fuel cell and stack.
- Demonstrate the operation of fuel cell stack and fuel cell system
- Apply the modeling techniques for fuel cell systems

SYLLABUS

Introduction – fuel cell; brief history of fuel cells, types of fuel cells and fuel cell applications. Thermodynamics and Electrochemical kinetics – Engineering thermodynamics, conversion efficiencies of heat engines and fuel cells, chemical reactions, chemical thermodynamics and electrochemical kinetics.

Fuel cell components and their impact on performance – General design features, fuel cell performance: the MEA and the current/voltage curve, MEA components and the fuel cell stack. Stack design – Sizing of a fuel cell stack, stack configuration, uniform distribution of reactants inside each cell, heat removal from a fuel stack and stack clamping.

Fuel cell modeling – Theory and governing equations, modeling domains and modeling examples.

Fuel cell system design – Hydrogen-air system, fuel cell systems with fuel processor, electrical subsystems and system efficiency.

Fuel cell applications – Transportation applications, stationary power, backup power and fuel cells for small portable power.

TEXT BOOKS:

1. For chapters 1 to 3: Fuel Cell Technology Hand Book, Edited by Gregor Hoogers, CRC Press.
2. For Chapters 4 to 7: PEM Fuel Cells: Theory and practice By Frano, Elsevier Academic Press

REFERENCE BOOKS:

1. Fuel cells principles and applications by B.Viswanathan and M. Aulice Scibioh, Universal Press. (India) Private Limited, Hyderabad.
2. Fuel Cell Systems Explained, second edition, by James Larminie and Andrew Dicks, John Wiley & Sons Ltd.

CH-3105(E)

POLYMER TECHNOLOGY (CORE ELECTIVE – I)

Course Objectives:

- To make a thorough understanding of the classification, characterization of the polymers and their structure and its applications
- To introduce the manufacturing methods of different polymers and different additives, blends and composites used in the process

Course Outcomes:

At the end of the course, the student will be able to

- Classify polymers and determine molecular weight of the polymer
- Understand thermodynamics of polymer structures
- Select polymerization reactor for a polymer product.
- Characterize polymers.
- State polymer additives, blends and composites
- Understand polymer rheology
- Identify suitable polymer processing methods

SYLLABUS

Introductory concepts and fundamentals: Definitions and concepts of plastics and polymers, comonomer, co-monomer, mesomer, co-polymer, functionality, visco-elasticity,

Classification of polymers, methods of determining molecular weights of polymers-

- (i) Methods based on colligative properties
- (ii) Sedimentation velocity method
- (iii) Sedimentation equilibrium method
- (iv) Gel-chromatography method
- (v) Light scattering analysis method
- (vi) End-group analysis method

Natural polymers- brief study of rubber, shellac, rosin, cellulose, proteins, Lignin's,

Chemistry of polymerization: Elementary concepts of addition polymerization, condensation polymerization and co-polymerization, glass transition temperature of polymers, methods of determining T_g, degradation of polymers due to mechanical, hydrolytic, thermal and backbone effects, Relation of the mechanical, thermal, electrical, physical and chemical properties with the structure of the polymer,

Methods of polymerization: Mass, solution, emulsion and suspension, role of the initiators, catalysts, inhibitors, solvents, fillers, reinforcing agents, stabilizers, plasticizers, lubricants, blowing agents, coupling agents, flame retardants, photo-degradants and bio-degradable on polymerization, Methods of manufacture, properties and uses of the following addition products;

Polyethylene (LDPE and HDPE) , polypropylene, PVC and its copolymers, Polystyrene and its copolymers, acetals and PTFE (polytetrafluoroethylene),

Methods of manufacture, properties and uses of the following condensation products: (i)Polyesters-PMMA, PET and ALKYO, (ii) PF-, UF- and MF-resins (iii) epoxy resins, polyurethanes and silicones,

Description of the following processing methods: (with the principles involved and equipment used) Mixing and compounding, extrusion, calendaring, laminating, moulding- compression, transfer, injection and blow moulding.

TEXT BOOKS:

1. 'Plastic Materials' by J.A.Brydson, Newnes-Butterworths (London) 1989

2. 'Textbook of Polymer Science', Billymeyer, F.W.Jr., 3rd edition, John Wiley & Sons,

REFERENCE BOOKS:

1. 'Introduction to Plastics' by J.H.Briston and C.C. Gosselin, Newnes, London

2. 'Polymeric Materials' by C.C.Winding and G.D.Hiatt, McGraw-Hill Publishers

CH-3106 : MASS TRANSFER-I LABORATORY

Course Objectives:

The student will be made familiarised with distillation process and will be able to determine liquid and vapour diffusion coefficient. The student will be able to calculate VLE, HTU, HETP and rate of evaporation by conducting experiments.

Course Outcomes:

At the end of the course, the student will be able to

- Determine separation performance of batch distillation, steam distillation, sieve plate and packed bed distillation
- Estimate the diffusion coefficient of vapour in gas
- Estimate the diffusion coefficient of liquid
- Determine the rate of evaporation

List of Experiments:

1. Steam distillation
2. Differential distillation
3. Height equivalent to a theoretical plate
4. Vapor-liquid equilibria
5. Determination of liquid diffusion coefficient
6. Determination of vapor diffusion coefficient
7. Surface evaporation
8. Height of a transfer unit.

CH-3107 : CHEMICAL TECHNOLOGY LABORATORY

Course Objectives:

The student will be made familiar with analysis of water, oils, coal, lime stone, bleaching powder saw dust etc. and preparations of soap, copper and chrome yellow pigments, Phenol formaldehyde resins.

Course Outcomes:

At the end of the course, the student will be able to

- Synthesize products such as soap, phenol formaldehyde resin, Chrome yellow pigment, and Copper pigment
- Estimation of total solids, dissolved solids,pH, chlorides, sulphates, temporary and permanent hardness in water
- Analyse acid value, Iodine value and saponification value of oil
- Estimate the purity of various materials

List of experiments:

A. Analysis of water :

1. Total solids, dissolved solids,pH
2. Chlorides and sulphates
3. Temporary, permanent and total hardness.

B. Analysis of oils :

4. Acid value
5. Iodine value
6. Saponification value

C. Miscellaneous analysis:

7. Analysis of coal: Proximate analysis
8. Analysis of lime: Estimation of acid insoluble's, available lime and calcium carbonate
9. Analysis of bleaching powder: Estimation of chlorine content.
10. Analysis of starch/glucose: Estimation of total reducing sugars
11. Analysis of saw dust: Estimation of total cellulose and –cellulose

D. Miscellaneous preparations:

12. Preparation of soap
13. Preparation of copper pigment
14. Preparation of chrome yellow pigment
15. Preparation of phenol formaldehyde resin.

CH-3108 : SEMINAR/MINOR PROJECT

Course Objectives:

- To make the student to think about the new methodologies for the Chemical Engineering problems and implement them either experimentally or theoretically.

- To enhance communication skills of the student to present his/her work and to interact with the students/ faculty/ industry people.

Course Outcomes:

At the end of the seminar/ Minor project, the student will be able to

- Conduct an independent research project involving experimentation/modelling/simulation/optimization in chemical engineering

- Analyze the results
- Communicate the research results orally to an audience
- Present a detailed written report.

CH-3109 : INDIAN CONSTITUTION

Course Objectives:

- The student learns about the scope and scheme of fundamental duties and fundamental rights.

- The student understands federal structure and distribution of legislative and financial powers and the parliamentary form of government of India.

Course Outcomes:

At the end of the course, the student will be able to

- Identify the scope and scheme of fundamental rights and fundamental duties
- Understand the features and characteristics of the Constitution of India
- Explain the Federal structure and distribution of legislative and financial powers between the Union and the States
- Explain Parliamentary Form of Government in India

- Describe Emergency Provisions.

SYLLABUS

1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India
3. Salient features and characteristics of the Constitution of India
4. Scheme of the fundamental rights
5. The scheme of the Fundamental Duties and its legal status
6. The Directive Principles of State Policy – Its importance and implementation
7. Federal structure and distribution of legislative and financial powers between the Union and the States
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India
9. Amendment of the Constitutional Powers and Procedure
10. The historical perspectives of the constitutional amendments in India
11. Emergency Provisions : National Emergency, President Rule, Financial Emergency
12. Local Self Government – Constitutional Scheme in India
13. Scheme of the Fundamental Right to Equality
14. Scheme of the Fundamental Right to certain Freedom under Article 19
15. Scope of the Right to Life and Personal Liberty under Article 21.

CH-3110 : SUMMER INTERNSHIP EVALUATION

All the students have to undergo Summer Internship for two months in the industries at the end of the second year second semester. Evaluation of the same will be conducted in this semester by the Department.

CH-3201 : MASS TRANSFER –II

Course Objectives :

To explore about different mass transfer operations and its applications in industrial scale.

Course Outcomes:

At the end of the course, the student will be able to

- Analyse VLE, LLE, and SLE data
- Select a suitable mass transfer operation for a given separation
- Determine number of stages in distillation, extraction and adsorption operations

- Estimate the height of packed column in distillation, extraction and adsorption operations
- Calculate drying rates and moisture content for batch and continuous drying operations.

SYLLABUS

Liquid-liquid operations: Extraction: Introduction, liquid-liquid equilibria, analytical and graphical solutions for single and multistage operations, continuous counter current operation without and with reflux, fractional extraction, equipment for liquid-liquid contacting operations, single stage, multistage and continuous contacting equipment,

Leaching: Preparation of solid, steady and unsteady state operation, equipment, analytical methods both theoretical and problematic approaches for single and multistage operations,

Adsorption: Theory of adsorption, Industrial adsorbents, adsorption equilibria, Freundlich equation, single and multistage operations, unsteady state adsorption, equipment for single stage and continuous contact, ion-exchange,

Drying: Equilibria, drying rate curve, batch and continuous drying, time of drying and calculations, mechanism of batch drying, equipment's for batch and continuous drying operations,

Crystallization: Equipment and analytical methods, factors governing nucleation and crystal growth rates, controlled rate of crystals, incorporation of principles into the design of the equipment,

Less conventional operations: Dialysis, thermal diffusion, mass diffusion,

Membrane separation processes: Separation of gases, separation of liquids, dialysis, membranes for liquid extraction, pervaporation, reverse osmosis.

TEXT BOOK:

2. 'Mass Transfer Operations', by Robert E. Treybal, III Edition, McGraw-Hill Book Co.

REFERENCE BOOKS:

1. 'Unit Operations in Chemical Engineering' by McCabe, W.L., Smith, J.C. and Harriot, P., 5th Edition, McGraw-Hill Book Co.

2. 'Chemical Engineering Hand Book' by J.H. Perry

CH-3202 : CHEMICAL REACTION ENGINEERING-II

Course Objectives:

- To endow with the knowledge on thermal characteristics of various reactions

- To accomplish knowledge on non-ideal reactors
- To impart the knowledge on heterogeneous reacting systems
- To study the design aspects of heterogeneous catalytic systems
- To impart the knowledge on mass transfer with reaction situations.

Course Outcomes:

At the end of the course, the student will be able to

- Explain the thermal characteristics and design of adiabatic reactors for single and multiple reactions
- Apply the non-ideality concepts in the reacting system for better understanding the deviations from ideality
- Apply the tanks-in-series model, and the dispersion (single parameter) models for a first-order reaction, to account for the non ideality
- Develop the progressive conversion model and shrinking core model for explaining the fluid particle reaction
- Understand the principles and mechanism involved in heterogeneous catalysis and analyze the data of heterogeneous catalytic reactions.
- Understand the rate controlling mechanisms in heterogeneous catalysis and their rate determinations.

SYLLABUS

Temperature and pressure effects – Heats of reaction and temperature – Equilibrium constants from thermodynamics – Equilibrium conversion – General graphical design procedure – Optimum temperature progression – Adiabatic operations.

Non ideal flow – Basics – C, E and F curves – Conversion in non ideal flow reactors – Dispersion model – Tanks-in-series model.

Heterogeneous catalysis – Physical adsorption – Chemisorption – Catalytic properties – Estimation of surface area, pore volume and porosity – Catalyst preparation – Catalyst poisons – Catalytic deactivation.

Solid catalysed reactions – Rate equations – Pore diffusion combined with surface kinetics – Thiele modulus – Effectiveness factor – Performance equations for reactions containing porous catalyst particles – Experimental methods for finding rates – Determining controlling resistances.

Noncatalytic systems – Design of fluid-fluid reactors – Factors to consider in selecting a reactor – Various reactors and contacting patterns for G/L reactions.

Design of fluid particle reactions – Progressive Conversion Model (PCM), Shrinking Core Model (SCM) – Comparison – Controlling mechanisms – Determination of rate controlling step.

TEXT BOOK:

1. 'Chemical Reaction Engineering' Levenspiel O, 3rd Edition, John Wiley & Sons.

REFERENCE BOOKS:

1. "Chemical Engineering Kinetics" by Smith, J.M. 3rd Edition, McGraw Hill Inc.

2. "Elements of Chemical Reaction Engineering" by Fogler, H.S, 3rd Edition, Printice Hall India Ltd.

CH-3203 : PROCESS INSTRUMENTATION AND CONTROL

Course Objectives:

In studying this course Chemical Engineering students will come to know the measurement of various process variables and acquire the knowledge of the operation of various process control systems effectively. The students learn.

- how physical quantities are measured and how they are converted to electrical or other forms.
- to use various types of instruments.
- represent the processes in terms of mathematical equations
- the concept of stability and know how to operate a control system in a stable way.
- to deal with various controllers and their functions and applications.

Course Outcomes:

At the end of the course, the student will be able to

- Recommend suitable instrument for the measurement temperature
- Select a method of measurement for pressure, composition, flow and level
- Develop transfer functions for the processes
- Examine the stability of various control systems
- Apply advanced control schemes for processes and identify the characteristics of control valves.

SYLLABUS

Qualities of measurement: The elements of instruments, static and dynamic characteristics, dynamic response of first order and second order instruments.

Expansion thermometers: Temperature scales, constant-volume gas thermometer, bimetallic thermometer, pressure spring thermometer, theory of volumetric and pressure thermometers, static accuracy of thermometer, comparison of pressure-spring thermometers.

Thermoelectric temperature measurement: Thermoelectricity, industrial thermocouples, thermocouple lead wires, thermal wells, response of thermocouples, the mill voltmeter.

Resistance thermometers: Thermal coefficient of resistance, industrial resistance thermometer bulbs, resistance thermometer circuits, null-bridge resistance thermometers, deflectional resistance thermometers.

Radiation temperature measurement: Introduction, blackbody devices and radiation receiving elements, radiation pyrometers, photoelectric pyrometers and optical pyrometers.

Methods of Composition analysis: Spectroscopic analysis, absorption, Emission and Mass spectroscopy- IR, UV absorption and mass spectrometers, Gas analysis by thermal conductivity, analysis of moisture in gases (humidity), psychrometer method, hygrometer method, dew-point method for moisture analysis in gases, measurement of moisture in paper, textile and lumber.

Measurement of pressure and vacuum: Pressure, vacuum and head, liquid column manometers, measuring elements for gauge pressure and vacuum, indicating elements for pressure gauges, measurement of absolute pressure, measurement of pressure in corrosive fluids, static accuracy of pressure gauges.

Measurement of Head and Level: Density and specific gravity, direct measurement of liquid level, pressure(level) measurement in open vessels, level measurement in pressure vessels, density measurement, level measurement by weighing.

Introduction to process dynamics and control, Response of First Order Systems - Physical examples of first order systems.

Response of first order systems in series, higher order systems: Second order and transportation lag.

Control systems Controllers and final control elements, Block diagram of a chemical reactor control system.

Closed loop transfer functions, Transient response of simple control systems.

Stability Criterion, Routh Test, Root locus. Transient response from root locus, Application of root locus to control systems Introduction to frequency response, Control systems design by frequency response.

Advanced control strategies, Cascade control, Feed forward control, ratio control, Smith predictor, dead time compensation, internal model control. Controller tuning and process identification. Control valves.

TEXT BOOKS:

1. Donald P Eckman. Industrial Instrumentation, CBS Publishers, New Delhi, 2004.

2. D.R. Coughanowr. Process Systems Analysis and Control, Mc Graw Hill, 1991.

REFERENCE BOOKS:

1. Hand Book of Instrumentation and control, Considine.
2. Chemical Process Control, G. Stephanopolous, Prentice Hall, 1984.

CH-3204 (A)

PROCESS MODELING & SIMULATION (CORE ELECTIVE-II)

Course Objectives:

- To introduce different types of models along with examples related to chemical engineering
- To instruct how to develop empirical models using different tools and the use of numerical methods for solution of Non- Linear Algebraic equations
- To disseminate the use of different numerical techniques for carrying out numerical integration and differentiation.
- To impart knowledge on modelling of various equipment and their simulation using different numerical techniques.
- To guide selection of the solution method based on the computational requirements of various solution options.
- To elucidate process simulation using modular and equation based solving approaches.

Course Outcomes:

At the end of the course, student will be able to:

- Classify different types of mathematical models
- Develop mathematical model for the given chemical engineering problem from basic engineering principles.
- Identify the appropriate numerical method for solving a given model.
- Solve ODEs and PDEs using different numerical methods.
- Simulate binary distillation column, gravity flow tank, batch reactor, Non-isothermal CSTR, and counter-current heat exchanger.
- Compare and contrast modular approaches with equation oriented approach.

SYLLABUS

Mathematical models for chemical engineering systems: classification of mathematical models- steady state vs dynamic models, lumped vs distributed parameter models, deterministic vs stochastic models. Examples of mathematical models- Two heated tanks, batch reactor, constant volume

CSTRs, non-isothermal CSTR, reactor with mass transfer, ideal binary distillation column, batch distillation with holdup.

Empirical model building- method of least squares, linear, polynomial and multiple regression, non-Linear regression. Solution of Non- Linear Algebraic equations- bisection, false position, Quasi Newton and Newton-Raphson methods.

Numerical integration- Trapezoidal rule, Simpson's rule and Newton-Cotes formula.

Numerical solution of differential equations- Euler's method, Runge-Kutta methods, predictor corrector methods.

Numerical solution of partial differential equations- elliptic, parabolic and hyperbolic equations, finite difference methods, Leibman's method, Crank Nicholson method. Applications to steady state and Unsteady state heat conduction and temperature distribution problems.

Process Simulation examples: VLE dew point and bubble point calculations, binary distillation column, gravity flow tank, batch reactor, Non-isothermal CSTR, countercurrent heat exchanger.

Process simulation using modular and equation based solving approaches: Developing a simulation model, a simple flow sheet, Sequential modular approach, Simultaneous modular approach, Equation solving approach.

TEXTBOOKS:

1. Process modelling, Simulation and Control for Chemical Engineers, 2nd ed., W. L. Luyben, McGraw-Hill, New York, 1990.
2. Numerical Methods for Engineers, S.K. Gupta, Wiley Eastern, New Delhi, 1995.

REFERENCE BOOKS:

1. Numerical Methods for Engineers and Scientists, S.S. Rao
2. Introduction to Numerical Methods in Chemical Engineering, P. Ahuja, PHI learning Pvt. Ltd., New Delhi, 2010
3. Process Modelling and Simulation, Amiya K. Jana, 2012.

CH-3204 (B)

PETROLEUM REFINERY ENGINEERING (CORE ELECTIVE – II)

Course Objectives:

- To introduce the basics of refinery engineering subject for petroleum specialization students to gain knowledge of the overall refinery operations, refinery products and its test methods.
- To learn various primary and secondary cracking process available to produce normal and value added products.

- Further, to learn the treatment process available to remove the impurities in the crude and finished products and its test methods for quality check.

Course Outcomes:

At the end of the course, the student will be able to

- Compare various theories on origin and formation of petroleum, to explain and summarize the composition of crude oil, to prepare a report on the world wide scenario of reserves and deposits and the Indian petroleum refining industry scenario.
- Describe and summarize various petroleum products, to know various analytical tests available for estimating various physico chemical properties and classify the crude into different classes.
- Classify the crude processing methods and describe the treatment process i.e. Desalting and Dehydration and infer the preliminary process i.e. Atmospheric Distillation and Vacuum Distillation Units.
- Summarize and infer various secondary cracking process to produce value added products and to design the equipment in the refining industry.

SYLLABUS

Origin and formation of Petroleum. Reserves and deposits of the world, Composition of crudes, Refinery introduction and Indian petroleum refining industry scenario.

Refinery products and test methods, Evaluation of crudes, Crude pretreatment-Dehydration and desalting, Pipe still heater. Atmospheric and Vacuum distillation of crude oil.

Thermal Conversion Process- Vis Breaking, Delayed Coking.

Catalytic Conversion Process- Fluid Catalytic Cracking, Hydrocracking, Hydrotreating, Alkylation, Isomerization, Polymerization and Reforming.

Lube Oil Process – Solvent deasphalting, solvent Extraction, Solvent Dewaxing and Hydro finishing.

Treatment of kerosene, additives, blending of gasoline, Asphalt and air blown asphalt.

TEXTBOOKS:

1. Petroleum Refining Technology by Dr. Ram Prasad
2. Modern Petroleum Refinery Engineering by B K Bhaskar Rao
3. Gary, J.H., Handwerk, G.E. and Kaiser, M.J. (2007) Petroleum Refining: Technology and Economics. 5th Edition, CRC Press, Boca Raton, 488 p.

4. Petroleum Refining. Vol. 3 Conversion Processes, Pierre Leprince (Editor).

CH-3204 (C)

WHITEWARE AND HEAVY CLAYWARE (CORE ELECTIVE - II)

Course Objectives:

- The applications for advanced ceramics have received major attention in recent years, particularly for use as parts in a future ceramic heat engine.
- The properties like corrosion resistance, chemical inertness, thermal shock resistance and other properties made both traditional and advanced ceramics highly attractive in a large number of applications.

Course Outcomes:

At the end of the course, the student will be able to

- Classify whiteware products
- Identify raw materials for heavy clayware and products of heavy clayware
- Importance of fine ceramics.
- How to use resources more efficiently.
- Demonstrate the tests and quality control measures of clay ware products

SYLLABUS

Classification of whiteware products: Body formulation and properties, tableware, earthenware talc bodies, vitreous bodies, high alumina bodies, porcelain, bone china, sanitary ware, stoneware, majolica, terracotta, art ware, physical properties of mixtures, role of water.

Whiteware: Classification, body composition, white wares at home, construction, electrical appliances, industrial uses, manufacturing and properties.

Heavy clayware: Raw materials, methods of winning and handling, classification of building materials, manufacture of building bricks, hollow bricks and other bricks, roof tiles, paving tiles, sewer pipes.

Fine ceramics: Packing of two component system, porosity, effect of grain size, unfired porosity, experimental verifications, wet to dry contraction, unfired strength, permeability and casting rate, dry to fired contraction.

Tests and quality control: IS inspection, LOI, plasticity, strength, MOR, thermal shock resistance, abrasion resistance, porosity, acid and alkali resistance, chipping resistance, chemical analysis, electrical and thermal conductivity.

TEXT BOOKS:

1. 'Pottery Science: Materials, Processes and Products' by Allen Dinsdale, Ellis Horwood Ltd., New York,
2. 'Ceramic White Ware' by Sudhir Sen, Oxford & IBH Publishing Co., New Delhi.

REFERENCE BOOK:

1. 'Industrial Ceramics' by F. Singer and S. Singer, Oxford & IBH Publishing Company.

CH-3204 (D)

COMPUTATIONAL FLUID DYNAMICS (CORE ELECTIVE - II)

Course Objectives:

- The course provides an introduction to computational fluid dynamics.
- The students will train the numerical solution of model problems.
- The students will learn to assess the quality of numerical results and the efficiency of numerical methods for basic fluid flow model problems.

Course Outcomes:

At the end of the course, the student will be able to

- Solve numerically ordinary differential equations with initial condition
- Discretize the equations using Finite difference and volume formulation
- Solve the discretized equations using different techniques
- Understand the concept of finite volume method and discretization procedure
- Understand grid generation techniques

SYLLABUS

Numerical solution of ordinary differential equations: Initial value problems of first order, Runge-Kuta methods, linear multi-step and predictor-corrector methods, R-K method for two simultaneous first order equations,

Finite difference discretization of first and second derivatives: Implementation of finite difference equations, explicit and implicit methods, errors and stability analysis,

Selected examples for finite difference applications in heat conduction: Heat dissipation through a constant area fin, two-dimensional steady heat conduction in rectangular geometry, one dimensional transient heat conduction in a slab, Crank-Nicolson method, Thomas algorithm,

Fundamentals of fluid flow modeling: Upwind scheme, transportive property, second upwind differencing, hybrid scheme,

Solution of unsteady Navier-Stokes equations for incompressible flows: Staggered grid, introduction to MAC method, MAC formulation of momentum balance equation, pressure correction equation,

Introduction to SIMPLE method: One-dimensional convection, diffusion equation, formulation of flow problem, discretized continuity and momentum equations, pressure correction equation,

Concept of finite volume method: Regular finite volumes, discretization procedure for continuity equation.

TEXT BOOK:

1. 'Computational Fluid Flow and Heat Transfer' 2nd edition by K. Muralidharan and T. Sundararajan, Narosa Publishing House, New Delhi, 2003

REFERENCE BOOK:

1. 'Computational Fluid Dynamics - The Basics and Applications' by John D. Anderson, Jr., McGraw-Hill Inc., New Delhi, 1995.

CH-3204 (E)

MULTI COMPONENT SEPARATION PROCESSES (CORE ELECTIVE - II)

Course Objectives:

- Provide an introduction to design methods of equilibrium and non-equilibrium multi-component mass transport processes
- The student will learn how to solve different shortcut and rigorous models
- The student will make use of conceptual design methods in designing and troubleshooting industrial mass transport processes

Course Outcomes:

At the end of the course, the student will be able to

- Predict multi component VLE data from the model constants of constituent binaries
- Determine high pressure equilibria

- Understand flash vapourization and multicomponent differential distillation
- Interpret the design considerations of fractionating process
- Design of distillation column for azeotropic and extractive distillation
- Differentiate tray design and operation versus packing design and operation

SYLLABUS

Multi component vapor –liquid equilibria: Ideal mixtures at low pressures, non-ideal mixtures, activity coefficient models - Wilson, NRTL, UNIQUAC and UNIFAC equations, evaluation of model constants from binary experimental data, prediction of multicomponent VLE from the model constants of the constituent binaries,

High pressure equilibria: Vaporization constants, K, Thermodynamic method for K, graphical charts, Chao-Seader correlation,

Equilibrium and Simple Distillation: Multicomponent equilibrium, flash vaporization(EFV), multicomponent differential distillation,

Design considerations in fractionating process: Quantitative relationships, ternary and multicomponent system fractionation, key fractionation concepts, selection of key components, column pressure, material balance, rigorous and approximate minimum reflux calculations, recommended short-cut methods for minimum reflux minimum plates at total reflux, FUG methods, Smith Brinkley method,

Multicomponent fractionation rigorous design procedures: Sorel method, Lewis-Matheson method, Thiele-Geddes method and its versions in distillation column design, techniques of separating azeotropic and close boiling mixtures by fractional distillation, azeotropic and extractive distillation, selection of solvents, design considerations, pseudo binary methods, solvent recovery,

Tray design and operation: The common tray types, tray capacity limits, tray hydraulics parameters, flow regimes on trays, column sizing, tray efficiency, fundamentals, tray efficiency prediction,

Packing design and operation: Packing types, packing hydraulics, comparing packings and trays, packing efficiency and scale-up.

TEXT BOOKS:

1. 'Distillation' by M. Van Winkle, McGraw Hill Book Company
2. 'Phase Equilibria in Chemical Engineering' by S.M. Wales, Butterworth publishers, 1985
3. 'Distillation Design' by Henery Z Kister, McGraw Hill Book Company

CH-3204 (F)

CHEMICAL ENGINEERING MATHEMATICS (CORE ELECTIVE - II)

Course Objectives:

- To learn various computational techniques for analyzing and solving chemical engineering problems.

Course Outcomes:

- At the end of the course, the student will be able to
 - Understand the fundamental mathematics and to solve problems of algebraic and differential equations, simultaneous equations and partial differential equations.
 - Evaluate problem solving strategies to procedural algorithms and to write program structures.
 - Solve engineering problems using computational techniques.

SYLLABUS

Mathematical formulation of the physical problems: i). Application of the law of conservation of mass, salt accumulation in stirred tank, starting an equilibrium still, solvent extraction in N stages, diffusion with chemical reaction and ii). application of the law of conservation of energy, radial heat transfer through a cylindrical conductor, heating a closed kettle, flow of heat from fin,

Analytical (explicit) solution of ordinary differential equations encountered in Chemical engineering problems: i). First order differential equations, method of separation of variables, equations solved by integration factors, certain examples involving mass and energy balances and reaction kinetics and ii). second order differential equations, non-linear equations, linear equations, simultaneous diffusion and chemical reaction in a tubular reactor, continuous hydrolysis of tallow in a spray column,

Partial differential equations: i). Formulation of partial differential equations, unsteady-state heat conduction in one dimension, mass transfer with axial symmetry, continuity equation, ii). boundary conditions- function specified, derivative specified and mixed conditions and iii). particular solutions of partial differential equation- compounding the independent variable into one variable, superposition of solutions, the method of images and particular solution suggested by the boundary conditions,

Finite differences: i). The difference operator, properties of the difference operator, difference tables, other difference operators, ii). linear finite difference equation, complementary solution, particular solution,

simultaneous linear difference equations and iii). non-linear finite difference equations, analytical solutions,

Solutions for the following type of problems by finite difference method:

a). Calculation of the number of plates required for an absorption column, b). calculation of the number of theoretical plates required for distillation column and c). calculation of number of stages required for a counter current extraction and leaching operation,

Application of statistical methods: i). Propagation of errors of experimental data, ii). parameter estimation of algebraic equations encountered in heat and mass transfer, kinetics and thermodynamics by method of averages, linear least squares and weighted linear least squares methods and iii). design of experiments - factorial and fractional factorial methods.

TEXT BOOK:

1. 'Mathematical Methods in Chemical Engineering' by V.G. Jenson and G.V. Jeffreys, Academic Press, London

REFERENCE BOOKS:

1. 'Applied Mathematics in Chemical Engineering' by Harold S. Mickley, Thomas S. Sherwood and Charles E. Reed, Tata McGraw Hill Publications.

2. 'Introductory Methods of Numerical Analysis' By S.S. Sastry, Prentice Hall of India Private Limited, New Delhi.

CH-3204 (G)

FERTILIZER TECHNOLOGY (CORE ELECTIVE - II)

Course Objectives:

- To introduce various nutrients and their role in growth of a plant
- To introduce different types of the nitrogenous, phosphatic, potassic and compound fertilizers
- To introduce different fertilizer production methods

Course Outcomes: At the end of the course, the student will be able to

- understand different raw material availability
- Explain the beneficiation of rock phosphate
- Discuss the production of all types of fertilizers
- Formulate different fertilizer mixtures

SYLLABUS

Details about indigenous fertilizer production – raw materials, details of various nutrients with their importance, sources of nitrogen and hydrogen,

steam reforming of hydrocarbons, partial oxidation of fuel cells with gas purification including high and low temperature shift conversion, carbondioxide removal processes and methanation.

Coal gasification, ammonia synthesis, thermodynamic principles associated with ammonia synthesis, ammonia reactors, nitric acid and sulfuric acid.

Urea – total recycle and stripping processes, process details of ammonium sulfate, ammonium chloride, ammonium nitrate, calcium ammonium nitrate.

Phosphate rock – availability and beneficiation methods for upgrading, bone meal, basic slag, single super phosphate, triple super phosphate, phosphoric acid by wet process and furnace process, AMI process with hydrochloric acid, complex fertilizers like mono and di-ammonium phosphates, urea ammonium phosphate.

Text book :

1. 'Hand Book of Fertilizers' published by fertilizer Association of India, New Delhi

Reference Books :

1. 'Chemistry and Technology of Fertilizers' by V. Sauchelli, Reinhold Publications

2. 'Fertilizers Manual, a UNIDO Publication from International Fertilizer Development Centre, Alabama, USA.

3. 'Chemical Technology-II' published by IIT, Madras.

CH-3205 (A)

NANO SCIENCE & TECHNOLOGY(OPEN ELECTIVE-II)

Course Objectives:

- To give foundational knowledge of the Nano science and related fields.
- To make the students acquire an understanding the Nano science and Applications
- To help the students understand in broad outline of Nanoscience and Nanotechnology.

Course Outcomes:

At the end of the course, the student will be able to

- Understand the properties of nanomaterials and their applications
- Synthesize nanoparticles
- Characterize nanomaterials
- Scale up the production of nanoparticles

- Understand applications of nanoparticles in nanobiology and nanomedicine

SYLLABUS

General Introduction: Basics of quantum mechanics, harmonic oscillator, magnetic phenomena, band structure in solids, Mossbauer and Spectroscopy, optical phenomena bonding in solids, anisotropy,

Silicon Carbide: Application of silicon carbide, nano materials preparation, sintering of SiC, X-ray diffraction data, electron microscopy sintering of nano particles, nano particles of alumina and zirconia, nano materials preparation, characterization, wear materials and nano composites,

Mechanical properties: Strength of nano crystalline SiC, preparation for strength measurements, mechanical properties, magnetic properties,

Electrical properties: Switching glasses with nanoparticles, electronic conduction with nano particles,

Optical properties: Optical properties, special properties and the coloured glasses

Process of synthesis of nano powders, electro deposition, important nano materials

Investigating and manipulating materials in the nanoscale: Electron microscope, scanning probe microscope, optical microscope for nano science and technology, X-ray diffraction

Nanobiology: Interaction between biomolecules and nanoparticle surface, different types of inorganic materials used for the synthesis of hybrid nano-bio assemblies, application of nano in biology, nanoprobe for analytical applications - a new methodology in medical diagnostics and biotechnology, current status of nano biotechnology, future perspectives of nanobiology, nanosensors,

NanoMedicines: Developing of nano-medicines, nanosystems in use, protocols for nanodrug administration, nanotechnology in diagnostics applications, materials for used in diagnostics and therapeutic applications, molecular nanomechanics, molecular devices, nanotribology, studying tribology at nanoscale, nanotribology applications.

TEXT BOOKS:

1. 'Nano Materials' by A.K.Bandyopadhyay, New Age Publishers
2. 'Nano Essentials' by T.Pradeep, TMH.

CH-3205 (B)

INDUSTRIAL SAFETY & MANAGEMENT (OPEN ELECTIVE-II)

Course Objectives:

- To know about Industrial safety programs and toxicology, Industrial laws, regulations and source models
- To understand about fire and explosion, preventive methods, relief and its sizing methods
- To analyse industrial hazards and its risk assessment.

Course Outcomes:

At the end of the course, the student will be able to

- Analyze the effects of release of toxic substances
- Select the methods of prevention of fires and explosions
- Understand the methods of hazard identification and prevention.
- Assess the risks using fault tree diagram
- Explain safety management in general and in industry specific
- Plan emergency preparedness and understand the occupational health hazards.

SYLLABUS

Introduction :Industrial Safety, Incident, accident, near miss, hazard, risk, emergency, disasters, risk criteria, Safety at work.

Prediction and evaluation of unsafe conditions : Identification of unsafe areas, unsafe acts, manifestation of unsafe conditions to emergency situation, lessons from accidents and disasters, safety audit and its elements, safety in plant layout, equipment design. Construction, erection, commissioning, material handling. Hazards – chemical hazards, thermodynamic hazards, electrical & electromagnetic hazards, mechanical hazards.

Risk – Definition, causes, potential and adverse effects.

Hazard Analysis – incident scenarios, residual risk, Concept Hazard Analysis (CHA), Preliminary Process Hazard Analysis PPHA, HAZOP, Fault Tree Analysis (FTA), Event Tree Analysis (ETA).

Risk Assessment – Risk criteria, causes of death/damage, individual risk, societal risk, criteria for acceptable risk tolerable risk, application of risk assessment, computation of fatality rates, severity rates, vulnerability analysis, introduction to computerized risk assessment techniques.

Safety Management (General) – safety policy perceptions, safety organization, safety audit techniques, project and Construction Safety – welding & cutting operations, fabrication, material handling, equipment spacing, safe plant layout procedures, storage tanks, erection & commissioning works, housekeeping methods, maintenance of storage yards, erection & maintenance of electrical panels and MCC rooms, electrical & mechanical safe guarding.

Emergency Preparedness – onsite & offsite emergency preparedness, emergency preparedness plans, site specific action plans and contingency plans, emergency facilities, rehabilitation & rescue operations, post emergency actions.

Safety Management (Industry Specific)

Chemical Manufacturing Plants, Fertilisers, Steel Plants, Petrochemical Plants, Metallurgical Plants, Mineral Process Industries, Sugar plants, semiconductor industry, Polymer manufacturing plans, Paper industry, Pharmaceutical and bulk drug industries, Vessel manufacturing industry, LPG bottling plants, Power Plants, tanneries and textiles.

Statutory framework – key provisions of Factories Act, Environmental Protection Act, Manufacture, Storage and Import of Hazardous Chemical rules, Static and Mobile Pressure Vessels rules, NFPA specifications, OSHA regulations.

Occupational health management – occupational health perspectives, pre-employment & periodical medical examinations, diseases, causes, consequences, Occupational health hazards in various industries – aluminium industry, asbestos, battery manufacturing, sugar, cement, coke ovens, cotton ginning, dairy, electro plating, fish canning, poultry, irrigation, lead smelting, mining, pesticides, power plants, refineries, pulp & paper industry, PVC processing, steel plants, fertilizers, sulphuric acid plants, tanneries and textiles.

International standards – British council's five star rating systems, International Safety Rating Systems (ISRS), ISO 14001 EMS, ISO 18001 OHSAS, BIS 14489 Code of Conduct for conducting safety audits.

TEXT BOOKS:

1. "Hazards in Chemical industries, 3rd edition" – Authored by Frank P. Lees
2. "Hazard identification and risk assessment" – Authored by Geoff Wells; Published by Institution of Chemical Engineers, Davis Building, 165-189 Railway Terrace, Rugby, Warwickshire CV21 3HQ, UK.

REFERENCE BOOKS:

1. "Safety Management 5th edition" – Authored by John V. Grimaldi and Rollin H. Simonds; Published by A.I.T.B.S. Publishers & Distributors, J-5/6, Krishna Nagar, Delhi – 110051.
2. "Environmental Health and Safety Management" – Authored by Nicholas P. Cheremisinoff and Madelyn L. Graffia; Published by Jaico Publishing House, Hyderabad.

CH-3205 (C)

ENVIRONMENTAL POLLUTION CONTROL ENGINEERING (OPEN ELECTIVE-II)

Course Objectives:

To understand the types of emissions from chemical industries and their effects on environment, methods of analysis of air pollutants, general methods of control like primary, secondary, tertiary treatment methods, solid waste management and Industrial safety.

Course Outcomes:

At the end of the course, the student will be able to

- Analyze the effects of pollutants on the environment
- Distinguish air pollution control methods
- Assess treatment technologies for wastewater
- Identify treatment technologies for solid waste
- Explain the hazards and safety measures in waste treatment
- Propose treatment methods for various industrial effluents

SYLLABUS

Types of emission from chemical industries and their effects on environment, Environmental legislation, noise pollution, occupational health hazards, meteorological factors in pollution dispersion (ALP and ELP), plume behaviour and characteristics, chimney design considerations: Plume rise, effective stack height.

Methods of analysis of air pollutants, particulate matter, SO_x, NO_x, CO_x analysis, removal of particulate matters: principles and design of settling chambers, solid traps, cyclone separators, fabric and design of fibre filters, scrubbers and electrostatic precipitators.

General methods of control and removal of sulphur dioxide, oxides of nitrogen, organic vapors from gaseous effluents with design aspects, sources of waste waters, effluent guidelines and standards, characterization of effluent streams, oxygen demanding wastes, oxygen sag curve, BOD curve, analysis of water pollutants.

Methods of primary treatment: Screening, sedimentation, floatation and neutralization, biological treatment, bacteria and bacterial growth curve, aerobic processes suspended growth processes, activated sludge process, extended aeration, contact stabilization, aerated lagoons and stabilization ponds, attached growth process with design aspects, trickling filters, rotary drum filters, fluidized bed contactors, anaerobic processes,

Methods of tertiary treatment: Carbon adsorption, ion exchange, reverse osmosis, ultra filtration, chlorination, ozonation & sonozone process, sludge treatment and disposal,

Solid waste management: solid waste collection, transportation, solid waste processing and recovery, hazards in waste management, risk assessment and safety measures, types of hazardous wastes, health effects, safety measures, risk assessment response measures, case studies or pollutants removal and safety measures in fertilizer, petrochemical, paper, pharmaceutical industries and petroleum refinery,

TEXT BOOK:

1. 'Environmental Pollution Control', by C.S. Rao, Wiley Eastern Limited.

REFERENCE BOOK:

1. 'Environmental Engineering' by Arcdio P.Sincero and Geogoria Sincero.

CH-3206

MASS TRANSFER-II LABORATORY

Course Objectives:

- The student will learn about the LLE, dynamics and mass transfer in spray tower, packed tower and sieve tray tower.
- The students will learn the drying characteristics of the given solid material.

Course Outcomes:

At the end of the course, the student will be able to

- Determine the LLE
- Determine the critical moisture content in drying
- Determine separation performance and mass transfer coefficients of sieve plate
- Identify the axial mixing characteristics in packed bed
- Evaluate the dynamics of liquid drops.

List of experiments:

1. Ternary liquid equilibria (Binodal curve)
2. Liquid-liquid equilibria.
3. Limiting flow rates in spray tower
4. Hydrodynamics of perforated plate tower
5. Volumetric mass transfer coefficients in perforated plate tower
6. Dynamics of liquid drops (Single drop extraction tower)

7. Studies of axial mixing characteristics in a packed bed
8. Gas-liquid mass transfer in packed tower
9. Drying characteristics of a given material

CH-3207

CHEMICAL REACTION ENGINEERING LABORATORY

Course Objectives:

- To familiarize students with main type of chemical reactors
- To analyze the experimental data to obtain the reaction rate expression (reaction order and specific reaction rate constant)
- To compare the conversion of reactants for a specific reaction in various types of reactor.
- To understand the concept of residence time distribution in reactor systems.
- To determine mass transfer coefficient of systems with chemical reaction

Course Outcomes:

At the end of the course, the student will be able to

- Determine the kinetics of a reaction in a batch reactor, CSTR, & PFR
- Determine the mass transfer coefficient (solid-liquid reacting system)
- Determine the kinetics by fractional conversion method
- Determine the temperature dependency of a reaction
- Evaluate the performance of reactors through RTD studies
- Compare the performance of single reactor with combination of reactors

List of experiments:

1. Determination of the order of a reaction using a batch reactor and analyzing the data by (a) differential method and (b) integral method
2. Determination of the activation energy of a reaction using a batch reactor
3. To determine the effect of residence time on conversion and to determine the rate constant using a CSTR
4. To determine the specific reaction rate constant of a reaction of a known order using a batch reaction.
5. To determine the order of the reaction and the rate constant using a tubular reactor

6. Determination of RTD and dispersion number in a tubular reactor using a tracer
7. Mass transfer with chemical reaction (solid-liquid system) – Determination of mass transfer coefficient
8. Axial mixing in a packed bed - Determination of RTD and the dispersion number for a packed bed using tracer
9. Langmuir adsorption isotherm - Determination of surface area of activated charcoal.
10. Performance of reactors in series: (i) A plug flow reactor followed by a CSTR and (ii) A CSTR followed by a plug flow reactor.

CH-3208

PROCESS INSTRUMENTATION & CONTROL LABORATORY

Course Objectives:

- To understand the dynamic behavior of the systems
- To evaluate response of first and higher order characteristics.
- Study the installed characteristics of the valve.
- Study if there is a hysteresis in the control valve and sensor.
- Evaluate the tuning of a PID control via manual and automatic tuning.

Course Outcomes:

- At the end of the course, the student will be able to
- Identify the dynamics of first order, second order, interacting and non-interacting processes
 - Determine control valve characteristics
 - Evaluate the hysteresis characteristics of Bourdon pressure gauge
 - Implement PID controller on a level control, temperature control and pressure control process
 - Demonstrate PID control trainer.

List of experiments:

1. Response of mercury-in glass thermometer
2. Response of mercury-in glass thermometer with thermal well.
3. Calibration & response of resistance thermometer
4. Response of manometer
5. Calibration of thermocouples
6. Response of single-tank liquid level system
7. Response of two-tank non-interacting liquid level system
8. Response of two tank interacting liquid level system

9. Study of on-off control – Control let off position.
10. Valve characteristics of equal % control valve
11. Valve characteristics of linear control valve
12. On-off control – controller on position
13. Studies on hysteresis characteristics of Bourdon pressure gauge
14. Hysteresis characteristics of equal % control valve
15. Studies on hysteresis characteristics of linear control valve
16. Response studies for different types of controller (P, PI, PID) using PID control trainer.
17. Level control trainer
18. Pressure control trainer
19. Temperature control trainer

CH-3209

INTELLECTUAL PROPERTY RIGHTS

Course Objectives:

- To introduce fundamental aspects of intellectual property rights.
- To disseminate knowledge on copyrights and its related rights and registration
- To provide comprehensive knowledge to the students regarding Indian position of patent law, procedure for granting patent, Infringement
- To provide knowledge to the students regarding registration of trade mark, Infringement of trade mark.

Course Outcomes:

- At the end of the course, the student will be able to
- Identify the types of IP and the importance of protection of IP
 - Differentiate the foundation and patent laws in India and developed countries
 - Explain how to obtain copy right and law of copy rights
 - Learn the purpose and function of trade marks and registration of trade mark
 - Describe risks involved and legal aspects of Trade Secret Protection
 - Understand IP Infringement issue and enforcement.

SYLLABUS

Introduction to Intellectual Property: Historical Perspective, Different Types of IP, agencies and treaties, Importance of protecting IP, international organizations, Innovations in products, processes, services and procedures -

product life cycles, favorable and unfavorable aspects in innovation; Inventions as intellectual property.

Patents :Historical Perspective, Basic and associated right, WIPO, PCT system, Traditional Knowledge, Patents and Healthcare – balancing promoting innovation with public health, Software patents and their importance for India, Foundation of patents and patent laws, procedures in India and developed countries; study of patents indifferent fields and their innovative content;patent searching process, ownership rights and transfer.

Copyrights: Introduction, How to obtain a copy right and Law of copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law, Differences of copyrights from Patents.

Geographical Indications: Definition, rules for registration, prevention of illegal exploitation, importance to India.

Trade Marks: Introduction to trademarks, Purpose and function of trademarks, acquisition of trade mark rights,protectable matter, selecting, and evaluating trade mark, trade mark registration processes.

Trade Secrets: Introduction and Historical Perspectives, Scope of Protection, Trade secrete law, Risks involved and legal aspects of Trade Secret Protection, Determination of trade secrete status, liability formisappropriations of trade secrets, protection for submission, trade secrete litigation, Unfair competition: Misappropriation right of publicity, false advertising.

New developments and Infringement Issues of IP:

New development of intellectual property: New developments in trade mark law; copy right law, patent law, intellectual property audits. International overview on intellectual property, international – trade mark law, copy right law, international patent law, and international development in trade secrets law, motivating and encouraging innovative attitude in individuals and organizations; entrepreneurial qualities and skills, learning and training.

IP Infringement issue and enforcement– Role of Judiciary, Role of law enforcement agencies – Police, Customs etc. Economic Value of Intellectual Property – Intangible assets and their valuation, Human attitudes, risks, hardships, examples of failure, case studies of inventors; Intellectual Property in the Indian Context – Various laws in India Licensing and technology transfer.

REFERENCE BOOKS:

1. Ganguli, P. Intellectual Property Rights: Unleashing the Knowledge Economy, Tata McGraw-Hill (2001).

2. Intellectual property right, Deborah. E. Bouchoux, Cengage learning.

3. Acharya, N.K. Textbook on intellectual property rights, Asia Law House (2001).

4. Miller, A.R. & Davis, M.H. Intellectual Property: Patents, Trademarks and Copyright in a Nutshell, West Group Publishers (2000).

5. Watal, J. Intellectual property rights in the WTO and developing countries, Oxford University Press, New Delhi.

CH -3210

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

Course Objectives:

- To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.

- To make the students understand the traditional knowledge and analyse it and apply it to their day to day life

Course Outcomes:

At the end of the Course, Student will be able to:

CO 1:Identify the concept of Traditional knowledge and its importance.

CO 2:Explain the need and importance of protecting traditional knowledge.

CO 3:Illustrate the various enactments related to the protection of traditional knowledge.

CO 4:Interpret the concepts of Intellectual property to protect the traditional knowledge.

CO 5:Explain the importance of Traditional knowledge in Agriculture and Medicine.

SYLLABUS

Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, Indigenous Knowledge (IK), characteristics, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge

Protection of traditional knowledge:The need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.

Legal framework and TK: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act); The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016.

Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge

Traditional Knowledge in Different Sectors: Traditional knowledge and engineering, Traditional medicine system, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK

TEXT BOOKS:

1. Traditional Knowledge System in India, by Amit Jha, 2009.

REFERENCE BOOKS:

1. Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002.
2. "Knowledge Traditions and Practices of India" Kapil Kapoor, Michel Danino.

SUMMER INTERNSHIP PROGRAM (2MONTHS)

All the students have to undergo Summer Internship for two months in the industries at the end of the third year second semester.

CH-4101

TRANSPORT PHENOMENA

Course Objectives:

- To make students understand the use of basic laws of mass, momentum and energy transport in the engineering analysis.
- Momentum transport deals with evaluation of velocity distributions in steady and unsteady laminar flow problems in simple geometries of Newtonian and non-newtonian fluids.
- Energy transport deal with the evaluation of steady/ unsteady temperature distributions in solids and in laminar flow.
- Mass transport deals with the evaluation of steady state concentration profiles with or without chemical (Homogeneous/ heterogeneous) reaction.

Course Outcomes:

- At the end of the course, the student will be able to
- Identify the transport properties of solids, liquids and gases

- Formulate a mathematical representation of flow / heat / mass transfer phenomena
- Solve steady state flow/heat/mass transfer problems for simple geometries analytically
- Solve unsteady flow/ heat problems for simple geometries

SYLLABUS

PART - A

Momentum transport: Viscosity and the mechanism of momentum transport- i). Newton's law of viscosity, ii). Non-Newtonian fluids and iii). pressure and temperature dependence of viscosity,

Velocity distributions in laminar flow: i). Shell momentum balances boundary conditions, ii). flow of a falling film, iii). flow through a circular tube and iv). flow through an annulus,

The equations of change for isothermal systems: i). The equations of continuity, motion and mechanical energy in rectangular and curvilinear coordinates, ii). use of the equations of change to set up steady flow problems and iii). dimensional analysis of the equations of change,

Velocity distributions with more than one independent variable and unsteady viscous flow,

PART-B

Energy transport: Thermal conductivity and the mechanism of energy transport- i). Fourier's law of heat conduction and ii). temperature and pressure dependence of thermal conductivity in gases and liquids,

Temperature distributions in solids and in laminar flow: i) Shell energy balances-boundary conditions, ii). heat conduction with an electrical heat source, iii). heat conduction with a viscous heat source, iv). heat conduction through composite walls, v). forced convection and vi). free convection,

The equations of change for non-isothermal systems: i). The equation of energy in rectangular and curvilinear coordinates, ii). the equations of motion for forced and free convection in non-isothermal flow, iii). use of the equations of change to set up steady state heat transfer problems and iv). dimensional analysis of the equations of change,

Temperature distribution with more than one independent variable: Unsteady state heat conduction in solids,

PART-C

Mass transport: Diffusivity and mechanism of mass transport- i). Definitions of concentrations, velocities and mass fluxes, ii). Fick's law of diffusion and iii). temperature and pressure dependence of mass diffusivity.

Concentration distribution in solids and in laminar flow: i). Shell mass balances – boundary conditions, ii). diffusion through a stagnant gas film,

iii). diffusion with heterogeneous chemical reaction, iv). diffusion with homogeneous chemical reaction and v). diffusion into a falling liquid film,

The equations of change for **multi-component systems**: i). The equations of continuity for a binary mixture, ii). the equations of continuity of A in curvilinear coordinates and iii). dimensional analysis of the equations of change for a binary isothermal fluid mixture,

TEXT BOOK:

1. 'Transport Phenomena' by R. Byron Bird, W.E. Steward and Edwin N. Lightfoot, John Wiley & Sons Inc., New York

REFERENCE BOOKS:

1. Transport phenomena' by Robert S. Brodkey & Haryr C. Hershey, McGraw Hills Company, New York

2. Transport Phenomena-for engineers' by Louis Theodore, International Book Compnay, London

3. 'Transport Phenomena' by W.J.Book and K.M.K.Multzall, JW&Sons Ltd.

4. 'Fundamentals of Momentum, Heat and Mass Transfer' by Mames R Welty, Charlese Wicks and Robert E Wilson, J W & Sons Inc., New York

5. Fluid Dynamics and Heat Transfer' by James G. Knudsen and Donald L.Katz., McGraw Hills Company Inc., New York.

CH-4102

PROCESS ENGINEERING & ECONOMICS

Course Objectives:

- To introduce types of interests, annuity, perpetuity, bond, debenture
- To introduce depreciation and cost accounting methods
- To introduce cash flow tree diagram, methods of cost estimation.
- To introduce profitability, profitability evaluation
- To introduce optimization in industries
- To introduce economic balance of various operations.

Course Outcomes:

At the end of the course the student will be able to

- Determine costs involved in process plants.
- Estimate depreciation costs and various ratios to tell about financial status of the company
- Perform economic analysis and optimum design of the processes
- Evaluate project profitability.

SYLLABUS

Value of money - equivalence: Value of money, equations for economic studies, equivalence, types of interest- discrete and continuous, annuities - relation between ordinary annuity and the periodic payments, continuous cash flow and interest compounding, present worth of an annuity, perpetuities and capitalized costs, bonds and debentures, value of a bond and yield rate,

Depreciation: Types and various methods of calculating depreciations, depreciation accounting.

Cost accounting: Basic relationship in accounting, balance sheet and income statement, various ratios to study the balance sheet and income statements,

Cost estimation: Cash flow for industrial operations, factors affecting investments and production costs, estimation of capital investment, cost indices, cost factors in capital investment, methods of estimating capital investment, estimation of total product cost- manufacturing costs and general expenses,

Profitability: Alternate investments and replacements. mathematical methods for profitability evaluation, economic production charts for plants operating below 100%, above 100% and under dumping conditions, general procedure for determining optimum conditions, break even chart for production schedule and its significance for optimum analysis,

Economic balance in fluid flow, heat transfer and mass transfer operations; optimum economic pipe diameter in fluid dynamics, optimum flow rate of cooling water in condenser in heat transfer and optimum reflux ratio in distillation operation,

Economic balance in cyclic operations and semi continuous cyclic operations, economic balance in yield and recovery, economic balance in chemical reactors, batch and flow reactors.

TEXT BOOKS:

1. 'Plant Design and Economics for Engineers' by Max S. Peters and K.D.Timmerhans, McGraw Hill Book Company,

2. 'Process Engineering Economics' by Herbest E. Schweyer, McGraw Hill Book Company.

CH-4103

CHEMICAL PROCESS EQUIPMENT DESIGN

Course Objectives:

This subject introduces the student to the science and art of chemical engineering design. By applying all the knowledge acquired so far, the student will be trained to develop project reports and to carryout design calculations of various process equipment. Finally the student will be able to

come out the investment needed for a particular process and also finds out the returns on investment.

Course Outcomes:

At the end of the course, the student will be able to

- Develop process design
- Enumerate general design consideration
- Design incompressible/compressible flow systems and estimate cost of filters.
- Select high and low pressure vessels
- Design of distillation column, heat exchangers and evaporators

SYLLABUS

Introduction of plant design and costs,

Process design development: Design project procedure, design information from the literature and other sources of information, flow diagrams, preliminary design, comparison of different processes, firm process design, equipment design and specialization, scale up in design, safety factors specifications, materials of construction,

General design considerations: Health and safety hazards, fire and explosion hazards, personnel safety, loss prevention, thermal pollution control, noise pollution and control, plant location, plant layout, plant operation and control, utilities, structural design, storage, materials handling, materials and fabrication selection.

Material transfer, handling and treatment equipment design and costs: Pumps and piping, frictional effects due to end losses, fittings, orifices and other installations, piping standards, pumps, tanks, pressure vessels and storage equipment, filters.

Mechanical design of process equipment: Design and selection of storage vessels and low pressure vessels, design of roofs, bottom plates, formed heads, flat plate and conical closures, tall vertical columns, supports to process vessels, distillation columns, heat exchanges, evaporators.

Heat transfer equipment design and costs: Basic theory of heat transfer, consideration in selection of heat transfer equipment, General methods for process design of heat exchangers, evaporators.

Mass transfer equipment design: Finite stage and continuous contactors, plate and column efficiencies, other design factors for finite stage contactors, packed towers, relative merits of plate and packed towers, mass transfer equipment costs, reactors.

TEXT BOOKS:

1. 'Plant design & Economics for Chemical Engineers', 4th edition, M.S.Peters&K.D.Timmerhaus, McGraw Hills Publishing Company
2. 'Process Equipment Design', 3rd Edition, M.V.Joshi, MacMillan India Ltd 1981

REFERENCE BOOKS:

1. 'Process-Plant-Design' by J.R.Backhurst&J.H.Harker, Heieman Education London
2. 'Chemical Engineering' Volume-VI (An introduction to Chemical Engineering Design) by J.M.Coulson & J.F.Richardson

CH-4104(A)

COMPUTER AIDED DESIGN (CORE ELECTIVE -III)

Course Objectives:

To revise the basic concepts in Fluid Mechanics, Heat Transfer, Mass Transfer and Chemical Reaction Engineering and apply the numerical methods with the aid of computer in designing such systems.

Course Outcomes:

- At the end of the course, the student will be able to
- Elaborate the need of computer aided design and advantages of simulation
 - Design the size of the pipe for a given pressure drop for Newtonian and non-newtonian fluids
 - Evaluate pressure drop in compressible fluid flow, pipe line networks and two phase flow
 - Develop the rating and design calculations in heat exchangers, distillation columns, extraction cascades, plate/packed bed absorbers and isothermal flash.
 - Design ideal reactors, packed bed and fluidized bed reactors
 - Estimate rate of extent of reaction vector for simultaneous reactions

SYLLABUS

CAD of fluid flow system:

Flow of Newtonian fluids in pipes
Pressure drop in compressible flow
Flow of Non-Newtonian fluids in pipes
Pipe network calculations

Two phase flow system, CAD of Heat transfer equipment: Shell and tube exchangers without phase change, Condensers, Reboilers, Furnaces, CAD of Mass transfer equipment: Distillation, Gas absorption, Liquid extraction, CAD of chemical Reactors: Chemical reaction equilibrium, Analysis of rate data, Ideal reactor models, Non-ideality in chemical reaction, Performance analysis using residence time distribution, Temperature effects in homogeneous reactors, Heterogeneous systems, Fluidized bed reactors.

TEXT BOOK:

1. Chemical Process Computations by Raghu Raman. Elsevier Scientific Publishers, London, 1987

REFERENCE. BOOKS:

1. Fundamentals and Modelling of Separation process by C D Holland, rentice Hall Inc. New Jercey, 1975
2. Catalytic Reactor Design by Orhan, Tarhan, Mc Graw Hill, 1983
3. Chemical Engineering, Vol 6 by Sinnott, Pergamon Press, 1993

CH-4104 (B)

**INDUSTRIAL POLLUTION AND CONTROL ENGINEERING
(CORE ELECTIVE -III)**

Course Objectives:

1. To understand the types of emissions from chemical industries and their effects on environment, remedial measures.
2. To enable the students to design water treatment system & to acquire knowledge on proper management of solid wastes.
3. To provide a general idea about safety in chemical industries.

Course Outcomes:

At the end of the course, the student will be able to

- Analyze the effects of pollutants on the environment
- Distinguish air pollution control methods
- Assess treatment technologies for wastewater
- Identify treatment technologies for solid waste
- Identify and manage industrial hazards

SYLLABUS

Types of emission from chemical industries and their effects on environment, Environmental legislation, noise pollution, occupational health hazards, meteorological factors in pollution dispersion (ALP and ELP),

plume behaviour and characteristics, chimney design considerations: Plume raise, effective stack height,

Methods of analysis of air pollutants, particulate matter, SO_x , NO_x , CO_x analysis, removal of particulate matters: principles and design of setting chambers, solid traps, cyclone separators, fabric and design of fibre filters, scrubbers and electrostatic precipitators,

General methods of control and removal of sulphur dioxide, oxides of nitrogen, organic vapors from gaseous effluents with design aspects, sources of waste waters, effluent guidelines and standards, characterization of effluent streams, oxygen demanding wastes, oxygen sag curve, BOD curve, analysis of water pollutants,

Methods of primary treatment: Screening, sedimentation, floatation and neutralization, biological treatment, bacteria and bacterial growth curve, aerobic processes suspended growth processes, activated sludge process, extended aeration, contact stabilization, aerated lagoons and stabilization ponds, attached growth process with design aspects, trickling filters, rotary drum filters, fluidized bed contactors, anaerobic processes,

Methods of tertiary treatment: Carbon adsorption, ion exchange, reverse osmosis, ultra filtration, chlorination, ozonation & sonozone process, sludge treatment and disposal,

Solid waste management: solid waste collection, transportation, solid waste processing and recovery, hazards in waste management, risk assessment and safety measures, types of hazardous wastes, health effects, safety measures, risk assessment response measures, case studies or pollutants removal and safety measures in fertilizer, petrochemical, paper, pharmaceutical industries and petroleum refinery,

Industrial safety: Why safety, accidents, causes and remedial measures, safety aspects of site selection, plant layout and unit plot planning, hazards of commercial chemical operations and reactions, safety aspects of process design, instrumentation for safe operations, safety aspects in design and inspection of pressure vessels, effect of toxic agents, toxicity vs hazards, respiratory hazards, safe experimentation and testing of reactions, materials for safety,

Flamable materials: Fire extinguishing agents and their applications, eye safety in chemical processing, personnel protective equipment, permit systems, hazard evaluation techniques, modern safety management systems, safety effectiveness.

TEXT BOOKS :

1. 'Environmental Pollution Control', by C.S. Rao, Wiley Eastern Limited

2. 'Safety and Accident Prevention in Chemical Operations' by Fawcett and Wood.

REFERENCE BOOKS:

1. 'Environmental Engineering' by Arcdio P.Sincero and Geogoria Sincero

2. 'Loss Prevention in Chemical Industries' by Frank P.Lees

CH-4104(C)

PROCESS OPTIMIZATION

(CORE ELECTIVE -III)

Course Objectives:

Optimization of Chemical Process is an important of subject for Chemical Engineers. It deals with various optimization techniques in reducing cost of production ,energy consumption, maximum throughput and minimum labour cost etc. Onstudying the course one can understand how to write a model of the process optimize the process using the model

Course Outcomes:

At the end of the course, the student will be able to

- Understand the definition of Optimization and how to write an Objective function
- Understand various types of Objective functions like Concave and Convex functions and its properties
- Study the Optimization of uni&multi dimensional search problems
- Solve the Optimization problems by Linear and Non-Linear Programming methods

SYLLABUS

Definition of optimization Applications of optimization optimal insulation thickness Requirements for an optimization technique, Writing an objective function Production schedule ,material balance requirements , six steps of solving an optimization problem

Basic concepts of optimization continuous and discontinuous , unimodal and multi modal functions concave and convex functions, Finding the optimal point, definition of maximum, minimum and saddle points with examples

Unconstrained unidimensional search , Newton method Quasi Newton method and Secant method, Speed of iterations linear ,order p and super

linear, Quadratic interpolation, cubic interpolation, Region elimination method, Fabonacci and Golden section method

Multivariable unconstrained optimization ,direct methods Powell method, Conjugate search direction, Gradient and conjugate Gradient, Fletcher Reeves method , Positive definite of Hessian matrix Marquadt method

Linear programming ,definition , solving the refinery schedule problem by linear programming method using graph, Simplex method and definition

Non linear programming , Lagrange multiplier method, Iterative linearization and Quadratic programming method, Necessary and sufficient condition for a minimum value ,Kuhn-tucker conditions

TEXT BOOKS:

1. Optimization of Chemical Process by Edgar and Himmelblau, 2nd edition, Mc GrawHill Publications.

2. Optimization Theory and Applications by S.S. Rao, 2nd Edition, Wiley Eastern Limited.

3. Formulation and optimization of Mathematical Models by C.L.Smith, R.W. Pike and P.W.Mur.

CH-4104(D)

RESERVOIR ENGINEERING (CORE ELECTIVE -III)

Course Objectives:

To know the fundamental concepts of reservoir engineering, basic properties of reservoir rocks, various types of reservoirs and driving mechanisms for the production of Oil and gas from an oil reservoir.

Course Outcomes:

At the end of the course, the student will be able to

- Identify the type of oil reservoirs by knowing the characteristics and mechanisms.
- Predict the reservoir performance by knowing the past performance history of the oil reservoir.

SYLLABUS

Fundamental concepts of Reservoir Engineering: Porosity, fluid saturation, permeability, flow through layered beds, flow through series beds, Klinkenberg effect, effective permeability data, phase behavior.

Oil reservoirs: Reservoir driving mechanisms, basic equation and tools, volatile oil reservoirs, identification of volatile oil reservoirs, ultimate recovery, predicting reservoirs behavior, performance, mechanics of reservoir performance, prediction procedure, limitations of predictions,

relating reservoir performance to time, factors affecting ultimate recovery, analysis of gas oil ratio history.

Depletion drive reservoirs: Producing characteristics and methods of identification, detailed procedure for predicting reservoir performance, limitations of predictions, factors affecting ultimate recovery.

Water drive reservoirs: Effect of free gas saturation on recovery, predicting reservoirs performance, calculating water influx, use of the unsteady state equation in predicting reservoir performance, validity of performance prediction, limitations in predicting reservoir performance, the material balance equation as a straight line.

Gravity drainage reservoirs: Permeability in the direction dip, dip of the reservoir, reservoir producing rates, oil viscosity, relative permeability characteristics, fundamental recovery process, predicting reservoir performance, apparent relative permeability, oil saturation method.

Combination of drive reservoirs: Index of drives, equations used, material balance equations, instantaneous gas- oil ratio equation.

Pressure maintenance: Pressure maintenance by gas injection, condensing gas drive, predicting performance by gas injected gas drive index, pressure maintenance by water injection, predicting performance by water injection, index of injected water drive, control of the gas cap, typical water injection pressure maintenance operations.

Improving oil recovery: Improving oil recovery by fluid immiscible gas–water, miscible fluid injection thermal oil recovery, predicting recovery from fluid injection products, Stiles's method of water flood prediction, derivation of water cut and recovery equations, frontal advance techniques for prediction result of either water or gas injection, well arrangements, peripheral water flooding, predicting behavior of peripheral water floods, special consideration involved in water flooding, water flood case history, predicting the results of water flooding.

TEXT BOOK:

1. 'Reservoir Engineering Manual' – 2nd Edition by Frank W. Cole, Gulf Publishing Company, Houston, Texas, 1969.

CH-4104(E)

FUELS, REFRACTORIES AND FURNACES (CORE ELECTIVE - III)

Course Objectives:

The main objective of this course is to study the different minerals used for the manufacturing of different types of refractories and its large scale applications in industries.

Course Outcomes:

At the end of the course, the students will be able to

- Understand the importance, types of refractories, properties, design and installation and different types of coatings on refractories.
- Explain about special refractories
- Describe refractories for iron & steel industry, Glass industry and cement & nonferrous industry

SYLLABUS

Introduction of Refractories

Production, demand and growth of refractories in India – layout of modern refractory plant – fundamental properties of refractories – Indian and international standards – factors for selection and use of refractories – test and quality control procedures.

Silica Refractories

Raw materials and composition – manufacturing process steps – quality of raw materials and process parameter on quartz inversion – glassy phase and other micro structural features – porosity, strength, RUL dependence on micro structure – specifications of silica refractories.

ALUMINA – SILICA REFRACTORIES

Al_2O_3 – SiO_2 phase diagram – clay, pyrophyllite, sillimanite, grog, bauxite and diaspore as raw materials – manufacturing processes – micro structure and properties

BASIC PROPERTIES

Magnesite, forsterite, dolomite and chrome based refractories – raw materials and composition – manufacturing processes – micro structure and properties.

SPECIAL REFRACTORIES

Oxide based, carbide based and nitride based refractories – cordierite – zirconia – carbon – fusion cast refractories, slide gate, purging refractories, and continuous casting refractories – ceramic fibres.

REFRACTORIES FOR IRON AND STEEL INDUSTRY

Coke oven, blast furnace, twin hearth, LD converter – continuous casting – electric arc furnace, induction furnaces – reheating furnaces – slide plate system – nozzle, shroud/ SDN – ladle and tundish lining practices – monolithic - gunning techniques – refractor, slag and metal interactions.

REFRACTORIES FOR CEMENT AND NON FERROUS INDUSTRY

Wet/ dry process for cement making – preheater and pre calcinatory and zone lining – alkali and wear resistance – refractory requirement and use in copper, aluminum and hydro carbon industry – use of monolithic.

REFRACTORIES FOR GLASS INDUSTRY

Design of glass tank for container, sheet, lamp, float glasses, refractory practices in side wall, throat, forehearth, and roof of glass tanks – regenerator systems – alumina and AZS fused cast refractories – glass corrosion resistance, oxidation, seed potential tests – glass defects and analysis – feeder expendables

REFRACTORIES FOR CERAMIC INDUSTRY

Kiln furniture – types – properties of requirement - silicon carbide, mullite, cordierite, alumina, zirconia – mullite, zirconia types – kiln design – LTM concept – fast firing technology

REFRACTORIES FOR ENERGY CONSERVATION

Insulation refractories – types- ceramic fiber product – design and installation – ceramic coatings – case studies in ceramic fiber usage.

TEXTBOOK:

1. B. M. Coop and E. M. Piekson, Raw Materials for the refractory industries and industry materials and consumer survey, 1981.

REFERENCE BOOKS:

1. J. H. Eheslers Refractories: production and Properties. Iron and Steel Institute, London, 1972.
2. Akira Nistrikawa, Technology of monolithic refractories, Plibrico japan co. Tokyo 1984
3. D.N. Nandi, Hand Book Refractory's, Tata Mc Graw hill publishing Co. New Delhi 1991
4. K.Shaw, Refractories and thick uses ADP sciences publisher U K 1972
5. Keishi GOTON, Powder Technology Hand Book, Marcel Dekker Inc. 1997
6. Chester J.H., Steel Plant Refractories, 2nd Edition, 1973, United Steel Companies Limited, Sheffield UK
7. Advances in Refractory Technology, Ed. Robert E Fisher, Ceramic Transaction Vol 4., American Ceramic society, 1990, Westerville, Ohio, USA.

CH-4104(F)

BIOCHEMICAL ENGINEERING (CORE ELECTIVE - III)

Course Objectives:

- To apply the chemical engineering principles in biological systems.

Course Outcomes

At the end of the course, the student will be able to

- Understand cell and enzyme kinetics
- Discuss methods of immobilization
- Calculate volume of a fermentor
- State sterilization methods
- Select downstream process to separate the products
- Estimation using various Bioanalytical techniques

SYLLABUS

Introduction to Biochemical engineering and Biotechnology: Overall view of biotechnology since its practice-to date, enzyme kinetics, derivation of M.M. equation of single as well as multiple substrates, enzyme inhibition, determination of M.M. parameters, industrial applications of enzymes,

Cell cultivation & kinetics: Microbial, animal and plant cell cultivation, cell immobilization, batch growth of cells, yield coefficient, monod growth kinetics,

Analysis and design of fermenters: Batch fermenter, mixed flow fermenter (chemostat), plug flow fermenter, mixed flow fermenters in series, and cell recycling,

Genetic engineering: DNA and RNA, cloning of genes, stability of recombinant microorganisms, gene manipulation,

Sterilization: Sterilization of media and air, thermal death kinetics, design criterion, continuous sterilization methods,

Aeration and agitation in fermenters: Correlations of mass transfer coefficient, measurement of interfacial area and gas holdup, power consumption, scale up concepts,

Bioanalytical techniques: Gas chromatography, thin layer and paper chromatography, HPLC, affinity, gel, adsorption and ion exchange chromatography.

TEXT BOOK :

1. 'Biochemical Engineering Fundamentals' 2nd edition by J.E.Bailey and D.F.Ollis, McGraw-Hill Publishers, Newyork, 1986

REFERENCE BOOKS:

1. 'Chemical Engineering' volume-3, 3rd Edition by J.F Richardson and D.G. peacock, (Chapter-5: Biochemical Reaction Engineering), Pergomon Press, U.K, 1994

2. 'Bioprocess Engineering: Basic Concepts' 2nd edition by M.L.Shuler and F.Kargi, Prentice Hall India, New Delhi, 2003

3. 'Biochemical engineering' by D.G. Rao, Tata McGraw-Hill Publishers, New Delhi,

4. 'Biochemical Engineering' by J.M. Lee, Prentice Hall, Englewood Cliffs, 1992.

CH-4104(G)

PAPER TECHNOLOGY (CORE ELECTIVE - III)

Course Objectives:

To understand the growth prospects of Indian paper mills, history of paper industry, different types, composition and uses of paper, raw materials for paper making, preparation of raw materials, classification of fibers, recovery of cooking chemicals from spent cooking liquors, Pulping processes, manufacture of paper and Testing of different properties of pulp and paper and the types of pollutants from paper industry and their treatment.

Course Outcomes: At the end of the course, the student will be able to

- Understand the history of development of paper industry in India and Importance of paper industry, historical background of paper making.
- Explain growth prospects of Indian Paper mills.
- Design the equipment used for the manufacture of paper.
- Explain how to reduce the paper wastes
- Maximize the production rate and recovery of useful chemicals.

SYLLABUS

History: Importance of paper industry, historical background of paper making, development of paper industry in India, Different types and uses of paper: Different types and uses of papers and paper boards, composition, method of making different types of papers and boards, Raw materials for paper making: Classification of fibres, characteristics and composition of some important vegetable fibers (hard woods, softwoods, bagasse, straws, rags and paper stock)Preparation of raw materials: Wood preparation – pulp wood measurement, barking, chipping, screening and conveying of chips)Pulping processes: Mechanical pulping, alkaline pulping (Soda and Kraft), sulfite pulping, semi-chemical pulping, recovery of cooking chemicals from spent cooking liquors, Pulp bleaching: Bleaching agents, bleaching methods – single stage and multi stage bleaching, Stock preparation: Beating and refining, sizing and loading (filling),Manufacture of paper: Paper machines (Fourdrinier and Cylinder), making of paper – forming section, press section, dryer section, calendaring section, Testing of different

properties of pulp and paper: Testing and evaluation of pulp, various properties of pulp and paper and their testing.

TEXT BOOKS:

1. 'Handbook of Pulp and Paper Technology' by Kenneth W.Britt, Vols.I&II

2. 'Modern Pulp and Paper Making' edited by John B.Calkin

3. 'Pulp and Paper: Science and Technology - Vols.I&II' by E.Libby, McGraw Hill Books Co.

4. 'Pulp and Paper Manufacture- Vols. I & II' by R.C.McDonald & Others, McGraw Hill Books Company.

CH-4105

OPEN ELECTIVE –III

Open Elective –III and Open Elective-IV are MOOCS courses
(To be specified/ approved by BOS)

CH-4106

OPEN ELECTIVE-IV

Open Elective –III and Open Elective-IV are MOOCS courses
(To be specified/ approved by BOS)

CH-4107

CHEMICAL PROCESS EQUIPMENT DESIGN LABORATORY (Open book practical examination)

Course Objectives:

The objective of the course is to design the heat exchangers and to check the suitability of the given heat exchanger and to learn how to formulate problems involving use of “new” and “old” equipment. The students will solve problems mass transfer equipments and chemical reactors

Course Outcomes:

At the end of the course, the student will be able to

- Design double pipe heat exchanger and shell and tube heat exchanger with/ without phase change
- Evaluate the suitability of given heat exchanger for the process
- Design the plate column absorption/ distillation tower
- Evaluate the performance and design of continuous/batch reactors

Syllabus

The following equipment are to be designed in detail:

1. Double pipe Heat Exchangers

2. Sensible heat exchangers (1-2 or 2-4),
3. Condenser and reboiler,
4. Multiple effect evaporator
5. Fractionating / Absorption column-Plate and packed columns,
6. Packed bed absorber,
7. Continuous and Batch reactors (homogeneous and heterogeneous)

CH-4108

SUSTAINABLE PROCESS ENGINEERING

Course Objectives: This subject attempts to address the gap existing between industry and institute. The student is introduced to various terminology and practices that are followed in the industry. This subject also deals with the application of core chemical engineering knowledge to the modern aspects of chemical engineering such as sustainability, green engineering, process safety and enterprise resource planning.

Course Outcomes:

At the end of the course, the student will be able to

- Explain the sustainability concepts
- Summarize waste minimization in reactors, separation processes and operations
- Identify waste in utility systems
- Identify hazards and implement safety management
- Plan enterprise resource and sustainable industries

SYLLABUS

Sustainability concepts – the concept of sustainable development, sustainability in the context of the process industries, some temporal characteristics of sustainability, the sustainable project or industry, conflicts in achieving sustainability objectives.

Cleaner production – introduction, the concept of cleaner production, the product life cycle, hierarchy of waste management, concepts and sources of waste, impacts of waste, driving forces for cleaner production, resistances to introducing cleaner production.

Industrial ecology – basic concepts, energy and materials recovery from waste streams, resource flow through the economy, transport and storage of raw materials and products, integrated site manufacture, some examples of industrial ecology initiatives.

Waste minimization in reactors – introduction, a checklist for reaction systems and reactors, chemistry of process route, impurities in reactor feed stocks, mixing of reactants, minimizing secondary reactions, recycle of

unreacted feed from reactor outlet, reversible reactions, catalysis, agent materials, case studies.

Waste minimization in separation processes – classification of separation processes, sources of waste in separation processes, distillation, gas absorption, adsorption, filtration, drying, evaporation and condensation, extraction, use of extraneous materials, case studies.

Identification of waste in utility systems – introduction, fuels, fuel combustion, common fuels, environmental impacts of flue gases, theoretical flame temperature, furnaces, flare stacks, steam generation, steam use, water sources and uses, recirculated cooling water from cooling towers, sea water cooling, air cooling, refrigeration, electricity demand and supply, distribution and use of electricity, compressed air, inert gas, vacuum.

Energy conservation – introduction, energy consumption in compression of gases and pumping of liquids, pressure losses in piping and through equipment, agitation and mixing, heat recovery, energy recovery from high pressure streams, insulation, plant layout.

Materials recycling – introduction, recycling of materials in chemical processes, closed loop and open loop recycling, onsite and offsite recycling, producer and consumer waste, hierarchical approach to materials recycling, plastics recycling, glass recycling, recycling of materials from products, waste treatment option, aqueous effluent treatment and water recycling, disposal of wastes.

Waste minimization in operations – non-flow sheet emissions from a process plant, plant startup, shut down of a plant, abnormal operation, plant maintenance, cleaning of plant and equipment, fouling, transport and storage of raw materials and products, fugitive emissions, environmental risks resulting from storm water, risks in mining and extraction of materials.

Life cycle assessment – introduction, product and process applications, basic steps, goal definition, inventory analysis, example of inventory data estimation, classification, improvement analysis, some challenges and uncertainties in LCA, alternative or supplementary approaches to LCA, LCA software, LCA case studies

Planning for sustainable process industries – introduction, forecasting, scenario development, technology innovation transition to renewable feed stocks, site selection, integration of process plants and process industries, distributed manufacture, government legislation, stakeholder engagement, lifestyle implications.

Process safety management- Process safety basics, The need for process safety, Process safety for engineering disciplines, Process safety in design, Process safety in work place

Hazard Identification and Risk Assessment – Introduction – concept hazard analysis – Preliminary process hazard analysis – critical analysis of system safety – HAZOP – FTA – Task Analysis – Task Analysis and Hazard Identification – Risk criteria – Risk assessment – Development of P&I diagrams – Hazchek list – A HAZOP study – Hazard Identification techniques – HAZID – LOPA – RAST – Whatif – Checklists – FMEA – ETA – Bow tie.

Environmental management in the chemical industry – Introduction – preamble – environmental communication – stakeholder's reaction – Impact of legislation – voluntary action by industry – standardization and certification of EMS – International aspects of environmental management.

Enterprise resource planning – Introduction to business functions and business processes, functional areas of operation, business processes, marketing and sales, supply chain management, accounting and finance, human resources, Information systems in functional areas, Development of ERP system, ERP soft wares and implementation, choosing consultants and vendors, significance and benefits of ERP software and systems.

Statutes and codes – Factories act 1948, The air (prevention and control of pollution) act 1981, The water (prevention and control of pollution) act 1974, The Environment (Protection) act 1986, Factories act 1948, ISO 9000 (QMS), ISO 14000 (EMS).

TEXT BOOKS:

1. David Brennan, Sustainable Process Engineering, 2012, CRC Press. (Chapters 1 to 11, 14 and 15)
2. Introduction to process safety for undergraduates and engineers by CCPS of AIChE, Wiley, 2016.
3. Geoff Wells, Hazard Identification and Risk Assessment, Antony Rowe Ltd, UK.
4. Frank Crawley, A guide to hazard identification methods, 2/e, Elsevier, 2020.
5. Ullman's encyclopaedia of industrial chemistry
6. Ellen F Monk, Bret J Wagner, Concepts in enterprise resource planning, 4/e, 2013, Course Technology. (Chapters 1 and 2)

CH-4109

SUMMER INTERNSHIP EVALUATION

All the students have to undergo Summer Internship for two months in the industries at the end of the third year second semester. Evaluation of the same will be conducted in this semester by the Department.

CH-4201

PROJECT WORK

(6 months Project Work/ Internship shall be carried out in the Industry)

Course Outcomes:

At the end of the course, the student will be able to

- Carry out literature review
- Formulate the problem involving manufacture of a chemical product/ experimentation/modelling/simulation/optimization/design
- Carry out the project involving manufacture of a chemical product/ experimentation/ modelling/simulation/optimization/design/industrial problem
- Discuss the results
- Communicate results orally to audience
- Present the detailed written report.

B.TECH. (HONORS)

CHH-1001

PROCESS MODELING AND SIMULATION

Course Objectives:

Deals with writing various process models based on basic physical process. It also deals with solving the various models by means of numerical methods by computer simulation. By studying this course, one can simulate various chemical processes by computer simulation.

Course Outcomes:

At the end of the course, the student will be able to

- Understand the writing of a model of a process based on basic physical processes like mass, momentum and energy balances.
- Develop a model equation for Tanks, Isothermal and Non-Isothermal Systems
- Understand the models for binary distillation column, batch reactors, etc.
- Solve the model equations by numerical methods.

SYLLABUS

Principles of formulation - Continuity equations – Energy equation – Equation of motion – Equations of state – Transport equations – Chemical Kinetics – Algebraic and Integral / differential equations, Explicit and Implicit equations – Numerical Integration, Feed forward and feed backward control.

Basic modeling for tank system, mixing vessel – Simultaneous mass and energy balances – Models for boiling, batch distillation, and partial condenser.

Models for Reactor – Model for heterogeneous catalysis – Models for pumping system – Model for heat exchanger.

Operational blocks in simulation- Simulation Programming – Simulation examples of three CSTR's in series, gravity flow tank, binary distillation column, non-isothermal CSTR.

Implicit function convergence ,Internal-halving convergence, Newton–Raphson method, False position convergence, Explicit convergence methods, Numerical Integration, Euler Integration, Runge - Kutta (fourth order) method.

TEXTBOOKS:

1. Process Modeling, Simulation and Control for Chemical Engineers by Luyben, W.L., McGraw Hill Books Co.

2. Mathematical Modeling in Chemical Engineering by Roger, G.E. Franks – John Wiley Sons Inc.

REFERENCE BOOKS:

1. Mathematical Methods in Chemical Engineering by V.G. Jenson and G.V. Jefferys, Academic Press – 2nd Edition.

CHH-1002

ADVANCED MASS TRANSFER

Course Objectives:

- To develop skills in the process design of mass transfer operations
- To understand problems involving mass transfer using the principles of material and energy balances.

Course Outcomes:

- At the end of the course, the student will be able to
- Design process equipment for various mass transfer operations.
- Demonstrate the use of equations of change for multi-component systems.
- Solve problems of mass transfer in laminar and turbulent regimes.
- Solve problems of interphase transport in non-isothermal systems.

SYLLABUS

Flux Definition :

- Mass and molar transport by convection
- Summary of mass and molar fluxes
- Fick's law

Differential Equations of Mass transfer :

- Differential equation for mass transfer
- Boundary conditions

Molecular diffusivities :

- Diffusivities in gases
- Diffusivities in liquids

Molecular diffusion :

- Steady state molecular diffusion
- Steady-State Equimolal counter diffusion in gases
- Steady state Equimolal unidirectional diffusion in gases
- Molar diffusion in liquids
- Diffusion through a stagnant gas film
- Diffusion with a moving interface
- Diffusion through a Nonisothermal Spherical film
- Diffusion with a homogeneous Chemical reaction
- Diffusion with a slow Heterogeneous Chemical reaction
- Diffusion with a Heterogeneous Chemical reaction
- Unsteady state diffusion in a slab
- Unsteady state diffusion in a Cylinder
- Unsteady state diffusion in a sphere

Mass Transfer coefficients

- Individual Mass transfer coefficients
- Overall Mass Transfer coefficients
- Mechanism of Mass transfer
- The two-film theory
- The penetration theory
- The theory of penetration with Random surface renewal

Mass transfer in Laminar Flow :

- Mass transfer in the laminar boundary layer on a flat plate (Integral Solution)
- Mass transfer in laminar Natural convection on a vertical plate
- Mass transfer in a falling liquid film in a laminar flow
 - o Mass transfer between a gas phase and a falling liquid film (gas absorption)
 - o Mass transfer between an inclined plate and a falling liquid film (Solid dissolution)
 - o Gas absorption with rapid reaction

Mass Transfer in turbulent flow

- Mass transfer in the turbulent boundary layer on a flat plate
- Mass transfer in turbulent Natural convection on a vertical plate

- Mass transfer between inclined plate and a falling liquid film in turbulent flow
- Analogies between momentum, heat and mass transfer
 - o Reynolds analogy
 - o Prandtl analogy
 - o Von Karman analogy
 - o Analogies in terms of j factor

TEXTBOOKS:

1. "Transport phenomena" R. Byron Bird, Warren E. Stewart and E.N. Light foot, Wiley & Sons, Inc., New York.
2. 'Mass Transfer Operations' Robert E. Treybal, third edition, Mc Graw-Hill International Edition, Chemical Engineering Series.

REFERENCE BOOKS:

1. "Transport Processes and separation Processes Principles" Geankoplis, Prentice-Hall of India, New Delhi
2. "Fundamentals of Momentum, Heat and Mass Transfer" James R. Welty, Charles E. Wicks and Robert E. Wilson, John Wiley & Sons, Inc., New York.
3. "Principles of Mass Transfer and Separation Processes" Dutta B.K, Prentice-Hall of India, New Delhi.

CHH-1003

POLLUTION CONTROL

Course Objectives:

- Focus on classification of air pollutants, water pollutants and solid waste –causes, effects and control methods, need of environmental Legislation.

Course Outcomes:

At the end of the course, the student will be able to

- Identify the sources, effects and analysis of air/ solids/ water pollutants
- Evaluate the preventive measures for the control of air pollutants, waste water treatment methods, and solid waste management methods in domestic, municipal waste.
- Importance of environmental legislation
- Propose control measures of pollutants emitted from different industries like Paper and pulp, fertilizer, sugar and alcohol, petrochemical and petroleum refinery, pharmaceutical and metal finishing industries.

SYLLABUS

Kinds of ecology, environment and ecofactors, types of ecosystems, sulphur cycles, phosphorous cycle, Nitrogen cycle and hydrological cycle

Sources for water, Air and solid pollution, Analysis and effects of the pollutants in air, in water, Solids(particulate matter, SO_x, NO_x, CO_x, CH_x).

Limits of pollutants, Environmental Legislation.

Control aspects of various pollutants Air (Particulate matter, SO_x, NO_x, CO_x, CH_x, Noise) water (primary, secondary and tertiary treatment techniques) Solids (recycling, incineration, bio-conversion).

Case studies of Industries: Paper and pulp, petrochemical, Fertilizer, Pharmaceuticals, tannery, sugar and alcohol industries, metal finishing industries.

TEXT BOOKS:

1. S.P.Mahajan., Pollution control in process Industries, Tata McGraw hill publishing company.
2. Arcadio P. Sincero and Georgia Sincero., Environmental Engineering
3. .Environmental Pollution Control., by C.S.Rao, wiely eastern Ltd.

CHH-1004

CORROSION ENGINEERING

Course Objectives:

- Basic aspects of electrochemistry relevant to corrosion phenomena,
- mportance and forms of corrosion.
- Knowledge on corrosion rate expressions and measurement techniques.
- Knowledge on factors influencing corrosion of iron and steel exposed to atmospheric, soil and aqueous medium.
- Basic knowledge on remedial measures for corrosion.

Course Outcomes:

At the end of the course, the student will be able to

- Understand basic principles of electrochemistry, importance of corrosion, corrosion tendency and electrode potentials.
- Identify the nature of corrosion and form in which it attacks(Uniform attack, Galvanic Corrosion, Crevice Corrosion, Pitting, Intergranular Corrosion, Selective Leaching, Erosion Corrosion and Stress Corrosion. Hydrogen damage.
- Estimate corrosion rates using polarization

- Understand the mechanism and propose viable remedial measures.

SYLLABUS

Basic Concepts and Outlines of Electrochemistry: Fundamentals of Electrochemical reactions, Faraday's Laws Electrolytic and ionic conductance, ionic mobility's, Transport Nos. Galvanic Cell and Electrolytic cells.

Definition and importance of corrosion, Dry cell, analogy, Corrosion Cells, Types of Corrosion Cells- a) Dissimilar electrode cells b) Concentration cells such as a salt concentration cells, differential aeration cells c) differential Temperature cells. Corrosion Rate Expressions - mdd, ipy, cpy, mpy, etc.

Corrosion Tendency and Electrode Potentials: Free Energy changes, Development of Nernst Equation for calculation of Half-cell potentials, Hydrogen electrode, Spontaneity of a reaction, Reversible cells and potentials – convention of Sign and calculations of EMF from standard Equilibrium potentials., EMF Series and Galvanic series, Reference Half Cells – Calomel, Silver-Silver Chloride and Saturated Copper-Copper Sulphate Half Cells. Pourbaix Diagram for Iron, Aluminum and magnesium, limitations of pourbaix diagrams.

Polarization and Corrosion Rates: Polarization and a Polarized Cell, Causes of Polarization – Concentration Polarization, Activation Polarization and IR drop. Hydrogen Over potentials, combined polarization and Mixed potential theory. Tafel Slopes and Tafel Equation. Graphical method of expressing Corrosion Reactions (Polarization diagrams/ Evans diagrams), Derivation of Stern-Geary Equation, Influence of Polarization on Corrosion rates.

Passivity: Characteristics of Passivation, Flade potential, behavior of passivators, transpassivity, Theories on Passivity.

Forms of Corrosion: Uniform attack, Galvanic Corrosion, Crevice Corrosion, Pitting, Intergranular Corrosion, Selective Leaching, Erosion Corrosion and Stress Corrosion. Hydrogen damage. Factors influencing, mechanisms, testing and prevention techniques for all forms of corrosion. Calculation of Corrosion rates using weight lost method and Polarization data. Electrochemical Impedance Spectroscopy.

Effect of Dissolved Oxygen (Air saturated Water, High Partial Pressure of Oxygen and Anaerobic bacteria), Temperature, pH, Galvanic coupling, velocity, dissolved salts concentration. Wet and dry corrosion.

TEXTBOOKS :

1. Corrosion and Corrosion Control by Herbert, H. Uhlig John Wiley and Sons Inc., New York.

2. Corrosion Engineering by Mars F Fontana, McGraw Hill.

3. An Introduction to Electrochemistry by Samuel Glass stone, Affiliated East West Press Pvt. Ltd.,

REFERENCE BOOKS :

1. Corrosion Volumes 1 & 2 by L.L. Shrier, Newnes - Butter-worths, London.

CHH-1005

PETROLEUM REFINERY ENGINEERING

Course Objectives:

To introduce the basics of refinery engineering subject for petroleum specialization students to gain knowledge of the overall refinery operations, refinery products and its test methods. To learn various primary and secondary cracking process available to produce normal and value added products. Further, to learn the treatment process available to remove the impurities in the crude and finished products and its test methods for quality check.

Course Outcomes :

At the end of the course, the student will be able to

- Classify and understand the methods available for quality check
- Evaluate crudes and crude pretreatment
- Describe various treatment processes available to increase the quality of the product.
- Select the heat transfer equipment for refineries
- Design atmospheric/Vacuum distillation column and catalytic cracking units.

SYLLABUS

Origin and formation of petroleum: Reserves and deposits of the world – Indian petroleum industry – Composition of crudes.

Refinery products specifications and test methods: Evaluation of crudes. Crudes Pretreatment dehydration and desalting. Physical properties of petroleum oils and products.

Introduction to processing- Refinery distillation – processes – catalytic cracking, Reforming Hydro cracking , and hydro treating, hydrosulfurization.

Chemical treatments & Extraction Processes :Alkylation, polymerization Lube oil processing.

De-waxing :Asphalt and air blown asphalt.

Treatment of products, additives, blending of gasoline, treatment of gasoline, Kerosene etc.,

Heat transfer **equipment in Refinery**– Heat exchangers and pipe still heaters.

Design – atmospheric distillation tower and Vacuum distillation tower, catalytic cracking units.

TEXT BOOKS:

1. Petroleum Refinery Engineering – Nelson.
2. Refinery distillation - Watkins.

CHH-1006

ENERGY ENGINEERING

Course Objectives:

To learn overview of solar radiation and its potential for collection to meet the energy needs of mankind and potential for solar energy option. To learn measuring techniques of solar radiation and its compilation.

To learn various design and operational aspects of solar energy collection and storage.

To learn the design and operation of solar energy appliances like liquid flat plate collectors, Solar Air Heaters, Thermal energy storage, Thermal energy storage, Solar Pond, Solar thermal power generation.

To learn theory and application of Photovoltaic cells

Course Outcomes:

At the end of the course, the student will be able to

- Estimate the availability of solar radiation
- Design of various equipment operated on solar energy
- Explain the principles and practice of Photovoltaic cells
- Classify collectors and analyze their performances
- Describe the production of solar thermal power generation
- Select thermal power storage methodologies.

SYLLABUS

The Solar Energy option

Thermal conversion – collection and storage Thermal applications – photovoltaic conversion – wind energy – Energy from Bio – mass – ocean thermal energy conversion.

Solar Radiation

Solar Radiation outside the earth's – atmosphere Solar radiation at the Earth's surface – Instruments for measuring Solar Radiation – Solar Radiation data – Solar Radiation Geometry Empirical equations for

predicting the availability of Solar Radiation – Solar radiation on tilted surface.

Liquid flat – Plate Collectors

Components of liquid flat plate – various types of collectors – Performance Analysis – Transmissivity – Absorptivity product – Overall loss coefficients and heat Transfer correlations – Collector efficiency heat removal factors – effect of various parameters on performance. Transient Analysis – Testing procedures.

Solar Air Heaters

Various types of solar Heaters – Performance Analysis of a conventional Air Heater – Testing procedures – Concentrating collectors – various types of concentrating collectors cylindrical and parabolic collectors – General receiver collectors.

Thermal energy storage

Sensible heat storage – Latent heat storage – Thermochemical storage

Solar Pond

Description – Performance analysis – Experimental studies – Operational Problems.

Solar Air Conditioning and Refrigeration

Heat pump cycle – Coefficient of performance of the heat pumps – solar air-conditioning with absorption – Refrigeration system (Ammonia water and lithium bromide – water systems).

Solar thermal power generation

Thermal and direct electricity generation – Major sub-stations of a solar thermal power plant, Examples of installed systems – Concentration ratio. Temperature and efficiency concepts – Solar farm and tower – Economics.

Photovoltaic Energy Conversion

Photovoltaic Energy Conversion Fundamentals – band theory of solids – Physical processes in a solar cell – Solar cell with light incidence – Solar cell module – Silicon Solar Cells – Copper Sulphate / Cadmium sulphide Solar Cells. (Bansal et al., chapters 9; Taylor, chapters 6, pages 256-298.

TEXT BOOKS:

1. Solar Energy: Principles of thermal collection and storage by S.P. Sukhatme, Tata McGraw Hill, New Delhi 1984 (Chapters 2 to 8)
2. Renewable energy sources and conversion technology by N. K. Bansal, M. Kleemann, Michael McIliss, 1990 (Chapters 2 – 9).

CHH-1007

TRANSPORT PHENOMENA-II

Course Objectives:

- To be able to analyze various transport processes with understanding of solution approximation methods and their limitations.

Course Outcomes:

At the end of the course, the student will be able to

- Understand the chemical and physical transport processes and their mechanism.
- Analyze heat, mass and momentum transfer problems with relevant approximations and boundary conditions.
- Develop steady and time dependent velocity/ temperature/ concentration distributions for laminar and turbulent flow.
- Calculate friction factor/ heat transfer coefficient / mass transfer coefficient.

SYLLABUS

Momentum Transport

- 1.1 The Equations of change for isothermal systems.
- 1.2 Velocity distributions with more than one independent variable.
- 1.3 Velocity distributions in turbulent flow.
- 1.4 Inter phase transport in isothermal systems.

Energy Transport

- 1.1 The Equations of change for non – isothermal systems.
- 1.2 Temperature distributions with more than one independent variable.
- 1.3 Temperature distributions in turbulent flow
- 1.4 Interphase transport in nonisothermal systems.

Mass Transport

- 1.1 The Equations of Change for multicomponent systems.
- 1.2 Concentration distribution with more than one independent variable.
- 1.3 Concentration distribution in turbulent flow.

TEXTBOOK:

1. "Transport phenomena" R. Byron Bird, Warren E. Stewart and E.N. Light foot, Wiley & Sons, Inc., New York.

REFERENCE BOOKS:

1. "Transport Processes and separation Processes Principles" Geankoplis, Prentice-Hall of India, New Delhi
2. "Fundamentals of Momentum, Heat and Mass Transfer" James R. Welty, Charles E. Wicks and Robert E. Wilson, John Wiley & Sons, Inc., New York.

3. "Boundary – Layer Theory", Dr.H.Schlichting, McGraw – Hill Book Company, New York.

CHH-1008

CHEMICAL REACTION ENGINEERING-III

Course Objectives:

- To focus on the thermal characteristics of various reactions and the design aspects of non isothermal and adiabatic reactors
- To focus on Heterogeneous data analysis and design
- To focus on CVD reactors
- To study the design aspects of heterogeneous catalytic systems
- To impart the knowledge on mass transfer with reaction in process catalysts

Course Outcomes:

At the end of the course, the student will be able to

- Understand the design aspects of non isothermal and adiabatic reactors
- Analyze heterogeneous data and design aspects of heterogeneous catalytic systems
- Derive the rate laws for CVD
- Develop the rate laws for heterogeneous fluid solid catalyzed reactions under rate limiting situations.

SYLLABUS

Review of Fundamentals Rate laws and stoichiometry, reactions with phase change (Scope: Chapter 3 of Fogler) Least squares Analysis of rate data: differential reactors: Laboratory reactors (Scope: sections 5.4 to 5.6 of Fogler) Multiple reactions (Scope: Chapter 9 of Fogler).

Isothermal reactor design (Scope: Chapter 4 of Fogler) Batch reactor, PFR, CSTR design. Pressure drop in reactors, Reversible reactions, unsteady state operation of reactors, Simultaneous reaction and separation

Catalysis and catalytic reactors (Scope: Chapter 6 of Fogler) Steps in catalytic reaction: derivation of rate laws, design for gas-solid reactions, heterogeneous data analysis and design; Chemical vapour deposition, catalyst reactivation, moving bed reactions.

Diffusion and reaction in process catalysts (Scope: Chapter 11 of Fogler).

Diffusion and reaction in spherical catalyst.

Internal effectiveness factor, falsified kinetics; estimation of diffusion and reaction limited regimes. Mass transfer and reaction in packed bed. Determination of limiting situations from reaction data, CVD reactors.

Non-isothermal reactor design (Scope: Chapter 8 of Fogler), Energy Balance, equilibrium conversion under adiabatic conditions unsteady state operation, multiple steady states.

TEXTBOOK:

1. Fogler. H.S: Elements for Chemical Reaction Engineering 2nd Edition, Prentice Hall, New Delhi, 1992.

REFERENCE BOOK:

1. Smith J.M: 'Chemical Engineering Kinetics' 3rd Edition, McGraw Hill, 1981.

CHH-1009

ADVANCED PROCESS DYNAMICS AND CONTROL

Course Objectives:

The main purpose of teaching Process Dynamics & Control for first year postgraduate students is to take the student from basic mathematics to a variety of design applications in a clear, concise manner. This course is focused on the use of the digital computer in complex problem solving and in process control instrumentation. For chemical engineering problem solving students need more advanced mathematical preparation like partial differential equations, linear algebra and Fourier series all are introduced in this course.

Course Outcomes:

At the end of the course, the student will be able to

- Understand sampled data control systems with Z- transforms.
- Describe the process in which the flow of the signals is interrupted periodically like in chromatograph.
- Calculate the open loop and closed loop response of a sampled data system
- Develop a pulse transfer function
- Identify nonlinear systems and explain phase plane analysis
- Demonstrate the control of heat exchangers, distillation columns and chemical reactors

SYLLABUS

Review of time domain, Laplace domain and frequency domain dynamics of process and control system.

Sampled data control system – sampling and Z–Transforms , open loop and closed loop response, Stability.

State space methods – representation of physical systems – transfer function matrix – Multivariable systems – Analysis and control.

Non linear control –examples of non linear systems – Methods of phase plane analysis.

Control of heat exchangers, distillation columns and Chemical Reactors.

TEXTBOOKS:

1. Process system Analysis and control, 2nd edition, Donald R Coughanower and Koppel.

2. Automatic process Control by Peter Harriot.

3. Process Modeling, Simulation and control for Chemical Engineers by W.L. Luyben.

CHH-1010

ANALYTICAL TECHNIQUES

Course Objectives:

To understand the different types of analysis methods used in chemical industries. The course consists of both chemical and instrumental methods and also both qualitative and quantitative methods of analysis. In this course, the chemical methods of quantitative analysis include all the aspects such as: selection and sampling of materials, preparation of solutions, and analysis of various chemical raw materials and products. In instrumental methods colorimetric, spectrophotometric, spectrographic, flame emission, photo meter have been discussed.

Course Outcomes:

At the end of the course, the student will be able to

- Understand the selection and preparation of the sample.
- Select sophisticated instruments for the analysis of mineral ores and chemical samples.
- Make use of instruments like X- Ray, flame emission spectroscopy.
- Describe instrumental methods for mineral investigation.
- Explain electrochemical methods of analysis

SYLLABUS

Theory of sampling, sampling of ores, minerals and coals, proximate and ultimate analysis of coal; coking index, calorific value of coal, its determination and calculation, analysis of ash,

Wet assaying of ores of iron, copper, lead, zinc and manganese, dry assaying process, fire saving methods for gold and silver,

Instrumental methods of mineral investigation: Theory and techniques of colorimetry and absorptiometry, photometer, spectrophotometers, atomic absorption spectrophotometer,

Electrochemical methods of analysis, Electrogravimetry methods, potentiometric titration, polarography, DTA,

X-ray techniques, emission of X-rays, X-rays instrumentation, X-ray diffraction, flame emission spectroscopy - source, equipment and application of emission spectroscopy.

REFERENCE BOOKS:

1. 'An Introduction to Metallurgical Analysis: Chemical & Instrumental' by S.K. Jain, Vikas Publishing House
2. A Text Book of Metallurgical Analysis' by B.C.Agarwal & S.P.Jain, Khanna Publications.
3. 'A Text Book of Quantitative Inorganic Analysis' by A.I.Vogel, ELBS Edition.

Appendix " Z" Item No.53

MASTER OF PHARMACY

(2020)

Regulations and Syllabus Four semester pattern With effect from 2020-21

M.PHARM (2020) REGULATIONS AND SYLLABUS

1. Admission, instruction and attendance
2. Examinations - Sessional and Semester - end
3. Eligibility criteria for appointment as examiner for M.Pharm examination
4. Regulations for pursuing M.Pharm III and IV Semester project
5. Declaration of results and classification:
6. Grading system:
7. Guidelines for paper setting and model papers.
1. Admission, instruction and attendance

The degree of Master of Pharmacy of the Andhra University will be conferred on a candidate who has satisfied the following conditions:

The candidate must have passed the B.Pharm. Degree examination of this University or B.Pharm. Degree examinations of any other University recognized by the Academic Council as equivalent thereto in First or Second class; and must have qualified in any entrance examination, if prescribed.

Every student, selected for admission to PG Pharmacy program in any PCI approved institution should have obtained registration with the State Pharmacy Council or should obtain the same within one month from the date of his/her admission, failing which the admission of the candidate shall be cancelled.

The candidate should have undergone a regular course of study as prescribed hereunder extending over a period of four semesters, ordinarily consecutive, and satisfied the academic requirements as prescribed hereinafter. The course of instruction and periods of study shall be as given in the scheme of instruction and in the syllabus.

The subjects of specializations for Master of Pharmacy Course shall be as follows:

1. Pharmaceutical Analysis
2. Pharmaceutical Chemistry
3. Pharmaceutics
4. Pharmaceutical Biotechnology
5. Pharmacology
6. Pharmacognosy
7. Pharmaceutical Regulatory Affairs
8. Pharmaceutical Quality Assurance
9. Industrial Pharmacy
10. Pharmacy Practice

Instruction and examination in each academic year is spread over two semesters with a minimum of 96 working days in each semester (192 in any given academic year). The odd semesters shall be conducted from the month of July to November and the even semesters shall be conducted from the month of December to April.

Each period of instruction is of 45 minutes duration. Eight periods of instruction are provided on each day and there are six working days in a week (Monday to Saturday).

Attendance Requirements: A regular course of study during an academic semester means a minimum of average attendance of 80% of all the courses of the semester computed by totaling the number of periods of lectures and practicals, as the case may be, held in every course. In special cases where sufficient causes were shown, the Vice-

Chancellor may on the recommendation of the Principal concerned condone the deficiency in the average attendance to an extent of 9% for reasons such as ill health, if the application for condonation is submitted at the time of actual illness and is supported by certificate of; authorized Medical officer approved by the Principal. However, in the case of students, who participate in activities like N.S.S., N.C.C., Inter- Collegiate tournaments conducted by Andhra University, Inter-University tournaments conducted by

Inter-university Board and any such other activities involving the representation of the College/University with the prior approval of the principal, the candidate may be deemed to have attended the college during the period solely for the purpose of the examination.

A candidate who cannot satisfy the attendance requirements in clause 1.5 because of late admission under special circumstances reasonable and acceptable to the University on the basis of document, shall fulfill the following conditions; Average attendance: A candidate shall have attended at least a total of 90% of the periods-lectures/practicals as the case may be held from the date of admission and also shall attend at least 50% of the total working days during that academic semester (Late admission means, admissions made after 45 days from date of commencement of the academic semester for the course).

If any candidate fails to satisfy the regulation under 1.5 or 1.6 she/he shall not be allowed for the University Examinations at the end of the semester, and he/she shall not be allowed for promotion to the next higher class of study. He/she shall be required to repeat the regular course of study of that academic semester along with the next regular batch.

A regular record of attendance in theory, practical, seminar, assignment, journal club, discussion with the supervisor, research work presentation and dissertation shall be maintained by the department/teaching staff of respective courses.

2. Examinations – Internal assessment and Semester-end Assessment for the award of degree shall consist of (a) internal assessment for 30 marks in each of the theory and practical courses separately. (b) Semester-end examination as detailed in the scheme of examination for 70 marks in each of the theory and practical separately.

Regulations concerning internal assessment: Internal assessment consist of continuous mode (10 marks for theory and 15 marks for practical) and sessional examinations (20 marks for theory and 15 marks for practical)

Scheme for awarding continuous mode marks for theory and practical

Theory-Criteria	Marks
Attendance	5
Student-Teacher Interaction	5
Theory sessional examination	20
Total theory internal assessment	30
Practical-Criteria	
Attendance	5
Record + Viva-voce	10
Practical sessional examination	15

Total practical internal assessment 30

Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory/Practical
95 -100	5
90-94	4
85-89	3
80-84	2
Less than 80	0

Guidelines for allotment of marks for Student-Teacher interaction

The teacher shall create some interactive sessions for theory topics and every student shall interact on the given topic relating to its application in pharmacy. The teacher should assess the student capacity for understanding of the concept taught. It shall not be like seminars.

Guidelines for allotment of marks Record + Viva-voce

The teacher should conduct viva-voce at the end of each practical and evaluate the record on continuous mode and shall award these marks.

2.2.4. Guidelines for sessional examinations

Two sessional examinations shall be conducted for each theory/practical course. The average marks of the two shall be computed.

The teacher who teaches the subject shall ordinarily to be the internal examiner. There shall be no provision for the improvement of the sessional marks.

There is no minimum mark prescribed for sessional examination for pass in the end semester examination.

If any student is absent for a single or both sessional examinations, the candidate will be awarded "ZERO" in the respective examination.

The theory average sessional mark shall be finally computed for 20 marks and average practical sessional mark shall be finally computed for 15 marks.

Regulations concerning M.Pharm I and II semester evaluation pattern:

There shall be one semester end examination in each theory course based on the question paper set by an external paper setter and there shall be single valuation. There shall be one semester end examination in each practical course as per the scheme of examination and valuation shall be done by examiner. The duration of the practical examination is of 6 hours as prescribed.

However the student may apply for revaluation of any subject in theory papers after declaring the results as per University examination guide lines.

Seminar

A seminar at the end of first and second semesters is separately conducted keeping in view of the enrichment of required communication, presentation and explanatory skills. A minimum of four seminars shall be given during the semester before the Program Committee and other students and documented separately for record in a Semester Seminar Register.

Comprehensive viva

At the end of II Semester comprehensive viva will be conducted for all the subjects

covering the theory subjects of I & II semesters by the external examiner and eligible internal examiners (at least two from the college) who taught these subjects. The candidate should obtain minimum of 50% marks for passing the examination.

Journal Club

In case of Journal Club, based on the research proposal, each student shall collect a minimum of 5 research papers (published in a reputed journal with impact factor of Thomson & Reuters of not less than 1.0) and should discuss in a Programme Committee (consisting of Head of the Department, Research Supervisor and other Senior faculty members) and documented separately for record in a Journal Club Register.

A student shall be eligible to carry forward all the courses of I, II semesters. However, he/she shall not be eligible to attend the courses of IV semester until the candidate clears III semester Midterm Project Review.

Regulations concerning M. Pharm. III and IV Semester evaluation pattern:

Evaluation of the seminar on the objectives and work plan of the proposed project is to be completed within one month from the commencement of the project date with three examiners from the same college consisting of research guide, another teacher in the concerned specialization and third teacher from different specialization. These teachers must fulfill the eligibility criteria laid down in Section 3.

Evaluation of the M.Pharm III Semester Mid-term project review and seminar on selected topic will be done by the research guide and external examiner. The seminar on the selected topic shall not be the one connected with the topic of the thesis work but should be related to concerned specialization.

A candidate shall submit four copies of his/her thesis either printed or typed, embodying the results of research work done by him under direction of an approved research director following the specific guidelines as stipulated under Section 5. All the candidates must submit their thesis within the prescribed date as per the academic calendar.

The thesis submitted by the candidate shall be examined by a Board of Examiners consisting of an External Examiner and the research director and shall have to be approved after holding a viva voce examination to test the knowledge of the candidate in the subject. The thesis will be evaluated independently by the external examiner and research director and in case the difference between examiners is more than 20%, the thesis shall be sent to a second external examiner whose award shall be the final. The viva-voce examination will be jointly conducted both by the external examiner and research director. A candidate can re-submit the thesis in a revised form after further work, if required to do so.

A candidate desiring of improving his/her class shall take either or both of the first two semesters as a whole. Guidelines for writing the thesis

The thesis should have the following pages in order:

1. Title page highlighting the title, name of the candidate, reg. no., guide name, college name and month and year of submission.
2. The inner title page containing the same details on white background.
3. Certificate from the Head of the institution
4. Certificate from the Research Director
5. Certificate from the ethical committees for approval of study, if any
6. Declaration by the student
7. Acknowledgements
8. Index highlighting chapter titles and sections titles
9. Index for tables, figures and plates, if any
10. Abbreviations and symbols
11. Materials used in the investigation with their procurement details like name of the company, batch number etc.
12. Equipment used in the study with the model number and other details
13. The thesis should contain the following chapters:
 - a) Aim and objectives of the investigation
 - b) Introduction and literature survey
 - c) Description: Methods and Materials, etc.
 - d) Experimental work
 - e) Results and discussion
 - f) Summary and conclusions
 - g) References (The references may be included at the end of each chapter or at the end of the thesis according to the convenience)

The thesis should be typed in times new roman in 12 font size with 1.5 line spacing from the beginning of the thesis including titles to the chapters

and sections. Bold font may be used wherever necessary. The students are expected to follow scientific grammar for writing *in vivo* etc. which should be in italics.

The citation of references should be done carefully by citing the complete reference i.e. name of all the authors. Usage of et al. is not allowed in the citation of reference. The students are expected to give the primary references rather than secondary or higher levels of references. The presentation of reference must be in Vancouver style.

No code names or numbers are allowed to be written in the thesis for the materials used in the project.

The examiners of thesis evaluation are expected to verify all this and appropriate corrections are to be made before conducting the viva-voce examination.

2.5.5 Project Work/IV Semester Assessment – Division of Marks:

Course 402 -Thesis Evaluation (Max. Marks – 150)

Criteria of Evaluation	Marks
Seminar/Presentation of work	20
Objective(s) of the work done	20
Methodology adopted	40
Results and Discussion	40
Conclusions and Outcomes	30
Total	150

The division of marks shall be clearly indicated for every candidate in the marks statement being sent to the University.

End Semester examinations

The End Semester examination for each theory, practical and other courses through semesters I to IV shall be conducted by the University except for the subject with asterisk symbol (*) in the tables of the each specialization courses (Non University Examinations) for which examinations shall be conducted by the subject experts at college level and the marks/grades shall be submitted to the University. In case of theory examinations, the question paper of the corresponding subject shall be mailed (Official mail id) to the Controller of Examinations and Chairman, BOS with signature of the Head of the Institute in PDF format within twenty four hours after completion of the examination.

3. Eligibility criteria for appointment as examiner for M.Pharm examination In order to eligible to be appointed as an internal examiner for the semester end examination in the respective specialization, a teacher shall have M. Pharm. or Ph.D. in the respective specialization with at least three years of M.Pharm teaching experience for the course concerned.

The eligibility of a teacher for guiding the M.Pharm III and IV semester project is as follows:

The teacher must have M.Pharm/Ph.D. in the respective specialization with an experience of minimum 3 years of Post Graduate teaching in the respective specialization.

The eligibility of such teachers qualified for guiding M.Pharm projects must be ratified by the Board of Studies before commencement of M.Pharm guidance.

The recognized M.Pharm guides are not eligible to guide more than 6 students in one academic year including joint guidance.

4. Regulations for pursuing M.Pharm III and IV Semester project

Students desirous of pursuing M.Pharm III and IV semester projects outside college are required to get the approval from the college before one month from the commencement of the project work. The research work can be carried out in a GMP compliant industry (as approved by WHO, USFDA etc.) and Central research laboratories like IICT, CDRI, NIH etc. or DSIR and Drug Control Administration recognized laboratories. A certificate to that effect must be incorporated in the M.Pharm thesis indicating the duration of stay. If the duration of stay is less than nine months the remaining period of stay in the college should be certified by the research supervisor and the Principal.

All the students should present a seminar on the objectives of their work, work plan, etc. within one month from the commencement of the project. The students should attend a mid-term review seminar in the presence of a committee consisting of one external examiner, research director. The suggestions made by the committee are to be taken into consideration for further work and should be presented in the thesis.

5. Declaration of results and classification:

A candidate shall be declared to have passed the examination held at the end of each semester if obtains i) not less than 40% in the each theory and 50% in each practical, seminar, comprehensive viva, thesis and thesis viva-voce at the end of each semester end examination and ii) an aggregate of 50% of all examinations of that semester including sessionals. There are no minimum marks prescribed for sessional examination.

A candidate who has successfully completed the examination in a course by securing not less than 50% of marks shall not be permitted to retake the examination in that course.

A candidate who fails to secure 50% of marks on the aggregate but secures 50% or

more in some courses and between 40-49% in the other courses, he/she shall be required to retake the semester and supplementary examination in one or more of the courses in which he/she secures less than

50% of marks as per his/her choice to satisfy the requirement of 50% aggregate.

Declaration of class

The classes shall be awarded on the basis of CGPA as follows

First Class with Distinction = CGPA of 7.50 and above

First Class = CGPA of 6.00 to 7.49

Second Class = CGPA of 5.00 to 5.99

6. Grading system:

Appropriate letter grades are awarded in each theory and practical subject to only such candidates who have passed in the university examinations. Internal assessment marks and university examination marks put together will be taken into account for the letter grading system in each subject separately.

A candidate registered for the university examination but fails to appear or fails to score the minimum required 40% marks in the university examination will get a grade 'F', indicating failure or grade of incompleteness.

A subject successfully completed cannot be repeated. Final evaluation of each subject (theory and practical separately) will be carried out on a 10- point grading system corresponding to the marks obtained in that subject. Each subject letter grade is converted into a specific grade value associated with the letter grade as given below (Table).

Grading of performances

Based on the performance, each student shall be awarded a final letter grade at the end of the semester for each course. The letter grades and their corresponding grade points are given below.

10-Point grading system

Percentage of marks	Grade	Grade points
90.00 - 100	O	10.0
80.00 - 89.99	A	9.0
70.00 – 79.99	B	8.0
60.00 – 69.99	C	7.0
50.00 – 59.99	D	6.0
40.00 – 49.99	E	5.0
< 40.00F (Fail)	0.0	

The grade W represents failure due to insufficient attendance in the semester or year W 0.0

Incomplete (subsequently to be changed into pass or E or O or F grade in the same semester) I 0.0

6.5 The Semester grade point average (SGPA):

The performance of a student in a semester is indicated by a number called 'Semester Grade Point Average' (SGPA). The SGPA is the weighted average of the

grade points obtained in all the courses by the student during the semester. For example, if a student takes five courses (Theory/Practical) in a semester with credits C1, C2, C3 and C4 and the student's grade points in these courses are G1, G2, G3 and G4, respectively, and then students' SGPA is equal to:

SGPA

The SGPA is calculated to two decimal points. It should be noted that, the SGPA for any semester shall take into consideration the F and AB grade awarded in that semester. For example if a learner has F or AB grade in course 4, the SGPA shall then be computed as:

SGPA

The credits allotted to each course are given in the respective specialization

Tables 1-10.

6.6. Cumulative Grade Point Average (CGPA)

The CGPA is calculated with the SGPA of all the IV semesters to two decimal points and is indicated in final grade report card/final transcript showing the grades of all IV semesters and their courses. The CGPA shall reflect the failed status in case of F grade(s), till the course(s) is/are passed. When the course(s) is/ are passed by obtaining a pass grade on subsequent examination(s) the CGPA shall only reflect the new grade and not the fail grades earned earlier. The CGPA is calculated as:

CGPA

Where $C_1, C_2, C_3, C_4, \dots$ is the total number of credits for semester I, II, III and IV and S_1, S_2, S_3 and S_4 are the SGPA of semester I, II, III and IV.

7. Guidelines for paper setting and model papers. Guidelines for theory paper setting for semester end examinations

The semester end question paper in each theory course is to be set for a total of 70 marks by an external paper setter as per the general model given below.

Question paper consists of 5 questions each carrying 5 marks out of which 4 questions are to be answered by the candidate and 7 questions each carrying 10 marks out of which 5 questions are to be answered by the candidate for a total of 70 marks. Each main question may contain subsections like a, b, c etc.

The questions given should be spread over the entire syllabus in an even manner covering all the units as per the pattern of the question paper given below.

Model question paper for theory course: Course No.

Specialization Name:

Title of the course:

Time: 3 Hours **Max. Marks: 70**

Part A (Question Numbers 1-5)

Answer any **four** questions out of five questions 4X5=20

One question has to be set from each unit.

Part B

Answer any **five** questions out of **seven** questions (Question Numbers 6-12) 5X10=50

Five questions are to be set from five units and the remaining two should cover at least four out of five units. The main questions may contain sub question like 6(a), 6(b) etc.

Guidelines for practical paper setting for semester end examination

The question paper in each semester end practical examination is to be set jointly by two examiners and evaluated, one external and one internal as per the general model provided below.

Model question paper for practical course: Course No.

Title of the course Time: 6 hrs.

1. Synopsis 10 marks

2. Major experiment 30 marks

3. Minor experiment 20 marks

4. Viva voce 10 marks

Total: 70 marks

Guidelines for theory/practical sessional examination paper setting:
Question paper pattern for theory Sessional examinations

Max. Marks: 30

Time: 2 Hours Part A

Answer any **two** questions out of three questions 2X5=10 Part B

Answer any **two** questions out of three questions 2X10=20

Each of the sessional examination question paper should cover at least half the units of the syllabus.

Question paper pattern for practical sessional examinations

Max. Marks: 30

Time: 4 hours

1.Synopsis 5 Marks

2.Experiment 20 Marks

3.Viva 5 Marks

Total: 30 Marks

Table 1: Pharmaceutical Analysis (MPA)

Code Total	Course	Credits	Hours/	Internal Assessment			Semester	
			week	Continuous mode	Sessional Exam	Total	End Exam	
I Semester								
MPA 101T	Modern Pharmaceutical Analytical Techniques	4	4	10	20	30	70	100
MPA 102T	Advanced Pharmaceutical Analysis	4	4	10	20	30	70	100
MPA 103T	Pharmaceutical Validation (Common paper for MPA and MQA)	4	4	10	20	30	70	100
MPA 104T	Food Analysis	4	4	10	20	30	70	100
MPA 105P	Pharmaceutical Analysis Practical - I	2	6	15	15	30	70	100
MPA 106P	Pharmaceutical Analysis Practical - II	2	6	15	15	30	70	100
MPA 107	Seminar*	2	4	50	—	—	—	50
Total		22	32	—	—	—	—	650
II Semester								
MPA 201T	Advanced Instrumental Analysis	4	4	10	20	30	70	100
MPA 202T	Modern Bio-Analytical Techniques	4	4	10	20	30	70	100
MPA 203T	Quality Control and Quality Assurance (Common paper for MPA and MQA)	4	4	10	20	30	70	100
MPA 204T	Herbal and Cosmetic Analysis	4	4	10	20	30	70	100
MPA 205P	Pharmaceutical Analysis Practical - III	2	6	15	15	30	70	100
MPA 206	Comprehensive Viva	2	—	—	—	—	—	50
MPA 207	Seminar*	2	2	50	—	—	—	50
Total		22	26	—	—	—	—	600

Table 1: Pharmaceutical Analysis (MPA) continued**III Semester**

MRM 301T	Research Methodology and Biostatistics*	2	4	10	20	30	70	100
MPA 302	Journal Club*	2	2	50	—	—	—	50
MPA 303	Discussion /Presentation (Dissertation Title & Project Proposal)*	2	—	50	—	—	—	50
MPA 304	Seminar on selected topic	4	4	—	—	—	100	100
MPA 305	Research Work Progress (Mid Term Report)	10	20	—	—	—	200	100
Total:		20	30	—	—	—	—	400

IV Semester

MPA 401	Journal Club*	2	2	50	—	—	—	50
MPA 402	Thesis evaluation	12	20	—	—	—	150	150
MPA 403	Thesis viva	4	—	—	—	—	50	50
Total:		20	22	—	—	—	—	250

* Non-University Examination

Table 2: Pharmaceutical Chemistry (MPC)

Code Total	Course	Credits	Hours/	Internal Assessment			Semester	
			week	Continuous mode	Sessional Exam	Total	End Exam	
I Semester								
MPC 101T	Modern Pharmaceutical Analytical Techniques	4	4	10	20	30	70	100
MPC 102T	Advanced Organic Chemistry - I	4	4	10	20	30	70	100
MPC 103T	Advanced Medicinal Chemistry	4	4	10	20	30	70	100
MPC 104T	Chemistry of Natural Products	4	4	10	20	30	70	100
MPC 105P	Pharmaceutical Chemistry Practical - I	2	6	15	15	30	70	100
MPC 106P	Pharmaceutical Chemistry Practical - II	2	6	15	15	30	70	100
MPC 107	Seminar*	2	4	50	—	—	—	50
Total		22	32	—	—	—	—	650

II Semester

MPC 201T	Advanced Spectral Analysis	4	4	10	20	30	70	100
MPC 202T	Advanced Organic Chemistry - II	4	4	10	20	30	70	100
MPC 203T	Computer Aided Drug Design (CADD)	4	4	10	20	30	70	100
MPC 204T	Pharmaceutical Process Chemistry	4	4	10	20	30	70	100
MPC 205P	Pharmaceutical Chemistry Practical - III	2	6	15	15	30	70	100
MPC 206	Comprehensive Viva	2	—	—	—	—	—	50
MPC 207	Seminar*	2	2	50	—	—	—	50
Total		22	26	—	—	—	—	600

Table 2: Pharmaceutical Chemistry (MPC) continued**III Semester**

Code Total	Course	Credits	Hours/	Internal Assessment			Semester	
			week	Continuous mode	Sessional Exam	Total	End Exam	
MRM 301T	Research Methodology and Biostatistics*	2	4	10	20	30	70	100
MPC 302	Journal Club*	2	2	50	—	—	—	50
MPC 303	Discussion /Presentation (Dissertation Title & Project Proposal)*	2	—	50	—	—	—	50
MPC 304	Seminar on selected topic	4	4	—	—	—	100	100
MPC 305	Research Work Progress (Mid Term Report)	10	20	—	—	—	200	100
Total:		20	30	—	—	—	—	400
IV Semester								
MPC 401	Journal Club*	2	2	50	—	—	—	50
MPC 402	Thesis evaluation	12	20	—	—	—	150	150
MPC 403	Thesis viva	4	—	—	—	—	50	50
Total:		20	22	—	—	—	—	250

* Non-University Examination

Table 3: Pharmaceuticals (MPH)

Code Total	Course	Credits	Hours/	Internal Assessment			Semester	
			week	Continuous mode	Sessional Exam	Total	End Exam	

I Semester

MPH 101T	Modern Pharmaceutical Analytical Techniques	4	4	10	20	30	70	100
MPH 102T	Advanced Biopharmaceutics & Pharmacokinetics (Common paper for MPH and MIP)	4	4	10	20	30	70	100
MPH 103T	Modern Pharmaceutics	4	4	10	20	30	70	100
MPH 104T	Regulatory Affairs	4	4	10	20	30	70	100
MPH 105P	Pharmaceutics Practical – I	2	6	15	15	30	70	100
MPH 106P	Pharmaceutics Practical – II	2	6	15	15	30	70	100
MPH 107	Seminar*	2	4	50	—	—	—	50
Total		22	32	—	—	—	—	650

II Semester

MPH 201T	Molecular Pharmaceutics (Nano Technology and Targeted DDS)	4	4	10	20	30	70	100
MPH 202T	Drug Delivery Systems (DDS)	4	4	10	20	30	70	100
MPH 203T	Computer Aided Drug Development (CADD)	4	4	10	20	30	70	100
MPH 204T	Pharmaceutical and Cosmetic Product Development	4	4	10	20	30	70	100
MPH 205P	Pharmaceutics Practical - III	2	6	15	15	30	70	100
MPH 206	Comprehensive Viva	2	—	—	—	—	—	50
MPH 207	Seminar*	2	2	50	—	—	—	50
Total		22	26	—	—	—	—	600

Table 3: Pharmaceutics (MPH) continued

III Semester

MRM 301T	Research Methodology and Biostatistics*	2	4	10	20	30	70	100
MPH 302	Journal Club*	2	2	50	—	—	—	50
MPH 303	Discussion /Presentation (Dissertation Title & Project Proposal)*	2	—	50	—	—	—	50
MPH 304	Seminar on selected topic	4	4	—	—	—	100	100
MPH 305	Research Work Progress (Mid Term Report)	10	20	—	—	—	200	100
Total:		20	30	—	—	—	—	400

IV Semester

MPH 401	Journal Club*	2	2	50	—	—	—	50
MPH 402	Thesis evaluation	12	20	—	—	—	150	150
MPH 403	Thesis viva	4	—	—	—	—	50	50
Total:		20	22	—	—	—	—	250

* Non-University Examination

Table 4: Pharmaceutical Biotechnology (MPB)

Code	Course	Credits	Hours/ week	Internal Assessment			Semester	
Total				Continuous mode	Sessional Exam	Total	End Exam	
I Semester								
MPB 101T	Modern Pharmaceutical Analytical Techniques	4	4	10	20	30	70	100
MPB 102T	Microbial Genetics and Cellular Biology	4	4	10	20	30	70	100
MPB 103T	Bioprocess Engineering and Technology	4	4	10	20	30	70	100
MPB 104T	Advanced Pharmaceutical Biotechnology	4	4	10	20	30	70	100
MPB 105P	Pharmaceutical Biotechnology Practical - I	2	6	15	15	30	70	100
MPB 106P	Pharmaceutical Biotechnology Practical - II	2	6	15	15	30	70	100
MPB 107	Seminar*	2	4	50	—	—	—	50
Total		22	32	—	—	—	—	650
II Semester								
MPB 201T	Proteins and Protein Formulation	4	4	10	20	30	70	100
MPB 202T	Immunotechnology	4	4	10	20	30	70	100
MPB 203T	Bioinformatics and Computational Biotechnology		4	4	10	20	30	70
100								
MPB 204T	Biological Evaluation of Drug Therapy	4	4	10	20	30	70	100
MPB 205P	Pharmaceutical Biotechnology Practical III	2	6	15	15	30	70	100
MPB 206	Comprehensive Viva	2	—	—	—	—	—	50
MPB 207	Seminar*	2	2	50	—	—	—	50
Total		22	26	—	—	—	—	600

Table 4: Pharmaceutical Biotechnology (MPB) continued**III Semester**

MRM 301T	Research Methodology and Biostatistics*	2	4	10	20	30	70	100
MPB 302	Journal Club*	2	2	50	—	—	—	50
MPB 303	Discussion /Presentation (Dissertation Title & Project Proposal)*	2	—	50	—	—	—	50
MPB 304	Seminar on selected topic	4	4	—	—	—	100	100
MPB 305	Research Work Progress (Mid Term Report)	10	20	—	—	—	200	100
Total:		20	30	—	—	—	—	400

IV Semester

MPB 401	Journal Club*	2	2	50	—	—	—	50
MPB 402	Thesis evaluation	12	20	—	—	—	150	150
MPB 403	Thesis viva	4	—	—	—	—	50	50
Total:		20	22	—	—	—	—	250

* Non-University Examination

Table 5: Pharmacology (MPL)

Code Total	Course	Credits	Hours/	Internal Assessment			Semester	
			week	Continuous mode	Sessional Exam	Total	End Exam	
I Semester								
MPL 101T	Modern Pharmaceutical Analytical Techniques	4	4	10	20	30	70	100
MPL 102T	Advanced Pharmacology – I4	4	4	10	20	30	70	100
MPL 103T	Pharmacokinetics and Drug Metabolism	4	4	10	20	30	70	100
MPL 104T	Cellular and Molecular Pharmacology	4	4	10	20	30	70	100
MPL 105P	Pharmacology Practical - I	2	6	15	15	30	70	100
MPL 106P	Pharmacology Practical – II	2	6	15	15	30	70	100
MPL 107	Seminar*	2	4	50	—	—	—	50
Total		22	32	—	—	—	—	650
II Semester								
MPL 201T	Advanced Pharmacology – II4	4	4	10	20	30	70	100

MPL 202T	Pharmacological and Toxicological Screening Methods	4	4	10	20	30	70	100
MPL 203T	Principles of Drug Discovery4	4	4	10	20	30	70	100
MPL 204T	Clinical Research and Pharmacovigilance	4	4	10	20	30	70	100
MPL 205P	Pharmacology Practical – III	2	6	15	15	30	70	100
MPL 206	Comprehensive Viva	2	—	—	—	—	—	50
MPL 207	Seminar*	2	2	50	—	—	—	50
Total		22	26	—	—	—	—	600

Table 5: Pharmacology (MPL) continued**III Semester**

MRM 301T	Research Methodology and Biostatistics*	2	4	10	20	30	70	100
MPL 302	Journal Club*	2	2	50	—	—	—	50
MPL 303	Discussion /Presentation (Dissertation Title & Project Proposal)*	2	—	50	—	—	—	50
MPL 304	Seminar on selected topic	4	4	—	—	—	100	100
MPL 305	Research Work Progress (Mid Term Report)	10	20	—	—	—	200	100
Total:		20	30	—	—	—	—	400

IV Semester

MPL 401	Journal Club*	2	2	50	—	—	—	50
MPL 402	Thesis evaluation	12	20	—	—	—	150	150
MPL 403	Thesis viva	4	—	—	—	—	50	50
Total:		20	22	—	—	—	—	250

* Non-University Examination

Table 6: Pharmacognosy (MPG)

Code Total	Course	Credits	Hours/	Internal Assessment			Semester	
			week	Continuous mode	Sessional Exam	Total	End Exam	
I Semester								
MPG 101T	Modern Pharmaceutical Analytical Techniques	4	4	10	20	30	70	100
MPG 102T	Advanced Pharmacognosy - I	4	4	10	20	30	70	100
MPG 103T	Phytochemistry	4	4	10	20	30	70	100

MPG 104T Industrial Pharmacognostical Technology	4	4	10	20	30	70	100
MPG 105P Pharmacognosy Practical - I2	6	15	15	30	70	100	
MPG 106P Pharmacognosy Practical - II2	6	15	15	30	70	100	
MPG 107 Seminar*	2	4	50	—	—	—	50
Total	22	32	—	—	—	—	650

II Semester

MPG 201T Medicinal Biotechnology	4	4	10	20	30	70	100
MPG 202T Advanced Pharmacognosy - II	4	4	10	20	30	70	100
MPG 203T Indian Systems of Medicine	4	4	10	20	30	70	100
MPG 204T Herbal Cosmetics	4	4	10	20	30	70	100
MPG 205P Pharmacognosy Practical - III 100	2	6	15	15	30	70	
MPG 206 Comprehensive Viva	2	—	—	—	—	—	50
MPG 207 Seminar*	2	2	50	—	—	—	50
Total	22	26	—	—	—	—	600

Table 6: Pharmacognosy (MPG) continued

III Semester

MRM 301T Research Methodology and Biostatistics*	2	4	10	20	30	70	100
MPG 302 Journal Club*	2	2	50	—	—	—	50
MPG 303 Discussion /Presentation (Dissertation Title & Project Proposal)*	2	—	50	—	—	—	50
MPG 304 Seminar on selected topic	4	4	—	—	—	100	100
MPG 305 Research Work Progress (Mid Term Report)	10	20	—	—	—	200	100
Total:	20	30	—	—	—	—	400

IV Semester

MPG 401 Journal Club*	2	2	50	—	—	—	50
MPG 402 Thesis evaluation	12	20	—	—	—	150	150
MPG 403 Thesis viva	4	—	—	—	—	50	50
Total:	20	22	—	—	—	—	250

* Non-University Examination

Table 7: Pharmaceutical Regulatory Affairs (MRA)

Code	Course	Credits	Hours/	Internal Assessment	Semester
Total			week	Continuous Sessional Total	End Exam

			mode	Exam						
I Semester										
MRA 101T Good Regulatory Practices	4	4	10	20	30	70	100			
MRA 102T Documentation and Regulatory Writing	4	4	10	20	30	70	100			
MRA 103T Clinical Research Regulations	4	4	10	20	30	70	100			
MRA 104T Regulations and Legislation for Drugs & Cosmetics, Medical Devices, Biologicals, Herbs & Food and Nutraceuticals in India & Intellectual Property Rights	4	4	10	20	30	70	100			
MRA 105P Regulatory Affairs Practical-I2	6	15	15	30	70	100				
MRA 106P Regulatory Affairs Practical-II 100	2	6	15	15	30	70				
MRA 107 Seminar*	2	4	50	—	—	—	50			
Total	22	32	—	—	—	—	650			

Table 7: Pharmaceutical Regulatory Affairs (MRA) continued

II Semester

MRA 201T Regulatory Aspects of Drugs & Cosmetics	4	4	10	20	30	70	100			
MRA 202T Regulatory Aspects of Herbal & Biologicals	4	4	10	20	30	70	100			
MRA 203T Regulatory Aspects of Medical Devices	4	4	10	20	30	70	100			
MRA 204T Regulatory Aspects of Food & Nutraceuticals	4	4	10	20	30	70	100			
MRA 205P Regulatory Affairs Practical - III	2	6	15	15	30	70	100			
MRA 206 Comprehensive Viva	2	—	—	—	—	—	50			
MRA 207 Seminar*	2	2	50	—	—	—	50			
Total	22	26	—	—	—	—	600			

III Semester

MRM 301T Research Methodology and Biostatistics*	2	4	10	20	30	70	100			
MRA 302 Journal Club*	2	2	50	—	—	—	50			
MRA 303 Discussion /Presentation (Dissertation Title & Project Proposal)*	2	—	50	—	—	—	50			

MRA 304	Seminar on selected topic	4	4	—	—	—	100	100
MRA 305	Research Work Progress (Mid Term Report)	10	20	—	—	—	200	100
Total:		20	30	—	—	—	—	400

IV Semester

MRA 401	Journal Club*	2	2	50	—	—	—	50
MRA 402	Thesis evaluation	12	20	—	—	—	150	150
MRA 403	Thesis viva	4	—	—	—	—	50	50
Total:		20	22	—	—	—	—	250

* Non-University Examination

Table 8: Pharmaceutical Quality Assurance (MQA)

Code Total	Course	Credits	Hours/	Internal Assessment			Semester	
			week	Continuous mode	Sessional Exam	Total	End Exam	
I Semester								
MQA 101T	Modern Pharmaceutical Analytical Techniques	4	4	10	20	30	70	100
MQA 102T	Quality Management System	4	4	10	20	30	70	100
MQA 103T	Pharmaceutical Validation (Common paper for MPA and MQA)	4	4	10	20	30	70	100
MQA 104T	Product Development and Technology Transfer	4	4	10	20	30	70	100
MQA 105P	Pharmaceutical Quality Assurance Practical - I	2	6	15	15	30	70	100
MQA 106P	Pharmaceutical Quality Assurance Practical - II	2	6	15	15	30	70	100
MQA 107	Seminar*	2	4	50	—	—	—	50
Total		22	32	—	—	—	—	650

MQA 205P	Pharmaceutical Quality Assurance Practical - III	2	6	15	15	30	70	100
MQA 206	Comprehensive Viva	2	—	—	—	—	—	50
MQA 207	Seminar*	2	2	50	—	—	—	50
Total		22	26	—	—	—	—	600

Table 8: Pharmaceutical Quality Assurance (MQA) continued

III Semester

MRM 301T	Research Methodology and Biostatistics*	2	4	10	20	30	70	100
MQA 302	Journal Club*	2	2	50	—	—	—	50
MQA 303	Discussion /Presentation (Dissertation Title & Project Proposal)*	2	—	50	—	—	—	50
MQA 304	Seminar on selected topic	4	4	—	—	—	100	100
MQA 305	Research Work Progress (Mid Term Report)	10	20	—	—	—	200	100
Total:		20	30	—	—	—	—	400

IV Semester

MQA 401	Journal Club*	2	2	50	—	—	—	50
MQA 402	Thesis evaluation	12	20	—	—	—	150	150
MQA 403	Thesis viva	4	—	—	—	—	50	50
Total:		20	22	—	—	—	—	250

* Non-University Examination

Table 9: Industrial Pharmacy (MIP)

Code Total	Course	Credits	Hours/	Internal Assessment			Semester	
			week	Continuous mode	Sessional Exam	Total	End Exam	
I Semester								
MIP 101T	Modern Pharmaceutical Analytical Techniques	4	4	10	20	30	70	100
MIP 102T	Advanced Biopharmaceutics & Pharmacokinetics (Common paper for MPH and MIP)	4	4	10	20	30	70	100
MIP 103T	Novel Drug Delivery Systems	4	4	10	20	30	70	100
MIP 104T	Intellectual Property Rights	4	4	10	20	30	70	100
MIP 105P	Industrial Pharmacy Practical - I	2	6	15	15	30	70	100

MIP 106P	Industrial Pharmacy Practical - II	2	6	15	15	30	70	100
MIP 107	Seminar*	2	4	50	—	—	—	50
Total		22	32	—	—	—	—	650

II Semester

MIP 201T	Scale Up and Technology Transfer	4	4	10	20	30	70	100
MIP 202T	Pharmaceutical Production Technology	4	4	10	20	30	70	100
MIP 203T	Entrepreneurship Management	4	4	10	20	30	70	100
MIP 204T	Pharmaceutical Formulation Development	4	4	10	20	30	70	100
MIP 205P	Industrial Pharmacy Practical - III	2	6	15	15	30	70	100
MIP 206	Comprehensive Viva	2	—	—	—	—	—	50
MIP 207	Seminar*	2	2	50	—	—	—	50
Total		22	26	—	—	—	—	600

Table 9: Industrial Pharmacy (MIP) continued

III Semester

MRM 301T	Research Methodology and Biostatistics*	2	4	10	20	30	70	100
MIP 302	Journal Club*	2	2	50	—	—	—	50
MIP 303	Discussion /Presentation (Dissertation Title & Project Proposal)*	2	—	50	—	—	—	50
MIP 304	Seminar on selected topic	4	4	—	—	—	100	100
MIP 305	Research Work Progress (Mid Term Report)	10	20	—	—	—	200	100
Total:		20	30	—	—	—	—	400

IV Semester

MIP 401	Journal Club*	2	2	50	—	—	—	50
MIP 402	Thesis evaluation	12	20	—	—	—	150	150
MIP 403	Thesis viva	4	—	—	—	—	50	50
Total:		20	22	—	—	—	—	250

* Non-University Examination

Table 10: Pharmacy Practice (MPP)

Code Total	Course	Credits	Hours/	Internal Assessment			Semester	
			week	Continuous mode	Sessional Exam	Total	End Exam	
I Semester								
MPP 101T	Clinical Pharmacy Practice	4	4	10	20	30	70	100
MPP 102T	Pharmacotherapeutics I	4	4	10	20	30	70	100
MPP 103T	Hospital & Community Pharmacy	4	4	10	20	30	70	100
MPP 104T	Clinical Research	4	4	10	20	30	70	100
MPP 105P	Pharmacy Practice Practical - I	2	6	15	15	30	70	100
MPP 106P	Pharmacy Practice Practical - II	2	6	15	15	30	70	100
MPP 107	Seminar*	2	4	50	—	—	—	50
Total		22	32	—	—	—	—	650

II Semester

MPP 201T	Principles of Quality Use of Medicines	4	4	10	20	30	70	100
MPP 202T	Pharmacotherapeutics - II	4	4	10	20	30	70	100
MPP 203T	Clinical Pharmacokinetics and Therapeutic Drug Monitoring	4	4	10	20	30	70	100
MPP 204T	Pharmacoepidemiology & Pharmacoeconomics	4	4	10	20	30	70	100
MPP 205P	Pharmacy Practice Practical - III	2	6	15	15	30	70	100
MPP 206	Comprehensive Viva	2	—	—	—	—	—	50
MPP 207	Seminar*	2	2	50	—	—	—	50
Total		22	26	—	—	—	—	600

Table 10: Pharmacy Practice (MPP) continued

III Semester

MRM 301T	Research Methodology and Biostatistics*	2	4	10	20	30	70	100
MPP 302	Journal Club*	2	2	50	—	—	—	50
MPP 303	Discussion /Presentation (Dissertation Title & Project Proposal)*	2	—	50	—	—	—	50
MPP 304	Seminar on selected topic	4	4	—	—	—	100	100

MPP 305	Research Work Progress (Mid Term Report)	10	20	—			200	100
Total:		20	30	—	—	—	—	400

IV Semester

MPP 401	Journal Club*	2	2	50	—	—	—	50
MPP 402	Thesis evaluation	12	20	—	—	—	150	150
MPP 403	Thesis viva	4	—	—	—	—	50	50
Total:		20	22	—	—	—	—	250

* Non-University Examination

PHARMACEUTICAL ANALYSIS (MPA)

First Semester

MODERN PHARMACEUTICAL ANALYTICAL TECHNIQUES (MPA 101T)

(Note: Common paper for MPA, MPC, MPH, MPB, MPL, MPG, MQA, & MIP, specializations)

Unit 1: a. UV-visible spectroscopy: Introduction, theory, laws and instrumentation associated with UV-visible spectroscopy, choice of solvents and solvent effect and applications of UV-visible spectroscopy.

b. IR spectroscopy: Theory, modes of molecular vibrations, sample handling, instrumentation of dispersive and Fourier-Transform IR Spectrometer, factors affecting vibrational frequencies and applications of IR spectroscopy, data interpretation.

c. Spectrofluorimetry: Theory of fluorescence, factors affecting fluorescence (characteristics of drugs that can be analyzed by fluorimetry), quenchers, instrumentation and Applications of fluorescence spectrophotometer.

d. Flame emission spectroscopy and Atomic absorption spectroscopy: Principle, instrumentation, interferences and applications. 12 Hours

Unit 2: NMR spectroscopy: Quantum numbers and their role in NMR, Principle, Instrumentation, Solvent requirement in NMR, Relaxation process, NMR signals in various compounds, Chemical shift, Factors influencing chemical shift, Spin-Spin coupling, Coupling constant, Nuclear magnetic double resonance, Brief outline of principles of FT-NMR and ¹³C NMR. Applications of NMR spectroscopy. 10 Hours

Unit 3: Mass Spectroscopy: Principle, Theory, Instrumentation of Mass Spectroscopy, Different types of ionization like electron impact, chemical, field, FAB and MALDI, APCI, ESI, APPI Analyzers of Quadrupole and Time of Flight, Mass fragmentation and its rules, Meta stable ions, Isotopic peaks and Applications of Mass spectroscopy. 10 Hours

Unit 4: Chromatography: Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution, isolation of drug from excipients, data interpretation and applications of the following:

a) Thin Layer chromatography b) High Performance Thin Layer Chromatography c) Ion exchange chromatography d) Column chromatography e) Gas chromatography f) High Performance Liquid chromatography g) Ultra High Performance Liquid chromatography

h) Affinity chromatography i) Gel Chromatography. 14 Hours Unit 5:

a. Electrophoresis: Principle, Instrumentation, Working conditions, factors affecting separation and applications of the following: a) Paper electrophoresis b) Gel electrophoresis

c) Capillary electrophoresis d) Zone electrophoresis e) Moving boundary electrophoresis

f) Iso electric focusing.

b. X ray Crystallography: Production of X rays, Different X ray methods, Bragg's law, Rotating crystal technique, X ray powder technique, Types of crystals and applications of X- ray diffraction.

c. Thermal Techniques: Principle, instrumentation, advantage and disadvantages, Pharmaceutical applications of DSC, DTA & TGA.

d. Microscopic techniques: Principles and applications of Scanning Electron Microscopy and Transmission Electron Microscopy analysis. 14 Hours

REFERENCES

1. Spectrometric Identification of Organic compounds - Robert M Silverstein. 6th ed. John Wiley & Sons, 2004.
2. Principles of Instrumental Analysis - Douglas A Skoog, F. James Holler, Timothy A. Nieman. 5th ed. Eastern Press, Bangalore, 1998.
3. Instrumental Methods of Analysis – Willards. 7th ed. CBS Publishers, New Delhi.
4. Practical Pharmaceutical Chemistry – Beckett and Stenlake. Vol 2. 4th ed. CBS Publishers, New Delhi
5. Organic Spectroscopy - William Kemp. 3rd ed. ELBS, 1991.
6. Quantitative Analysis of Drugs in Pharmaceutical Formulation – P.D. Sethi. 3rd ed. CBS Publishers, New Delhi, 1997.
7. Pharmaceutical Analysis - Modern Methods – Part B – J.W. Munson. Vol 11. Marcel- Dekker Series.
8. Spectroscopy of Organic Compounds - P.S. Kalsi. 2nd ed. Wiley Estern Ltd., Delhi.
9. Textbook of Pharmaceutical Analysis – K.A. Connors. 3rd ed. John Wiley & Sons.

ADVANCED PHARMACEUTICAL ANALYSIS (MPA 102T)

Unit 1: Impurities and stability studies: Definition, classification of impurities in drug substance or active pharmaceutical ingredients and quantification of impurities as per ICH guidelines – Q3A & Q3D. Impurities in new drug products: Rationale for the reporting and control of degradation products, reporting degradation products content of batches, listing of degradation products in specifications, qualification of degradation products.

Impurities in residual solvents: General principles, classification of residual solvents, Analytical procedures, limits of residual solvents, reporting levels of residual solvents. 12 Hours

Unit 2: Impurity profiling and degradant characterization (ICH Q2A & Q2B): Stability studies accelerated stability testing & shelf life calculation, WHO and ICH stability testing guidelines, stability zones.

Elemental impurities: Basics of impurity profiling and degradant characterization with special emphasis. Method development and concepts of validation. Element classification, control of elemental impurities, Potential Sources of elemental impurities, Identification of potential elemental impurities, analytical procedures, instrumentation & C, H, N and S analysis. (Ref: USP 38 NF 33, Vol. I, 2015, Chapter 232 & 233). 14 Hours

Unit 3: Stability testing protocols (ICH Q1A): Selection of batches, container orientation, test parameters, sampling frequency, specification, storage conditions, recording of results, concept of stability, commitment etc. Important mechanistic and stability related information provided by results of study of factors like temperature, pH, buffering species ionic strength and dielectric constant etc. on the reaction rates with practical considerations. Photostability testing guidelines, ICH stability guidelines for biological products (ICHQ5C).

Stability testing of phytopharmaceuticals: Regulatory requirements, protocols, HPTLC/HPLC finger printing, interactions and complexity. 12 Hours

Unit 4: Biological tests: Preservative challenging test, disinfectant efficacy test and its validation. Neutralizer efficacy test, membrane filter integrity test, bacterial endotoxin test & microbial limit test. Container–closure integrity test for sterile products. 12 Hours

Unit 5: Immunoassays (IA): Basic principles, Production of antibodies, Separation of bound and unbound drug, Radioimmunoassay, Optical IA, Enzyme IA (ELISA), Fluoro IA, Luminescence IA, Quantification and applications of IA. 10 Hours

REFERENCES

1. Vogel's Textbook of Quantitative Chemical Analysis - Jeffery J Bassett, J. Mendham, R. C. Denney. 5th ed. ELBS, 1991.

2. Practical Pharmaceutical Chemistry - Beckett and Stenlake. Vol 2, 4th ed. CBS Publishers, New Delhi.

3. Textbook of Pharmaceutical Analysis – K.A. Connors. 3rd ed. John Wiley & Sons, 1982

4. Pharmaceutical Analysis - Higuchi, 2nd ed. Wiley – Inter Science Publication, 1961.

5. Quantitative Analysis of Drugs in Pharmaceutical Formulation – P.D. Sethi, 3rd ed. CBS Publishers, New Delhi.

6. Pharmaceutical Analysis- Modern Methods – J.W. Munson – Part B. Volume 11, Marcel Dekker.

7. The Quantitative Analysis of Drugs – D.C. Carratt. 3rd ed. CBS Publishers, New Delhi, 1964.

8. Indian Pharmacopoeia 2007, 2010, 2014 & 2018.

9. Methods of Sampling and Microbiological Examination of Water, First Revision, BIS

10. Analytical Profiles of Drug Substances – Klaus Florey. Vol 1 – 20, Elsevier, 2005

11. Analytical Profiles of Drug Substances and Excipients – Harry G Brittain. Volume 30, Elsevier, 2005.

12. The Analysis of Drugs in Biological Fluids - Joseph Chamberlain. 2nd ed. CRC Press,

13. ICH Guidelines for Impurity Profiles and Stability Studies

PHARMACEUTICAL VALIDATION (MPA 103T)

(Note: Common paper for MPA and MQA specializations)

Unit 1: Introduction to validation: Definition of calibration, qualification and validation, scope, frequency and importance. Difference between calibration and validation. Calibration of weights and measures. Advantages of validation, scope of validation, organization for validation, validation master plan, types of validation, streamlining of qualification & validation process and validation master plan.

Qualification: User requirement specification, design qualification, factory acceptance test (FAT)/site acceptance test (SAT), installation qualification, operational qualification, performance qualification, re-qualification (Maintaining status-calibration preventive maintenance, change management). 12 Hours

Unit 2: Qualification of analytical instruments/Equipment: Training & qualification of analyst. qualification of UV-visible spectrophotometer, FTIR, DSC, GC, HPLC, HPTLC, and dissolution test apparatus. 10 Hours

Unit 3: Validation of utility systems: Pharmaceutical water system, HVAC system, compressed air and nitrogen. Facility qualification, AHU validation, clean room validation.

Cleaning validation: Cleaning method development, sampling techniques, validation of analytical method used in cleaning. Cleaning of equipment, cleaning of facilities. Cleaning in place (CIP). Validation of facilities in sterile and non-sterile plant.

Computerized system validation: Electronic records and digital significance-21 CFR part 11 and GAMP 5, LIMS, audit trail and data integrity. 12 Hours

Unit 4: Process validation: Concept, process and documentation of process validation. Prospective, concurrent & retrospective validation, re validation criteria, process validation of various formulations (coated tablets, capsules, ointment/creams, liquid orals and aerosols).

Aseptic filling: Media fill validation, USFDA guidelines on process validation- A life cycle approach.

Analytical method validation: General principles, validation of analytical method as per ICH guidelines (Q2A) and USP. Preparation & qualification of working standards and reference standards. 12 Hours

Unit 5: General principles of intellectual property: Concepts of intellectual property (IP), intellectual property protection (IPP), intellectual property rights (IPR); economic importance, mechanism for protection of intellectual property – patents, copyright, trademark; factors affecting choice of IP protection; penalties for violation; role of IP in pharmaceutical industry; global ramification and financial implications. Filing a patent application; patent application forms and guidelines. Types of patent applications-provisional and non-provisional, PCT and convention patent applications; International patenting requirement procedures and costs; rights and responsibilities of a patentee; practical aspects regarding maintaining of a patent file; patent infringement meaning and scope. Significance of transfer of technology (TOT), IP and ethics-positive and negative aspects of IPP; societal responsibility, avoiding unethical practices. 14 Hours

REFERENCES

1. Pharmaceutical Process Validation - B. T. Loftus & R. A. Nash. Drugs and Pharm Sci. Series, Vol. 129, 3rd ed. Marcel Dekker.
2. The Theory & Practice of Industrial Pharmacy - Leon Lachman, Herbert A Lieberman & Joseph L Kanig. 3rd ed. Varghese Publishing House, Bombay.
3. Validation of Aseptic Pharmaceutical Processes - Carleton & Agalloco. 2nd ed. Marcel Dekker.
4. Pharmaceutical Process Scale-Up - Michael Levin. Drugs and Pharm. Sci. Series. Vol. 157. 2nd ed. Marcel Dekker.

5. Validation Standard Operating Procedures: A Step by Step Guide for Achieving Compliance in the Pharmaceutical, Medical Device, and Biotech Industries - Syed Imtiaz Haider.

6. Validation of Pharmaceutical Processes: Sterile Products - Frederick J Carlton and James Agalloco. 2nd ed. Marcel Dekker.

7. Pharmaceutical Equipment Validation: The Ultimate Qualification Handbook - Phillip A Cloud. Interpharm Press.

8. Analytical Method Validation and Instrument Performance Verification - Churg Chan, Heiman Lam, Y.C. Lee & Yue. Zhang. Wiley Inter Science.

9. Validation Master Plan - Terveeks or Deeks. Davis Harwood International Publishing.

FOOD ANALYSIS (MPA 104T)

Unit 1: Carbohydrates: Classification and properties of food carbohydrates, general methods of analysis of food carbohydrates, changes in food carbohydrates during processing, digestion, absorption and metabolism of carbohydrates. Dietary fiber, crude fiber and application of food carbohydrates.

Proteins: Chemistry and classification of amino acids and proteins, physico-chemical properties of protein and their structure, general methods of analysis of proteins and amino acids. 12 Hours

Unit 2: Lipids: Classification, general methods of analysis, determination of adulteration in fats and oils, various methods used for measurement of spoilage of fats and fatty foods.

Vitamins: Classification of vitamins, principle & microbial assays of vitamin-B₁, B₂ & B₁₂. 12 Hours

Unit 3: Food additives: Introduction, analysis of Preservatives, antioxidants, artificial sweeteners, flavors, flavor enhancers, stabilizers, thickening and jelling agents.

Pigments and synthetic dyes: Natural pigments, their occurrence and characteristic properties, permitted synthetic dyes, non-permitted synthetic dyes used by industries, method of detection of natural, permitted and non-permitted dyes. 12 Hours

Unit 4: General analytical methods for milk, milk constituents and milk products like ice cream, milk powder, butter, margarine, cheese including adulterants and contaminants of milk. Analysis of fermentation products like wine, spirits, beer and vinegar. 12 Hours

Unit 5: Pesticide analysis: Effects of pest and insects on various food, use of pesticides in agriculture, pesticide cycle, organophosphorus and organochlorine pesticides analysis, determination of pesticide residues in grain, fruits, vegetables, milk and milk products. Legislation regulations of

food products with special emphasis on BIS, Agmark, FDA and US-FDA. FSSAI guidelines-special emphasis on mycotoxins, microbiology, antibiotic residues in foods. HACCP (Biological, Physical & Chemical hazards), Regulatory aspects of CODEX Alimentarius. 12 Hours

REFERENCES

1. The Chemical Analysis of Foods – David Pearson. 7th ed. Churchill Livingstone, Edinburgh London, 1976
2. Introduction to the Chemical Analysis of Foods – S. Nielsen. Jones & Bartlett Publishers, Boston, London, 1994.
3. Official Methods of Analysis of AOAC International. 6th ed. Volume 1 & 2. 1997.
4. Analysis of Food Constituents – Multon. John Wiley & Sons.
5. Official methods of analysis of AOAC International - Dr. William Horwitz. 18th ed. 2005.

PHARMACEUTICAL ANALYSIS PRACTICAL - I (MPA 105P)

1. Analysis of Pharmacopoeial compounds and their formulations by UV-Vis spectrophotometer
2. Simultaneous estimation of multi component containing formulations by UV spectrophotometry
3. Experiments based on HPLC
4. Experiments based on gas chromatography
5. Estimation of riboflavin/quinine sulphate by fluorimetry
6. Estimation of sodium/potassium by flame photometry
7. Assay of official compounds by different titrations
8. Assay of official compounds by instrumental techniques.
9. Quantitative determination of hydroxyl group.
10. Quantitative determination of amino group
11. Colorimetric determination of drugs by using different reagents
12. Impurity profiling of drugs

PHARMACEUTICAL ANALYSIS PRACTICAL - II (MPA 106P)

1. Calibration of glassware
2. Calibration of pH meter
3. Calibration of UV-Visible spectrophotometer
4. Calibration of FTIR spectrophotometer
5. Calibration of GC instrument
6. Calibration of HPLC instrument
7. Cleaning validation of any one equipment

8. Determination of total reducing sugar
9. Determination of proteins
10. Determination of saponification value, iodine value, peroxide value, acid value in food products
11. Determination of fat content and rancidity in food products
12. Analysis of natural and synthetic colors in food
13. Determination of preservatives in food
14. Determination of pesticide residue in food products
15. Analysis of vitamin content in food products
16. Determination of density and specific gravity of foods
17. Determination of food additives.
18. Analysis of vanillin content in foods
19. Analysis of oxalate content in guava fruit
20. ELISA & CLIA – demonstration
21. IMVIC test - Indole test, methyl red test, Voges-Proskauer test, citrate utilization test

Second Semester

ADVANCED INSTRUMENTAL ANALYSIS (MPA 201T)

Unit 1: HPLC: Principle, analytical method development, pharmaceutical applications, peak shapes, capacity factor, selectivity, plate number, plate height, resolution, band broadening, pumps, injector, detectors, columns, column problems, gradient HPLC, HPLC solvents, trouble shooting, sample preparation, method development, new developments in HPLC-role and principles of ultra, nano liquid chromatography, and preparative HPLC in pharmaceutical analysis. Advancement in enantiomeric separations, Immobilized polysaccharide CSP's and HILIC approaches. 12 Hours

Unit 2: Biochromatography: Size exclusion chromatography, ion exchange chromatography, ion pair chromatography, affinity chromatography general principles - stationary phases and mobile phases.

Gas chromatography: Derivatization, head space sampling, analytical method development and quantification. 12 Hours

Unit 3: Super critical fluid chromatography: Principle, instrumentation, pharmaceutical applications.

Capillary electrophoresis: General considerations and method development in CE, Crown ethers as buffer additives in capillary electrophoresis. CE-MS hyphenation & its applications. 12 Hours

Unit 4: Mass spectrometry: LC-MS hyphenation and DART MS analysis. Mass analyzers (Quadrupole, Time of flight, FT-ICR, Ion Trap and Orbitrap)

instruments. MS/MS systems (Tandem: QqQ, TOF-TOF; Q-IT, Q-TOF, LTQ-FT, LTQ-Orbitrap). 12 Hours

Unit 5: NMR spectroscopy : Brief outline of principles of NMR & FT-NMR. Spin-spin and spin-lattice relaxation phenomenon. ¹³C NMR, 1-D and 2-D NMR, NOESY and COSY techniques, interpretation and qualitative and quantitative applications of NMR spectroscopy. LC-NMR hyphenations. ICP-MS, ICP-OES, PES, TOC Analysis, KF titration, melting point determination using advanced instrumentation. 12 Hours

REFERENCES

1. Spectrometric Identification of Organic Compounds - Robert M Silverstein. 6th ed. John Wiley & Sons, 2004.
2. Principles of Instrumental Analysis - Douglas A Skoog, F. James Holler & Timothy A Nieman. 5th ed. Eastern Press, Bangalore, 1998.
3. Instrumental Methods of Analysis – Willards. 7th ed. CBS Publishers, New Delhi.
4. Organic Spectroscopy - William Kemp. 3rd ed. ELBS, 1991.
5. Quantitative Analysis of Pharmaceutical Formulations by HPTLC – P.D. Sethi. CBS Publishers, New Delhi.
6. Quantitative Analysis of Drugs in Pharmaceutical Formulation – P.D. Sethi. 3rd ed. CBS Publishers, New Delhi.
7. Pharmaceutical Analysis- Modern Methods – Part B – J.W. Munson. Vol 11, Marcel Dekker Series.
8. Organic Spectroscopy - Donald L Paviya. 5th ed.

MODERN BIO-ANALYTICAL TECHNIQUES (MPA 202T)

Unit 1: Extraction of drugs and metabolites from biological matrices: General need, principle and procedure involved in the bioanalytical methods such as protein precipitation, liquid - liquid extraction and solid phase extraction and other novel sample preparation approach.

Bioanalytical method validation: USFDA and EMEA guidelines. 12 Hours

Unit 2: Biopharmaceutical consideration: Introduction, in vitro: dissolution and drug release testing, alternative methods of dissolution testing. Solubility: experimental methods. permeability: in-vitro, in-situ and in-vivo methods. 12 Hours

Unit 3: Pharmacokinetics and toxicokinetics: Basic consideration, drug interaction (PK-PD interactions), the effect of protein-binding interactions, the effect of tissue-binding interactions, toxicokinetics-toxicokinetic evaluation in preclinical studies, importance and applications of toxicokinetic studies. LC-MS in bioactivity screening and proteomics. 12 Hours

Unit 4: Metabolite identification: In vitro/in vivo approaches, protocols and sample preparation. Microsomal approaches (rat liver microsomes (RLM) and human liver microsomes (HLM) in Met-ID - Regulatory perspectives. In vitro assay of drug metabolites & drug metabolizing enzymes. 12 Hours

Unit 5: Drug product performance: In vivo: bioavailability and bioequivalence. Drug product performance, purpose of bioavailability studies, relative and absolute availability. Methods for assessing bioavailability, bioequivalence studies, design and evaluation of bioequivalence studies, study designs, crossover study designs, generic biologics (biosimilar drug products), clinical significance of bioequivalence studies. 12 Hours

REFERENCES

1. Analysis of Drugs in Biological Fluids - Joseph Chamberlain. 2nd ed. CRC Press.
2. Principles of Instrumental Analysis - Douglas A Skoog. 5th ed. Eastern Press, Bangalore.
3. Pharmaceutical Analysis - Higuchi, Brochman & Hassen. 2nd ed. Wiley Interscience
4. Pharmaceutical Analysis - Modern methods – Part B – J.W. Munson. Vol 11, Marcel Dekker.
5. Practical HPLC Method Development – Snyder & Kirkland. 2nd ed. John Wiley & Sons.
6. Chromatographic Analysis of Pharmaceuticals – John A Adamovics. 2nd ed. Marcel Dekker.
7. Chromatographic Methods in Clinical Chemistry & Toxicology – Roger L Bertholf & Ruth E Winecker. John Wiley & Sons, New Jersey, USA, 2007.
8. Good Laboratory Practice Regulations - Sandy Weinberg. Vol. 69. 2nd ed. Marcel Dekker.
9. Good laboratory Practice Regulations – Allen F. Hirsch. Vol. 38. Marcel Dekker, 1989.
10. ICH, USFDA & CDSO Guidelines.

QUALITY CONTROL AND QUALITY ASSURANCE (MPA 203T)

(Common paper for MPA and MQA specializations)

Unit 1: Introduction: Concept and evolution of quality control and quality assurance. Good laboratory practice, GMP, overview of ICH guidelines - QSEM, with special emphasis on Q- series guidelines.

Good laboratory practices: Scope of GLP, definitions, quality assurance unit, protocol for conduct of non-clinical testing.

CPCSEA guidelines: Control on animal house, report preparation and documentation. 12 Hours

Unit 2: cGMP guidelines according to schedule M, USFDA (inclusive of CDER and CBER) Pharmaceutical Inspection Convention (PIC), WHO and EMEA covering: Organization and personnel responsibilities, training, hygiene and personal records, drug industry location, design, construction and plant lay out, maintenance, sanitation, environmental control, utilities and maintenance of sterile areas, clean room validation, control of contamination, sterility assurance, AHU system & qualification, and Good Warehousing Practice. 12 Hours

Unit 3: Developing specification (ICH Q6 and Q3), sampling methods for raw and packing materials. Purchase specifications, vendor qualification and maintenance of stores for various materials.

Testing of primary packing materials as per IP & USP: Glass containers, plastics, rubber.

Analysis of raw materials, packaging materials: In-process quality control and finished products quality control for following formulations in pharma industry according to Indian, US and British pharmacopoeias: tablets, capsules, ointments, suppositories, creams, parenterals, ophthalmic and surgical products. Quality control test for containers, closures and secondary packing materials. 12 Hours

Unit 4: Documentation in pharmaceutical industry: Three tier documentation, policy, procedures and work instructions, and records (Formats), basic principles - how to maintain, retention and retrieval etc. Standard operating procedures (how to write), Master Formula Record, Batch Manufacturing Record, quality audit plan and reports. Specification and test procedures, protocols and reports. distribution records. Electronic data handling. Concepts of controlled and uncontrolled documents. Submission documents for regulators DMFs, as Common Technical Document and Electronic Common Technical Documentation (CTD, eCTD). 12 Hours

Unit 5: Manufacturing operations and controls: Sanitation of manufacturing premises, mix-ups and cross contamination, processing of intermediates and bulk products, packaging operations, IPQC, release of finished product, process deviations, charge-in of components, time limitations on production, drug product inspection, expiry date calculation, calculation of yields, production record review, change control, sterile products, aseptic process control, packaging. 12 Hours

REFERENCES

1. Quality Assurance Guide by organization of Pharmaceutical Procedures of India. 3rd Revised ed. Vol 1 & 2, Mumbai, 1996.

2. Good Laboratory Practice Regulations - Sandy Weinberg. Vol. 69. 2nd ed. Marcel Dekker.

3. Quality Assurance of Pharmaceuticals - A compendium of Guidelines and Related Materials. Vol 1 & 2. 2nd ed. WHO Publications, 1999.

4. How to Practice GMP's - P.P. Sharma. Vandana Publications, Agra, 1991.

5. The International Pharmacopoeia - Vol. I, II, III, IV & V - General Methods of Analysis and Quality Specification for Pharmaceutical Substances, Excipients and Dosage forms, 3rd ed. WHO, Geneva, 2005.

6. Good Laboratory Practice Regulations - Allen F Hirsch. Vol 38. Marcel Dekker.

7. ICH guidelines

8. ISO 9000 and Total Quality Management

9. The Drugs and Cosmetics Act 1940 - Deshpande & Nilesh Gandhi. 4th ed. Susmit Publishers.

10. QA Manual - D.H. Shah 1st ed. Business Horizons, 2000.

11. Good Manufacturing Practices for Pharmaceuticals; A Plan for Total Quality Control - Sidney H. Willig. Vol. 52. 3rd ed. Marcel Dekker.

12. GMP/ISO Quality Audit Manual for Healthcare Manufacturers and Their Suppliers - Steinborn L (Volume 1 - With Checklists and Software Package). 6th ed. Taylor & Francis.

13. Quality Systems and Controls for Pharmaceuticals - D.K. Sarker. John Wiley & Sons, 2008.

HERBAL AND COSMETIC ANALYSIS (MPA 204T)

Unit 1: Herbal remedies: Toxicity and regulations: Herbals vs. conventional drugs, Efficacy of herbal medicine products, validation of herbal therapies, pharmacodynamics and pharmacokinetic issues. Herbal drug standardization: WHO and AYUSH guidelines.

Regulatory requirements for setting herbal drug industry: Global marketing management, Indian and international patent law as applicable herbal drugs and natural products and its protocol. 12 Hours

Unit 2: Adulteration and deterioration: Introduction, types of adulteration/substitution of herbal drugs, causes and measure of adulteration, sampling procedures, determination of foreign matter, DNA finger printing techniques in identification of drugs of natural origin, heavy metals, pesticide residues, phototoxin and microbial contamination in herbal formulations. 12 Hours

Unit 3: Testing of natural products and drugs: Effect of herbal medicine on clinical laboratory testing, adulterant screening using modern analytical

instruments, stability testing of natural products, protocol. Monographs of herbal drugs: Study of monographs of herbal drugs and comparative study in IP, USP, Ayurvedic Pharmacopoeia, American Herbal Pharmacopoeia, British Herbal Pharmacopoeia, WHO guidelines in quality assessment of herbal drugs.

12 Hours

Unit 4: Herbal drug-drug interaction: WHO and AYUSH guidelines for safety monitoring of natural medicine, spontaneous reporting schemes for bio drug adverse reactions, bio drug- drug and bio drug-food interactions with suitable examples. Challenges in monitoring the safety of herbal medicines. 12 Hours

Unit 5: Evaluation of cosmetic products: Determination of moisture, ash, volatile matter, heavy metals, fineness of powder, density, viscosity of cosmetic raw materials and finished products. Study of quality of raw materials and general methods of analysis of raw material used in cosmetic manufacture as per BIS.

Schedule S: Standards for cosmetics. Indian Standard specification laid down for sampling and testing of various cosmetics in finished forms such as baby care products, skin care products, dental products, personal hygiene preparations, lips sticks. Hair products and skin creams by the Bureau Indian Standards. 12 Hours

REFERENCES

1. Pharmacognosy - G. E. Trease & W.C. Evans. Saunders Edinburgh, New York.
2. Pharmacognosy - Kokate, Purohit & Gokhale.
3. Quality Control Methods for Medicinal Plant, WHO, Geneva.
4. Pharmacognosy & Pharmacobiotechnology - Ashutosh Kar.
5. Essential of Pharmacognosy - S.H.Ansari.
6. Cosmetics – Formulation, Manufacturing and Quality Control - P.P. Sharma. 4th ed. Vandana Publications Pvt. Ltd., Delhi.
7. Indian Standard Specification for Raw Materials, BIS, New Delhi.
8. Indian Standard Specification for 28 Finished Cosmetics BIS, New Delhi.
9. Harry's Cosmeticology. 8th ed.
10. Suppliers Catalogue on Specialized Cosmetic Excipients.
11. Poucher's Perfumes, Cosmetics & Soaps – Hilda Butler. 10th ed. Kluwer Academic Publishers.
12. Handbook of Cosmetic Science and Technology. 3rd ed.

PHARMACEUTICAL ANALYSIS PRACTICAL - III (MPA 205P)

1. Comparison of absorption spectra by UV and Wood ward - Fiesure rule
2. Interpretation of organic compounds by FTIR
3. Interpretation of organic compounds by NMR
4. Interpretation of organic compounds by MS
5. Determination of purity by DSC in pharmaceuticals
6. Identification of organic compounds using FTIR, NMR, CNMR and mass spectra
7. In process and finished product quality control tests for tablets, capsules, parenterals and creams
8. Quality control tests for primary and secondary packing materials
9. Assay of raw materials as per official monographs
10. Bio molecules separation utilizing various sample preparation techniques and quantitative analysis of components by gel electrophoresis.
11. Bio molecules separation utilizing various sample preparation techniques and quantitative analysis of components by HPLC techniques
12. Isolation of analgesics from biological fluids (blood, serum and urine)
13. Protocol preparation and performance of analytical/bio analytical method validation
14. Protocol preparation for the conduct of BA/BE studies according to guidelines
15. Testing of related and foreign substances in drugs and raw materials
16. Preparation of Master Formula Record
17. Preparation of Batch Manufacturing Record
18. Quantitative analysis of rancidity in lipsticks and hair oil
19. Determination of aryl amine content and developer in hair dye
20. Determination of foam height and SLS content of shampoo
21. Determination of total fatty matter in creams (soap, skin and hair creams)
22. Determination of acid value and saponification value
23. Determination of calcium thioglycolate in depilatories

Pharmaceutical Chemistry (MPC 101T)

First Semester

Modern Pharmaceutical Analytical Techniques (MPC 101T)

(Note: Common paper for MPA, MPC, MPH, MPB, MPL, MPG, MQA, & MIP, specializations)

Unit 1: a. UV-visible spectroscopy: Introduction, theory, laws and instrumentation associated with UV-visible spectroscopy, choice of solvents and solvent effect and applications of UV-visible spectroscopy.

b. IR spectroscopy: Theory, modes of molecular vibrations, sample handling, instrumentation of dispersive and Fourier-Transform IR Spectrometer, factors affecting vibrational frequencies and applications of IR spectroscopy, data interpretation.

c. Spectrofluorimetry: Theory of fluorescence, factors affecting fluorescence (characteristics of drugs that can be analyzed by fluorimetry), quenchers, instrumentation and Applications of fluorescence spectrophotometer.

d. Flame emission spectroscopy and Atomic absorption spectroscopy: Principle, instrumentation, interferences and applications. 12 Hours

Unit 2: NMR spectroscopy: Quantum numbers and their role in NMR, Principle, Instrumentation, Solvent requirement in NMR, Relaxation process, NMR signals in various compounds, Chemical shift, Factors influencing chemical shift, Spin-Spin coupling, Coupling constant, Nuclear magnetic double resonance, Brief outline of principles of FT-NMR and ¹³C NMR. Applications of NMR spectroscopy. 10 Hours

Unit 3: Mass Spectroscopy: Principle, Theory, Instrumentation of Mass Spectroscopy, Different types of ionization like electron impact, chemical, field, FAB and MALDI, APCI, ESI, APPI Analyzers of Quadrupole and Time of Flight, Mass fragmentation and its rules, Meta stable ions, Isotopic peaks and Applications of Mass spectroscopy. 10 Hours

Unit 4: Chromatography: Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution, isolation of drug from excipients, data interpretation and applications of the following:

a) Thin Layer chromatography b) High Performance Thin Layer Chromatography c) Ion exchange chromatography d) Column chromatography e) Gas chromatography f) High Performance Liquid chromatography g) Ultra High Performance Liquid chromatography h) Affinity chromatography i) Gel Chromatography. 14 Hours

Unit 5: a. Electrophoresis: Principle, Instrumentation, Working conditions, factors affecting separation and applications of the following: a) Paper electrophoresis b) Gel electrophoresis

c) Capillary electrophoresis d) Zone electrophoresis e) Moving boundary electrophoresis f) Iso electric focusing.

b. X ray Crystallography: Production of X rays, Different X ray methods, Bragg's law, Rotating crystal technique, X ray powder technique, Types of crystals and applications of X-ray diffraction.

c. Thermal Techniques: Principle, instrumentation, advantage and disadvantages, Pharmaceutical applications of DSC, DTA & TGA.

d. Microscopic techniques: Principles and applications of Scanning Electron Microscopy and Transmission Electron Microscopy analysis. 14 Hours

REFERENCES

1. Spectrometric Identification of Organic compounds - Robert M Silverstein. 6th ed. John Wiley & Sons, 2004.

2. Principles of Instrumental Analysis - Douglas A Skoog, F. James Holler & Timothy A Nieman. 5th ed. Eastern Press, Bangalore, 1998.

3. Instrumental Methods of Analysis – Willards. 7th ed. CBS Publishers, New Delhi.

4. Practical Pharmaceutical Chemistry – Beckett and Stenlake. Vol 2. 4th ed. CBS Publishers, New Delhi

5. Organic Spectroscopy - William Kemp. 3rd ed. ELBS, 1991.

6. Quantitative Analysis of Drugs in Pharmaceutical Formulation – P.D. Sethi. 3rd ed. CBS Publishers, New Delhi, 1997.

7. Pharmaceutical Analysis - Modern Methods – Part B – J.W. Munson. Vol 11. Marcel- Dekker Series.

8. Spectroscopy of Organic Compounds - P.S. Kalsi. 2nd ed. Wiley Eastern Ltd., Delhi.

9. Textbook of Pharmaceutical Analysis – K.A. Connors. 3rd ed. John Wiley & Sons.

ADVANCED ORGANIC CHEMISTRY – I (MPC 102T)

Unit 1: Basic aspects of organic chemistry: 1. Organic intermediates: Carbocations, carbanions, free radicals, carbenes and nitrenes. Their method of formation, stability and synthetic applications.

2. Types of reaction mechanisms and methods of determining them.

3. Detailed knowledge regarding the reactions, mechanisms and their relative reactivity and orientations. Addition reactions: a) Nucleophilic uni- and bimolecular reactions (SN1 and SN2) b) Elimination reactions (E1 & E2; Hoffman & Saytzeff's rule) c) Rearrangement reaction. 12 Hours

Unit 2: Study of mechanism and synthetic applications of following named reactions: Ugi reaction, Brook rearrangement, Ullmann coupling reactions, Dieckmann Reaction, Doebner- Miller Reaction, Sandmeyer Reaction, Mitsunobu reaction, Mannich reaction, Vilsmeier- Haack

Reaction, Sharpless asymmetric epoxidation, Baeyer-Villiger oxidation, Shapiro & Suzuki reaction, Ozonolysis and Michael addition reaction. 12 Hours

Unit 3: Synthetic reagents & applications: Aluminium isopropoxide, N-bromo succinamide, diazomethane, dicyclo hexyl carbodimide, Wilkinson reagent, Witting reagent. Osmium tetroxide, titanium chloride, diazopropane, diethyl azido carboxylate, triphenyl phosphine, benzotriazol-1-yloxy tris(dimethylamino) phosphonium hexafluoro-phosphate (BOP), potassium-*t*-butoxide, lead tetra acetate, sodium methoxide

Protecting groups

- Role of protection in organic synthesis
- Protection for the hydroxyl group, including 1,2-and 1,3-diols: ethers, esters, carbonates, cyclic acetals & ketals
- Protection for the carbonyl group: Acetals and ketals
- Protection for the carboxyl group: Amides and hydrazides, esters
- Protection for the amino group and amino acids: Carbamates and amides 12 Hours

Unit 4: Heterocyclic chemistry: Organic name reactions with their respective mechanism and application involved in synthesis of drugs containing five, six membered and fused heterocyclics such as Debus-Radziszewski imidazole synthesis, Knorr pyrazole synthesis Pinner pyrimidine synthesis, Combes quinoline synthesis, Berntsen acridine synthesis, Smiles rearrangement and Traube purine synthesis.

Synthesis of few representative drugs containing these heterocyclic nucleus such as ketoconazole, metronidazole, miconazole, celecoxib, antipyrin, metamizole sodium, terconazole, alprazolam, triamterene, sulfamerazine, trimethoprim, hydroxy chloroquine, quinine, chloroquine, quinacrine, amsacrine, prochlorperazine, promazine, chlorpromazine, theophylline, mercaptopurine and thioguanine. 12 Hours

Unit 5: Synthon approach and retrosynthesis applications

- Basic principles, terminologies and advantages of retro synthesis; guidelines for dissection of molecules.
- Functional group interconvert ion and addition (FGI and FGA), C-X disconnections; C-C disconnections – alcohols and carbonyl compounds; 1,2-, 1,3-, 1,4-, 1,5-, 1,6- difunctionalized compounds.
- Strategies for synthesis of three, four, five and six membered ring with examples. 12 Hours

REFERENCES

- Advanced Organic Chemistry, Reaction, Mechanisms and Structure – J. March. John Wiley & Sons, New York.

- Mechanism and Structure in Organic Chemistry – E.S. Gould, Hold Rinchart & Winston.

- Organic Chemistry - Clayden, Greeves, Warren & Wothers. Oxford University Press 2001.

- Organic Chemistry - I.L. Finar. Vol 1 and 2. ELBS, Pearson Education.

- A guide to Mechanisms in Organic Chemistry - Peter Skyes. Orient Longman, New Delhi.

- Reactive Intermediates in Organic Chemistry - Tandon & Gowel. Oxford & IBH Publishers.

- Combinational Chemistry - Synthesis and Applications – Stephen R Wilson & Anthony W Czarnik. Wiley-Blackwell.

- Organic Chemistry – Carey. 5th ed. Viva Books Pvt. Ltd.

- Organic Synthesis - The Disconnection Approach - S. Warren. Wiley India

- Principles of Organic Synthesis – R.O.C. Norman & J.M. Coxan. Nelson Thornes.

- Organic Synthesis - Special Techniques – V.K. Ahluwalia and R. Agarwal. Narosa Publishers.

- Organic Reaction Mechanisms – V.K. Ahluwalia & R.K. Parashar 4th ed. Narosa Publishers.

ADVANCED MEDICINAL CHEMISTRY (MPC 103T)

Unit 1: Drug discovery: Stages of drug discovery, lead discovery; identification, validation and diversity of drug targets. Biological drug targets: Receptors, types, binding and activation, theories of drug receptor interaction, drug receptor interactions, agonists vs. antagonists, artificial enzymes. 12 Hours

Unit 2: Pro-drug design and analog design: 1. Pro-drug design: Basic concept, Carrier linked pro-drugs/Bio-precursors, pro-drugs of functional group, pro-drugs to improve patient acceptability, drug solubility, drug absorption and distribution, site specific drug delivery and sustained drug action. Rationale of pro-drug design and practical consideration of pro-drug design.

- Combating drug resistance: Causes for drug resistance, strategies to combat drug resistance in antibiotics and anticancer therapy, genetic principles of drug resistance.

- Analog design: Introduction, classical & non classical, bio-isosteric replacement strategies, rigid analogs, alteration of chain branching, changes in ring size, ring position isomers, design of stereo isomers and geometric

isomers, fragments of a lead molecule, variation in inter-atomic distance.
12 Hours

Unit 3: 1. Medicinal chemistry aspects of the following classes of drugs, systematic study, SAR, mechanism of action and synthesis of new generation molecules of following classes of drugs:

a) Anti-hypertensive drugs, psycho-active drugs, anti-convulsant drugs, H1 & H2 receptor antagonist, COX-1 & COX-2 inhibitors, adrenergic & cholinergic agents, anti-neoplastic and antiviral agents. b) Stereochemistry and drug action: Realization that stereo selectivity is a pre-requisite for evolution. Role of chirality in selective and specific therapeutic agents. Case studies, enantio selectivity in drug adsorption, metabolism, distribution and elimination. 12 Hours

Unit 4: Rational design of enzyme inhibitors: Enzymes as targets - enzyme kinetics & principles of enzyme inhibitors, enzyme inhibitors in medicine, enzyme inhibitors in basic research, rational design of non-covalently and covalently binding enzyme inhibitors. 12 Hours

Unit 5: Peptidomimetics: Therapeutic values of peptidomimetics, design of peptidomimetics by manipulation of the amino acids, modification of the peptide backbone, incorporating conformational constraints locally or globally. Chemistry of prostaglandins, leukotrienes and thromboxones. 12 Hours

REFERENCES

1. Medicinal Chemistry – Burger. Vol. 1 –6.
2. Wilson and Gisvold's Text Book of Organic Medicinal and Pharmaceutical Chemistry, 12th ed. Lippincott, New Delhi.
3. Comprehensive Medicinal Chemistry - Corwin & Hansch. Pergamon Publishers.
4. Computational and Structural Approaches to Drug Design - Robert M Stroud
5. Introduction to Quantitative Drug Design - Y.C. Martin.
6. Principles of Medicinal Chemistry - William Foye. 7th ed. Lippincott, New Delhi.
7. Drug Design Volumes – Arienes. Academic Press, Elsevier Publishers, Noida, UP.
8. Principles of Drug Design - Smith.
9. The Organic Chemistry of the Drug Design and Drug Action - Richard B Silverman. 2nd ed. Elsevier Publishers, New Delhi.
10. An Introduction to Medicinal Chemistry - Graham L Patrick. 3rd ed. Oxford University Press, USA.

11. Biopharmaceutics and Pharmacokinetics – D.M. Brahmarkar. 2nd ed. Vallabh Prakashan.

12. Peptidomimetics in Organic and Medicinal Chemistry - Antonio Guarna & Andrea Trabocchi. 1st ed. Wiley Publishers.

CHEMISTRY OF NATURAL PRODUCTS (MPC 104T)

Unit 1: Study of Natural products as leads for new pharmaceuticals for the following classes of drugs: a) Drugs affecting the central nervous system: morphine alkaloids. b) Anticancer drugs: paclitaxel and docetaxel, etoposide, and teniposide c) Cardiovascular drugs: lovastatin, teprotide and dicoumarol d) Neuro-muscular blocking drugs: curare alkaloids e) Anti-malarial drugs and analogues f) Chemistry of macrolide antibiotics: erythromycin, azithromycin, roxithromycin, and clarithromycin, tetracycline and β -lactam antibiotics (cephalosporins and carbapenem). 12 Hours

Unit 2: 1. Alkaloids: General introduction, classification, isolation, purification, molecular modification and biological activity of alkaloids, general methods of structural determination of alkaloids, structural elucidation and stereochemistry of ephedrine, morphine, ergot, emetine and reserpine, Cinchona alkaloids, artemisin and its derivatives.

2. Flavonoids: Introduction, isolation and purification of flavonoids, general methods of structural determination of flavonoids; Structural elucidation of quercetin.

3. Steroids: General introduction, chemistry of sterols, sapogenin and cardiac glycosides. Stereochemistry and nomenclature of steroids, chemistry of contraceptive agents male & female sex hormones (testosterone, estradiol, progesterone), adrenocorticoids (cortisone), contraceptive agents and steroids (vitamin D). 12 Hours

Unit 3: 1. Terpenoids: Classification, isolation, isoprene rule and general methods of structural elucidation of terpenoids; Structural elucidation of drugs belonging to mono (citral, menthol, camphor), di (retinol, phytol, taxol) and tri terpenoids squalene, ginsenoside carotinoids (α carotene).

2. Vitamins: Chemistry and physiological significance of vitamin A, B₁, B₂, B₁₂, C, E, folic acid and niacin. 12 Hours

Unit 4: 1. Recombinant DNA technology and drug discovery: rDNA technology, hybridoma technology, new pharmaceuticals derived from biotechnology; oligo-nucleotide therapy. Gene therapy: Introduction, clinical application and recent advances in gene therapy, principles of RNA & DNA estimation.

2. Active constituent of certain crude drugs used in indigenous system diabetic therapy - Gymnema sylvestre, Salacia reticulata, Pterocarpus marsupium, Swertia chirata, Trigonella foenum graecum; Liver dysfunction – Phyllanthus niruri; Antitumor – Curcuma longa Linn.

12 Hours

Unit 5: Structural characterization of natural compounds: Structural characterization of natural compounds using IR, ¹H NMR, ¹³C NMR and MS spectroscopy of specific drugs, e.g., penicillin, morphine, camphor, vitamin D, quercetin and digitalis glycosides. 12 Hours

REFERENCES

1. Modern Methods of Plant Analysis - Peech & M.V. Tracey. Springer-Verlag, Berlin.
2. Phytochemistry – Miller - Jan Nostrant Rein Hld, Vol. 1 and 2.
3. Recent Advances in Phytochemistry - Scikel Runeckles. Vol. 1 to 4. Springer Science.
4. Chemistry of Natural Products, Vol 1 onwards IWPAC.
5. Natural Product Chemistry - Nakanishi Gggolo. University Science Books, California.
6. Natural Product Chemistry "A laboratory Guide" – Rapheal Khan.
7. The Alkaloid Chemistry and Physiology - RHF Manske. Academic Press.
8. Introduction to Molecular Phytochemistry – C.H.J. Wells. Chapmanstall.
9. Organic Chemistry of Natural Products - Gurdeep & Chatwall, Vol 1 and 2. Himalaya Publishing House.
10. Organic Chemistry of Natural Products - O.P. Agarwal, Vol 1 and 2. Krishan Prakashan.
11. Organic Chemistry - I.L. Finar. Vol 1 and 2. Pearson Education.
12. Elements of Biotechnology - P.K. Gupta. Rastogi Publishers.
13. Pharmaceutical Biotechnology - S.P.Vyas and V.K. Dixit. CBS Publishers, New Delhi.
14. Biotechnology - Purohit and Mathur. 13th ed. Agro-Bios.
15. Phytochemical Methods of Harborne. Springer, Netherlands.
16. Medicinal Chemistry – Burger. Vol. 1-6.

PHARMACEUTICAL CHEMISTRY PRACTICAL – I (MPC 105P)

1. Analysis of Pharmacopoeial compounds and their formulations by UV-Vis spectrophotometer, RNA & DNA estimation
2. Simultaneous estimation of multi component containing formulations by UV spectrophotometry
3. Experiments based on column chromatography
4. Experiments based on HPLC
5. Experiments based on gas chromatography

6. Estimation of riboflavin/quinine sulphate by fluorimetry
7. Estimation of sodium/potassium by flame photometry

PHARMACEUTICAL CHEMISTRY PRACTICAL - II (MPC 106P)

To perform the following reactions of synthetic importance:

1. Purification of organic solvents, column chromatography
2. Claisen-Schmidt reaction
3. Benzylic acid rearrangement
4. Beckmann rearrangement
5. Hoffmann rearrangement
6. Mannich reaction
7. Synthesis of medicinally important compounds involving more than one step along with purification and characterization using TLC, melting point and IR spectroscopy (4 experiments)
8. Estimation of elements and functional groups in organic natural compounds
9. Isolation, characterization like melting point, mixed melting point, molecular weight determination, functional group analysis, co-chromatographic technique for identification of isolated compounds and interpretation of UV and IR data
10. Some typical degradation reactions to be carried on selected plant constituents

Second Semester

ADVANCED SPECTRAL ANALYSIS (MPC 201T)

Unit 1: UV and IR spectroscopy: Wood Ward – Fieser rule for 1,3-butadienes, cyclic dienes and α,β-carbonyl compounds and interpretation compounds of enones. ATR-IR, IR Interpretation of organic compounds. 12 Hours

Unit 2: NMR spectroscopy: 1-D and 2-D NMR, NOESY and COSY, HECTOR, INADEQUATE techniques, interpretation of organic compounds. 12 Hours

Unit 3: Mass spectroscopy: Mass fragmentation and its rules, fragmentation of important functional groups like alcohols, amines, carbonyl groups and alkanes, meta stable ions, Mc Lafferty rearrangement, ring rule, isotopic peaks, interpretation of organic compounds. 12 Hours

Unit 4: Chromatography: Principle, instrumentation and applications of the following:

a) GC-MS b) GC-AAS c) LC-MS d) LC-FTIR e) LC-NMR f) CEMS g) High performance thin layer chromatography h) Supercritical fluid chromatography i) Ion chromatography

j) I-EC (Ion-exclusion chromatography) k) Flash chromatography. 12 Hours Unit 5:

1. Thermal methods of analysis: Introduction, principle, instrumentation and application of DSC, DTA and TGA.

2. Raman Spectroscopy, introduction, principle, instrumentation and applications.

3. Immuno and radio immuno assay, biological standardization, bioassay, ELISA, radioimmunoassay of digitalis and insulin. 12 Hours

REFERENCES

1. Spectrometric Identification of Organic Compounds - Robert M Silverstein. 6th ed. John Wiley.

2. Principles of Instrumental Analysis - Douglas A Skoog, F. James Holler & Timothy A Nieman. 5th ed. Eastern Press, Bangalore, 1998.

3. Instrumental Methods of Analysis – Willards. 7th ed. CBS Publishers, New Delhi.

4. Organic Spectroscopy - William Kemp. 3rd ed. ELBS, 1991.

5. Quantitative Analysis of Pharmaceutical Formulations by HPTLC – P.D. Sethi. CBS Publishers, New Delhi.

6. Quantitative Analysis of Drugs in Pharmaceutical formulation – P.D. Sethi. 3rd ed. CBS Publishers, New Delhi.

7. Pharmaceutical Analysis- Modern Methods - Part B – J.W. Munson. Vol 11. Marcel Dekker.

ADVANCED ORGANIC CHEMISTRY – II (MPC 202T)

Unit 1: Green chemistry: Introduction, principles of green chemistry. Microwave assisted reactions: Merit and demerits of its use, increased reaction rates, mechanism, superheating effects of microwave, effects of solvents in microwave assisted synthesis, microwave technology in process optimization, its applications in various organic reactions and heterocycle synthesis. Ultrasound assisted reactions: Types of sonochemical reactions, homogenous, heterogeneous liquid-liquid and liquid-solid reactions, synthetic applications. Continuous flow reactors: Working principle, advantages and synthetic applications. 12 Hours

Unit 2: Chemistry of peptides: Coupling reactions in peptide synthesis. Principles of solid phase peptide synthesis, t-BOC and FMOC protocols, various solid supports and linkers: Activation procedures, peptide bond formation, deprotection and cleavage from resin, low and high HF cleavage protocols, formation of free peptides and peptide amides, purification and

case studies, site-specific chemical modifications of peptides. Segment and sequential strategies for solution phase peptide synthesis with any two case studies. Side reactions in peptide synthesis: Deletion peptides, side reactions initiated by proton abstraction, protonation, over activation and side reactions of individual amino acids. 12 Hours

Unit 3: Photochemical reactions: Basic principles of photochemical reactions. Photo-oxidation, photo-addition and photo-fragmentation. Pericyclic reactions Mechanism, Types of pericyclic reactions such as cyclo addition, electrocyclic reaction and sigmatropic rearrangement reactions with examples. 12 Hours

Unit 4: Catalysis: Types of catalysis, heterogeneous and homogenous catalysis, advantages and disadvantages. Heterogeneous catalysis – preparation, characterization, kinetics, supported catalysts, catalyst deactivation and regeneration, some examples of heterogeneous catalysis used in synthesis of drugs. Homogenous catalysis, hydrogenation, hydro formylation, hydrocyanation, Wilkinson catalysts, chiral ligands and chiral induction, Ziegler Natta catalysts, some examples of homogenous catalysis used in synthesis of drugs. Transition- metal and organo-catalysis in organic synthesis: Metal-catalyzed reactions. Biocatalysis: Use of enzymes in organic synthesis, immobilized enzymes/cells in organic reaction. Phase transfer catalysis theory and applications, ionic liquids. 12 Hours

Unit 5: Stereochemistry & asymmetric synthesis: Basic concepts in stereochemistry – optical activity, specific rotation, racemates and resolution of racemates, the Cahn, Ingold, Prelog (CIP) sequence rule, meso compounds, pseudo asymmetric centres, axes of symmetry, Fischers D and L notation, cis-trans isomerism, E and Z notation. Methods of asymmetric synthesis using chiral pool, chiral auxiliaries and catalytic asymmetric synthesis, enantiopure separation and Stereo selective synthesis with examples. 12 Hours

REFERENCES

1. Advanced Organic Chemistry, Reaction, Mechanisms and Structure – J. March. John Wiley & Sons, New York.

2. Mechanism and Structure in Organic Chemistry – E.S. Gould, Hold Rinchart & Winston.

3. Organic Chemistry - Clayden, Greeves, Warren & Wothers. Oxford University Press 2001.

4. Organic Chemistry - I.L. Finar. Vol 1 and 2. ELBS, Pearson Education.

5. Organic Chemistry – Carey. 5th ed. Viva Books Pvt. Ltd.

6. Organic Synthesis - The Disconnection Approach - S. Warren. Wiley India

7. Principles of Organic Synthesis – R.O.C. Norman & J.M. Coxan. Nelson Thorns.

8. Organic Synthesis - Special Techniques – V.K. Ahluwalia & R. Agarwal. Narosa Publishers.

9. Organic Reaction Mechanisms – V.K. Ahluwalia and R.K. Parashar 4th ed. Narosa Publishers.

COMPUTER AIDED DRUG DESIGN (CADD) (MPC 203T)

Unit 1: Introduction to Computer Aided Drug Design (CADD): History, different techniques and applications. Quantitative Structure Activity Relationships: Basics, History and development of QSAR: Physicochemical parameters and methods to calculate physicochemical parameters: Hammett equation and electronic parameters (sigma), lipophilicity effects and parameters (log P, pi-substituent constant), steric effects (Taft steric and MR parameters) Experimental and theoretical approaches for the determination of these physicochemical parameters. 12 Hours

Unit 2: Quantitative Structure Activity Relationships/Applications: Hansch analysis, Free Wilson analysis, relationship between them, advantages and disadvantages; Deriving 2D-QSAR equations. 3D-QSAR approaches and contour map analysis. Statistical methods used in QSAR analysis and importance of statistical parameters. 12 Hours

Unit 3: Molecular modeling and docking: Molecular and Quantum mechanics in drug design. Energy minimization methods: comparison between global minimum conformation and bioactive conformation. Molecular docking and drug receptor interactions: Rigid docking, flexible docking and extra-precision docking. Agents acting on enzymes such as DHFR, HMG-CoA reductase and HIV protease, choline esterase (AChE & BChE). 12 Hours

Unit 4: Molecular properties and drug design: Prediction and analysis of ADMET properties of new molecules and its importance in drug design. De novo drug design: Receptor/enzyme- interaction and its analysis, Receptor/enzyme cavity size prediction, predicting the functional components of cavities, Fragment based drug design. Homology modeling and generation of 3D-structure of protein. 12 Hours

Unit 5: Pharmacophore mapping and virtual screening: Concept of pharmacophore, pharmacophore mapping, identification of Pharmacophore features and Pharmacophore modeling; Conformational search used in pharmacophore mapping. In silico drug design and virtual screening techniques similarity based methods and pharmacophore based screening, structure based In-silico virtual screening protocols. Application of bioinformatics in drug design. 12 Hours

REFERENCES

1. Computational and Structural Approaches to Drug Discovery - Robert M Stroud and Janet F Moore. RCS Publishers.

2. Introduction to Quantitative Drug Design - Y.C. Martin. CRC Press, Taylor & Francis.

3. Drug Design – Ariens. Vol 1 to 10. Academic Press, 1975, Elsevier Publishers.

4. Principles of Drug Design - Smith & Williams. CRC Press, Taylor & Francis.

5. The Organic Chemistry of the Drug Design and Drug Action - Richard B Silverman. Elsevier Publishers.

6. Medicinal Chemistry - Burger, Vol. 1 –6.

7. An Introduction to Medicinal Chemistry - Graham L Patrick. 3rd ed. Oxford University Press, USA.

8. Wilson and Gisvold's Text Book of Organic Medicinal and Pharmaceutical Chemistry. 12th ed. Lippincott, New Delhi.

9. Comprehensive Medicinal Chemistry – Corwin & Hansch. Pergamon Publishers.

10. Computational and Structural Approaches to Drug Discovery - Robert M Stroud & Janet F Moore. RCS Publishers.

PHARMACEUTICAL PROCESS CHEMISTRY (MPC 204T)

Unit 1: Process chemistry: Introduction, synthetic strategy stages of scale up process: Bench, pilot and large scale process. In-process control and validation of large scale process. Case studies of some scale up process of APIs. Impurities in API, types and their sources including genotoxic impurities. 12 Hours

Unit 2: Operations: Extraction: Liquid equilibria, extraction with reflux, extraction with agitation, counter current extraction. Filtration: Theory of filtration, pressure and vacuum filtration, centrifugal filtration. Distillation: azeotropic and steam distillation. Evaporation: types of evaporators, factors affecting evaporation. Crystallization: crystallization from aqueous, non-aqueous solutions, factors affecting crystallization, nucleation. Principle and general methods of preparation of polymorphs, hydrates, solvates and amorphous APIs. 12 Hours

Unit 3: Unit processes - I: Nitration: Nitrating agents, aromatic nitration, kinetics and mechanism of aromatic nitration, process equipment for technical nitration, mixed acid for nitration. Halogenation: Kinetics of halogenations, types of halogenations, catalytic halogenations. Case study on industrial halogenation process. Oxidation: Introduction, types of oxidative reactions, liquid phase oxidation with oxidizing agents. Non-metallic oxidizing agents such as H₂O₂, sodium hypochlorite, oxygen gas, ozonolysis. 12 Hours

Unit 4: Unit processes - II: Reduction: Catalytic hydrogenation, heterogeneous and homogeneous catalyst; hydrogen transfer reactions, metal hydrides. Case study on industrial reduction process. Fermentation: Aerobic and anaerobic fermentation. Production of antibiotics (penicillin and streptomycin), vitamins (B_2 and B_{12}), statins (lovastatin, simvastatin). Reaction progress kinetic analysis: streamlining reaction steps, route selection, characteristics of expedient routes, characteristics of cost-effective routes, reagent selection, families of reagents useful for scale-up. 12 Hours

Unit 5: Industrial safety: MSDS (Material Safety Data Sheet), hazard labels of chemicals and personal protection equipment (PPE). Fire hazards, types of fire & fire extinguishers. Occupational Health & Safety Assessment Series 1800 (OHSAS-1800) and ISO-14001 (Environmental Management System). Effluents and its management. 12 Hours

REFERENCES

1. Process Chemistry in the Pharmaceutical Industry: Challenges in an Ever-Changing Climate - An Overview - K. Gadamasetti. CRC Press.
2. Pharmaceutical Manufacturing Encyclopedia. 3rd ed. Volume 2.
3. Medicinal Chemistry – Burger. Vol. 1–6.
4. Unit Operations of Chemical Engineering - W.L. McCabe, J.C. Smith & Peter Harriott. 7th ed.
5. Polymorphism in Pharmaceutical Solids – H.G. Britain. Vol 95. Dekker Series, 1999.
6. Introduction to Chemical Processes: Principles, Analysis, Synthesis - Regina M Murphy.
7. Pharmaceutical Process Chemistry for Synthesis: Rethinking the Routes to Scale-Up - Peter J Harrington.
8. Unit Processes in Organic Synthesis (MGH) - P.H. Groggins.
9. Chemical Technology - F.A. Henglein. Pergamon Publishers.
10. Dryden's Outlines of Chemical Technology - M. Gopal. WEP East-West Press.
11. Principle of Industrial Chemistry – Clausen & Mattson. Wiley Publishing Co.
12. Industrial Chemicals - Lowenheim & M.K. Moran.
13. A text book of Chemical Technology - S.D. Shukla & G.N. Pandey. Vol. 2. Vikas Publishing.
14. Industrial Organic Chemistry - J.K. Stille. (Prentice Hall publishers)
15. Chemical Process – Shreve. Mc Graw-Hill.
16. Industrial Chemistry - B.K. Sharma. Goel Publishing House.
17. ICH Guidelines website www.ich.org
18. United States Food and Drug Administration official website www.fda.gov

PHARMACEUTICAL CHEMISTRY PRACTICAL – III (MPC 205P)

1. Synthesis of organic compounds by adapting different approaches involving a) oxidation
b) reduction/hydrogenation c) Nitration (3 experiments)
2. Comparative study of synthesis of APIs/intermediates by different synthetic routes (2 experiments)
3. Assignments on regulatory requirements in API (2 experiments)
4. To carry out the preparation of following organic compounds
5. Preparation of 4-chlorobenzhydrylpiperazine. (an intermediate for cetirizine HCl).
6. Preparation of 4-iodotoluene from p-toluidine.
7. NaBH_4 reduction of vanillin to vanillyl alcohol
8. Preparation of umbelliferone by Pechhman reaction
9. Preparation of triphenyl imidazole
10. To perform the microwave irradiated reactions of synthetic importance (Any two)
11. Determination of log P, MR, hydrogen bond donors and acceptors of selected drugs using software
12. Calculation of ADMET properties of drug molecules and its analysis using software Pharmacophore modeling
13. 2D-QSAR based experiments
14. 3D-QSAR based experiments
15. Docking study based experiment
16. Virtual screening based experiment
17. Comparison of absorption spectra by UV and Woodward – Fieser rule
18. Interpretation of organic compounds by FTIR
19. Interpretation of organic compounds by NMR
20. Interpretation of organic compounds by MS
21. Determination of purity by DSC in pharmaceuticals
22. Identification of organic compounds using FTIR, NMR, ^{13}C NMR and Mass spectra

First Semester

Modern Pharmaceutical Analytical Techniques (MPH 101T)

(Note: Common paper for MPA, MPC, MPH, MPB, MPL, MPG, MQA, & MIP, specializations)

Unit 1: a. UV-visible spectroscopy: Introduction, theory, laws and instrumentation associated with UV-visible spectroscopy, choice of solvents and solvent effect and applications of UV-visible spectroscopy.

b. IR spectroscopy: Theory, modes of molecular vibrations, sample handling, instrumentation of dispersive and Fourier-Transform IR Spectrometer, factors affecting vibrational frequencies and applications of IR spectroscopy, data interpretation.

c. Spectrofluorimetry: Theory of fluorescence, factors affecting fluorescence (characteristics of drugs that can be analyzed by fluorimetry), quenchers, instrumentation and Applications of fluorescence spectrophotometer.

d. Flame emission spectroscopy and Atomic absorption spectroscopy: Principle, instrumentation, interferences and applications. 12 Hours

Unit 2: NMR spectroscopy: Quantum numbers and their role in NMR, Principle, Instrumentation, Solvent requirement in NMR, Relaxation process, NMR signals in various compounds, Chemical shift, Factors influencing chemical shift, Spin-Spin coupling, Coupling constant, Nuclear magnetic double resonance, Brief outline of principles of FT-NMR and ¹³C NMR. Applications of NMR spectroscopy. 10 Hours

Unit 3: Mass Spectroscopy: Principle, Theory, Instrumentation of Mass Spectroscopy, Different types of ionization like electron impact, chemical, field, FAB and MALDI, APCI, ESI, APPI Analyzers of Quadrupole and Time of Flight, Mass fragmentation and its rules, Meta stable ions, Isotopic peaks and Applications of Mass spectroscopy. 10 Hours

Unit 4: Chromatography: Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution, isolation of drug from excipients, data interpretation and applications of the following:

a) Thin Layer chromatography b) High Performance Thin Layer Chromatography c) Ion exchange chromatography d) Column chromatography e) Gas chromatography f) High Performance Liquid chromatography g) Ultra High Performance Liquid chromatography h) Affinity chromatography i) Gel Chromatography. 14 Hours

Unit 5: a. Electrophoresis: Principle, Instrumentation, Working conditions, factors affecting separation and applications of the following: a) Paper electrophoresis b) Gel electrophoresis

c) Capillary electrophoresis d) Zone electrophoresis e) Moving boundary electrophoresis f) Iso electric focusing.

b. X ray Crystallography: Production of X rays, Different X ray methods, Bragg's law, Rotating crystal technique, X ray powder technique, Types of crystals and applications of X- ray diffraction.

c. Thermal Techniques: Principle, instrumentation, advantage and disadvantages, Pharmaceutical applications of DSC, DTA & TGA.

d. Microscopic techniques: Principles and applications of Scanning Electron Microscopy and Transmission Electron Microscopy analysis. 14 Hours

REFERENCES

1. Spectrometric Identification of Organic compounds - Robert M Silverstein. 6th ed. John Wiley & Sons, 2004.

2. Principles of Instrumental Analysis - Douglas A Skoog, F. James Holler & Timothy A. Nieman. 5th ed. Eastern Press, Bangalore, 1998.

3. Instrumental Methods of Analysis – Willards. 7th ed. CBS Publishers, New Delhi.

4. Practical Pharmaceutical Chemistry – Beckett and Stenlake. Vol 2. 4th ed. CBS Publishers, New Delhi

5. Organic Spectroscopy - William Kemp. 3rd ed. ELBS, 1991.

6. Quantitative Analysis of Drugs in Pharmaceutical Formulation – P.D. Sethi. 3rd ed. CBS Publishers, New Delhi, 1997.

7. Pharmaceutical Analysis - Modern Methods – Part B – J.W. Munson. Vol 11. Marcel- Dekker Series.

8. Spectroscopy of Organic Compounds - P.S. Kalsi. 2nd ed. Wiley Estern Ltd., Delhi.

9. Textbook of Pharmaceutical Analysis - K.A. Connors. 3rd ed. John Wiley & Sons.

ADVANCED BIOPHARMACEUTICS & PHARMACOKINETICS (MPH 102T)

(Common paper for MPH and MIP specializations)

Unit 1: Drug absorption from the gastrointestinal tract and other routes of administration: Mechanisms and factors affecting drug absorption from different routes, influence of pH– partition theory on drug absorption. Factors affecting dissolution rate and its process, Noyes- Whitney equation. dissolution testing methods for solids - tablets, capsules and for suspensions. Correlation of in vivo and in vitro dissolution data. 12 Hours

Unit 2: Biopharmaceutical considerations in drug product design and in vitro drug product performance. Introduction - biopharmaceutical factors affecting bioavailability, rate limiting steps in drug absorption, physicochemical nature of drug, formulation factors affecting drug product performance. In vitro dissolution and drug release testing, dissolution test apparatus and methods as per IP and USP for different types of drug delivery systems, design of dissolution testing for conventional and controlled release products. Data handling and correction factor, bio relevant media, similarity and dissimilarity factors f_1 & f_2 , alternative methods of dissolution testing, problems of variable control in dissolution testing performance of drug products. Drug product stability during dissolution

testing, in vitro evaluation of drug release from different dosage forms. 12 Hours

Unit 3: Pharmacokinetics: Basic considerations, pharmacokinetic models, compartment modeling: one compartment model - IV bolus, IV infusion, extra-vascular. Multi compartment models in brief, calculation of parameters in two compartment models. Non-linear pharmacokinetics: causes of non-linearity, Michaelis – Menten equation, estimation of k_m and V_{max} . Concept of clearance and its applications. Problems related to the above. 12 Hours

Unit 4: Drug Product Performance: Bioavailability and bioequivalence, drug product performance, purpose of bioavailability studies, relative and absolute availability. Methods, protocol design for assessing bioavailability, bioequivalence studies, design and evaluation of bioequivalence studies, study designs, cross over study designs, evaluation of the data, bioequivalence example, study submission and drug review process. In vitro - in vivo correlations in protocol design, levels of correlation, biopharmaceutical classification system, methods. Permeability: Generic biologics (biosimilar drug products), clinical significance of bioequivalence studies. 12 Hours

Unit 5: Application of pharmacokinetics: Modified-release drug products, targeted drug delivery systems and biotechnological products. Significance of pharmacokinetic and pharmacodynamic drug interactions in the design of the modified release products. 12 Hours

REFERENCES

1. Pharmacokinetics - Milo Gibaldi. 2nd ed.
2. Applied Biopharmaceutics and Pharmacokinetics - Leon Shargel. 5th ed.
3. Biopharmaceutics and Clinical Pharmacokinetics - Robert E Notari. 4th ed.
4. Modern Pharmaceutics - Gilbert S. Banker, Christopher T Rhodes. 4th ed.
5. Clinical Pharmacokinetics & Pharmacodynamics - Malcolm Rowland & Tozer. 4th ed. Lippincott Publications.
6. Drug Disposition and Pharmacokinetics - Stephen H Curry. 3rd ed.
7. Current Concepts in the Pharmaceutical Sciences : Biopharmaceutics - James Swarbrick
8. Current Concepts in the Pharmaceutical Sciences:Dosage Form Design and Bioavailability - James Swarbrick.

MODERN PHARMACEUTICS (MPH 103T)

Unit 1: Preformulation Concepts – Drug excipient interactions-different methods, kinetics of stability, stability testing. Theories of dispersion and pharmaceutical dispersion (emulsions and suspensions, SMEDDS) preparation and stability. Large and small volume parenterals – physiological and formulation consideration, manufacturing and evaluation.

Optimization techniques in pharmaceutical formulation: Concept and parameters of optimization. Optimization techniques in pharmaceutical formulation and processing. Statistical design, response surface method, contour designs, factorial designs and application in formulation. 12 Hours

Unit 2: Validation: Introduction to pharmaceutical validation, scope & merits of validation. Validation and calibration of master plan, ICH & WHO guidelines for calibration and validation of equipment, validation of specific dosage form, types of validation. Government regulations, manufacturing process model, user requirement specifications (URS), design qualification (DQ), installation qualification (IQ), operational qualification (OQ) & performance qualification (PQ) of facilities. 12 Hours

Unit 3: cGMP & industrial management: Objectives and policies of current good manufacturing practices (cGMP), layout of buildings, services, equipment and their maintenance. Production management, production organization, materials management, handling and transportation, inventory management and control, production and planning control, sales forecasting, budget and cost control, industrial and personal relationship. Concept of total quality management (TQM). 12 Hours

Unit 4: Compression and compaction: Physics of tablet compression, compression, consolidation, effect of friction, distribution of forces, compaction profiles. Heckel plots, Strain gauges, evaluation of forces, energy consumption, factors influencing consolidation parameters.12 Hours

Unit 5: Drug release characteristics and modeling: Diffusion parameters, evaluation of matrix and reservoir systems and swelling matrix tablets, burst effect, modeling of drug release using different equations (Higuchi model, Peppas model, Hixson Crowell, zero order & first order). Linearity, concept of significance, standard deviation, Chi square test, students T-test, ANOVA test. 12 Hours

REFERENCES

1. Encyclopedia of Pharmaceutical Technology - James Swarbrick. 3rd ed. Informa Healthcare Publishers.
2. Pharmaceutical Dosage Forms : Tablets - Herbert A Lieberman & Leon Lachman, Volume 1 - 3. Marcel Dekker, Inc.

3. The Theory and Practice of Industrial Pharmacy - Roop K Khar, S.P. Vyas, Farhan J Ahmad, Gaurav K Jain. 4th ed. CBS Publishers, New Delhi.

4. Martin's Physical Pharmacy and Pharmaceutical Sciences - Patrick J Sinko. 6th ed. BI Publications Pvt. Ltd.

5. Pharmaceutical Dosage Forms : Disperse Systems - Herbert A Lieberman, Martin M Rieger & Gilbert S Banker. Vol 1 – 3. Informa Healthcare.

6. Pharmaceutical Dosage Forms : Parenteral Medication – Sandeep Nema & John Ludwig, Vol 1 – 3. 3rd ed. Informa Healthcare.

7. Aulton's Pharmaceutics – The Design and Manufacture of Medicines - M.E. Aulton & M.G. Kevin Taylor. 5th ed. Elsevier.

8. Remington – The Science and Practice of Pharmacy – Loyd V Allen. 22nd ed.

REGULATORY AFFAIRS (MPH 104T)

Unit 1: Documentation in pharmaceutical industry: Master formula record, DMF drug master file (DMF), distribution records. Generic drugs product development, introduction, Hatch- Waxman Act and amendments, Code of Federal Regulations (CFR), drug product performance in vitro, ANDA regulatory approval process, NDA approval process. 12 Hours

Unit 2: Bioequivalence and drug product assessment: Scale up post approval changes, post marketing surveillance, outsourcing BA and BE to CRO. Regulatory requirement for product approval, active pharmaceutical ingredient (API), biologics, novel therapies by obtaining NDA, ANDA generic drugs. Pharmaceutical product development (Q8), quality risk management (Q9) and pharmaceutical quality systems (Q10). Quality by design (Q_bD), principles in pharmaceutical development, regulatory and industry views on Q_bD, elements of Q_bD, ANDA applications and examples. 12 Hours

Unit 3: Critical manufacturing controls (CMC), post approval regulatory affairs: Regulation for combination products and medical devices. CTD and eCTD format, industry and FDA liaison. ICH - Guidelines of ICH - Q, S, E, M. Regulatory requirements of EU, MHRA, TGA and ROW countries. 12 Hours

Unit 4: Non clinical drug development: Global submission of IND, NDA, ANDA. Investigation of medicinal products dossier (IMPd) and investigator brochure (IB).

Clinical trials: Developing clinical trial protocols. Institutional review board/independent ethics committee - Formulation and working procedures, informed consent process and procedures. HIPAA- new requirement to clinical study process, pharmacovigilance safety monitoring in clinical trials. 12 Hours

Unit 5: General principles of intellectual property rights (IPR): IP protection, economic importance, mechanism of protection. Patents, criteria, types of patent application-steps, trademarks and copy rights. 12 Hours

REFERENCES

1. The Theory and Practice of Industrial Pharmacy - Leon Lachman, H.A. Lieberman & Joseph L Kanig. 3rd ed. Varghese Publishing, 1991.

2. Lachman/Lieberman's The Theory and Practice of Industrial Pharmacy - Roop K Khar,

S.P. Vyas, Farhan J Ahmad & Gaurav K Jain. 4th ed. CBS Publishers, New Delhi.

3. Quality Assurance of Pharmaceuticals – WHO. Vol. 1 & 2. Pharma Book Syndicate.

4. Pharmaceutical Product development - N.K. Jain. CBS Publishers, New Delhi.

5. Law relating to Drugs & Cosmetics - Vijay Malik. Eastern Book Company.

PHARMACEUTICS PRACTICAL - I (MPH 105P)

1. Analysis of Pharmacopoeial compounds and their formulations by UV - Visible spectrophotometer.

2. Colorimetric analysis of aspirin.

3. Kinetic studies of aspirin degradation.

4. Molecular weight determination of polymers by viscosity method.

5. Preparation of granules, drying by conventional dryer and fluidized bed dryer and comparing the granules by their flow property.

6. HPLC analysis of any one drug.

7. GMP audit requirements as per CDSCO.

8. Preparation of check-lists for registration of IND as per ICH CTD format.

9. Preparation of check-lists for registration of NDA as per ICH CTD format.

10. Preparation of check-lists for registration of ANDA as per ICH CTD format.

11. To carry out pre formulation studies of tablets.

12. To study the effect of Compression force on tablets disintegration time.

PHARMACEUTICS PRACTICAL - II (MPH 106P)

1. Improvement of dissolution of drugs by solid dispersions, cyclo dextrin complexation etc.

2. Effect of ointment base on drug diffusion using agar plate method and diffusion membrane.
3. To study the effect of particle size on dissolution of a tablet.
4. To study the effect of binders on dissolution of a tablet.
5. To plot Heckel plot, Higuchi and Peppas plot and determine similarity factors.
6. Improvement of dissolution characteristics of slightly soluble drug by solid dispersion technique.
7. Protein binding studies of a highly protein bound drug and poorly protein bound drug.
8. Absorption kinetics of paracetamol in goat intestine (ex vivo study)
9. Pharmacokinetic and IVIVC data analysis by WinNonlin® Software (Demo).
10. In vitro cell studies for permeability and metabolism (Demo).
11. Effect of surfactant on drug dissolution using BCS II drugs.

Second Semester

MOLECULAR PHARMACEUTICS (NANO TECHNOLOGY & TARGETED DDS) (MPH 201T)

Unit 1: Targeted drug delivery systems: Concepts, events and biological process involved in drug targeting. Tumor targeting and brain specific delivery. 12 Hours

Unit 2: Targeting Methods: Introduction, preparation, evaluation and application of nano particles & liposomes. 12 Hours

Unit 3: Micro capsules/micro spheres: Types, preparation, evaluation and applications of monoclonal antibodies, niosomes, aquasomes, phytosomes, electrosomes. 12 Hours

Unit 4: Pulmonary drug delivery systems: Aerosols, metered dose inhalers, dry powder inhalers, propellants, containers, types, preparation and evaluation. Intra nasal route delivery systems; types, preparation and evaluation. 12 Hours

Unit 5: Nucleic acid based therapeutic delivery system: Gene therapy, introduction (ex vivo & in vivo gene therapy). Potential target diseases for gene therapy (inherited disorder and cancer). Gene expression systems (viral and non viral gene transfer). Liposomal gene delivery systems. Bio distribution and pharmacokinetics. Knowledge of therapeutic antisense molecules and aptamers as drugs of future. 12 Hours

REFERENCES

1. Novel Drug Delivery Systems – Y.W. Chien. 2nd ed. (Revised and expanded). Marcel Dekker.

2. Controlled Drug Delivery: Concepts and Advances - S.P. Vyas & R.K. Khar. 1st ed. Vallabh Prakashan, New Delhi.

3. Controlled and Novel Drug Delivery - N.K. Jain. 1st ed. CBS Publishers, New Delhi, 1997.

DRUG DELIVERY SYSTEMS (MPH 202T)

Unit 1: Sustained release (SR) and controlled release (CR) formulations: Introduction & basic concepts, advantages/disadvantages, factors influencing, physicochemical & biological approaches for SR/CR formulation, mechanism of drug delivery from SR/CR formulation. Polymers: introduction, definition, classification, properties and application. Dosage Forms for personalized medicine: Introduction, definition, pharmacogenetics, categories of patients for personalized medicines. Customized drug delivery systems, bioelectronic medicines, 3D printing of pharmaceuticals, tele pharmacy. 12 Hours

Unit 2: Rate controlled drug delivery systems: Principles & fundamentals, types, activation; Modulated drug delivery systems; mechanically activated, pH activated, enzyme activated, and osmotic activated drug delivery systems, feedback regulated drug delivery systems; principles & fundamentals. 12 Hours

Unit 3: Gastro retentive drug delivery systems: Principle, concepts, advantages and disadvantages. Modulation of GI transit time, approaches to extend GI transit. Buccal drug delivery systems: Principle of mucoadhesion, advantages and disadvantages, mechanism of drug permeation, methods of formulation and evaluation. 12 Hours

Unit 4: **Ocular drug delivery systems:** Barriers of drug permeation, methods to overcome barriers. Transdermal drug delivery systems: Structure of skin and barriers, penetration enhancers, formulation and evaluation 12 Hours

Unit 5: Protein and Peptide Delivery: Barriers for protein delivery. Formulation and evaluation of delivery systems of proteins and other macromolecules.

Vaccine delivery systems: Vaccines, uptake of antigens, single shot vaccines, mucosal and transdermal delivery of vaccines.

Medical devices: Materials and their requirements for manufacture of specialized medical devices-disposable hypodermic needles and syringes, prefilled syringes, drug eluting stents, orthopedic implants and intra ocular lenses. 12 Hours

REFERENCES

1. Novel Drug Delivery Systems – Y.W. Chien. 2nd ed. (Revised and expanded). Marcel Dekker.

2. Controlled Drug Delivery Systems - J. R. Robinson & V.H.L. Lee. Marcel Dekker, Inc.
3. Encyclopedia of Controlled Delivery - Edith Mathiowitz. John Wiley and Sons, Inc.
4. Controlled Drug Delivery: Concepts and Advances - S.P. Vyas & R.K. Khar. 1st ed. Vallabh Prakashan, New Delhi.
5. Controlled and Novel Drug Delivery - N.K. Jain. 1st ed. CBS Publishers, New Delhi, 1997.

COMPUTER AIDED DRUG DEVELOPMENT (MPH 203T)

Unit 1: Computers in pharmaceutical research and development: A general overview: History of computers in pharmaceutical research and development.

Statistical modeling in pharmaceutical research and development: Descriptive versus mechanistic non parametric and parametric modeling. Statistical parameters, estimation, confidence regions, nonlinearity at the optimum, sensitivity analysis, optimal design, population modeling. 12 Hours

Unit 2: Computational modeling of drug disposition: Introduction, modeling techniques: Drug absorption, solubility, intestinal permeation, drug distribution, drug excretion, active transport; P-gp, BCRP, nucleoside transporters, hPEPT1, ASBT, OCT, OATP, BBB-choline transporter. 12 Hours

Unit 3: Computer-aided formulation development: Solid dosage forms, disperse systems such as suspensions, emulsions and micro emulsion drug carrier system with examples. Legal protection of innovative uses of computers in R&D, the ethics of computing in pharmaceutical research. Computers in clinical development: Clinical data collection and management, computers in market analysis. 12 Hours

Unit 4: Computer-aided biopharmaceutical characterization: Gastrointestinal absorption simulation. Introduction, theoretical background, model construction, parameter sensitivity analysis, virtual trial, fed vs. fasted state, in vitro dissolution and in vitro-in vivo correlation, biowaiver considerations

Computer simulations in pharmacokinetics and pharmacodynamics: Introduction. Computer simulation: Whole organism, isolated tissues, organs, cell, proteins and genes. 12 Hours

Unit 5: Artificial intelligence (AI): Concepts and applications, robotics. Computational fluid dynamics: General overview and applications. Pharmaceutical automation, pharmaceutical applications, advantages and disadvantages. Current challenges and future directions. 12 Hours

REFERENCES

1. Computer Applications in Pharmaceutical Research and Development - Sean Ekins. John Wiley & Sons, 2006.
2. Computer-Aided Applications in Pharmaceutical Technology - Jelena Djuris. 1st ed. Woodhead Publishing.
3. Encyclopedia of Pharmaceutical Technology - James Swarbrick & James G Boylan. Vol
13. Marcel Dekker Inc, New York, 1996.

PHARMACEUTICAL AND COSMETIC PRODUCT DEVELOPMENT (MPH 204T)

Unit 1: Preformulation studies: Molecular optimization of APIs (drug substances), crystal morphology and variations, powder flow, structure modification, drug-excipient compatibility studies by TLC, DTA, DSC and TGA spectral studies, formulation additives: Study of different formulation additives, factors influencing their incorporation, role of formulation development and processing, new developments in excipient science. 12 Hours

Unit 2: Solubility: Importance, experimental determination, phase solubility analysis, pH-solubility profile, techniques to improve solubility of drugs and utilization of analytical methods – cosolvency, salt formation, complexation, solid dispersion, micellar solubilization and hydrotrophy, methods of characterization. 12 Hours

Unit 3: Product stability: Mechanisms of degradation and protection, stability testing of drugs and pharmaceuticals, factors influencing-media effects and pH effects, accelerated stability studies, interpretation of kinetic data (API & tablets). Solid state stability and shelf-life assignment. Stability protocols, reports and ICH guidelines. 12 Hours

Unit 4: Herbal Cosmetics : Herbal ingredients used in Hair care, skin care and oral care. Review of guidelines for herbal cosmetics by private bodies like cosmos with respect to preservatives, emollients, foaming agents, emulsifiers and rheology modifiers. Challenges in formulating herbal cosmetics. 12 Hours

Unit 5: Cosmetics: Formulation, manufacturing and quality control methods of following cosmetic products. Hair care products - Shampoos, hair dyes, shaving products and depilatories. Dental hygiene products: Tooth paste, mouth washes. Skin care products: Hand cream, cleansing cream, foundation creams. 12 Hours

REFERENCES

1. Harry's Cosmeticology. 8th ed.
2. Poucher's Perfumes, Cosmetics & Soaps – Hilda Butler. 10th ed. Kluwer Academic Publishers.

3. Cosmetics - Formulation, Manufacture and Quality Control – P.P. Sharma. 4th ed.
4. Hand Book of Cosmetic Science and Technology - A.O. Barel, M. Paye & H.I. Maibach. 3rd ed.
5. Cosmetic and Toiletries Recent Suppliers' Catalogue.
6. CTFA Directory.

PHARMACEUTICS PRACTICAL – III (MPH 205P)

1. To perform in vitro dissolution profile of Controlled release or Sustained release marketed formulation.
2. Formulation and evaluation of sustained release matrix tablets.
3. Formulation and evaluation of osmotically controlled DDS.
4. Preparation and evaluation of Floating DDS- Hydro dynamically balanced DDS.
5. Formulation and evaluation of Muco-adhesive tablets.
6. Formulation and evaluation of transdermal patches.
7. To study the effect of temperature change, non solvent addition, incompatible polymer addition in micro capsule preparation.
8. Formulation and evaluation of microspheres.
9. Formulation and evaluation of liposomes or niosomes.
10. Demonstration statistical designing in formulation development through QBD approach.
11. Development and evaluation of Creams.
12. Development and evaluation of Shampoo and Tooth paste.
13. Effect of surfactant on the solubility of drugs.
14. Effect of pH on the solubility of drugs.
15. Stability testing of drugs in dosage forms at 25°C/60% RH and 40°C/75% RH and determine the shelf life.
16. Compatibility evaluation of drugs and excipients (DSC & FTIR).

PHARMACEUTICAL BIOTECHNOLOGY (MPB)

First Semester

MODERN PHARMACEUTICAL ANALYTICAL TECHNIQUES (MPA 101T)

(Note: Common paper for MPA, MPC, MPH, MPB, MPL, MPG, MQA, & MIP, specializations)

Unit 1: a. UV-visible spectroscopy: Introduction, theory, laws and instrumentation associated with UV-visible spectroscopy, choice of solvents and solvent effect and applications of UV-visible spectroscopy.

b. IR spectroscopy: Theory, modes of molecular vibrations, sample handling, instrumentation of dispersive and Fourier-Transform IR

Spectrometer, factors affecting vibrational frequencies and applications of IR spectroscopy, data interpretation.

c. Spectrofluorimetry: Theory of fluorescence, factors affecting fluorescence (characteristics of drugs that can be analysed by fluorimetry), quenchers, instrumentation and Applications of fluorescence spectrophotometer.

d. Flame emission spectroscopy and Atomic absorption spectroscopy: Principle, instrumentation, interferences and applications. 12 Hours

Unit 2: NMR spectroscopy: Quantum numbers and their role in NMR, Principle, Instrumentation, Solvent requirement in NMR, Relaxation process, NMR signals in various compounds, Chemical shift, Factors influencing chemical shift, Spin-Spin coupling, Coupling constant, Nuclear magnetic double resonance, Brief outline of principles of FT-NMR and ¹³C NMR. Applications of NMR spectroscopy. 10 Hours

Unit 3: Mass Spectroscopy: Principle, Theory, Instrumentation of Mass Spectroscopy, Different types of ionization like electron impact, chemical, field, FAB and MALDI, APCI, ESI, APPI Analyzers of Quadrupole and Time of Flight, Mass fragmentation and its rules, Meta stable ions, Isotopic peaks and Applications of Mass spectroscopy. 10 Hours

Unit 4: Chromatography: Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution, isolation of drug from excipients, data interpretation and applications of the following:

a) Thin Layer chromatography b) High Performance Thin Layer Chromatography c) Ion exchange chromatography d) Column chromatography e) Gas chromatography f) High Performance Liquid chromatography g) Ultra High Performance Liquid chromatography h) Affinity chromatography i) Gel Chromatography. 14 Hours

Unit 5: a. Electrophoresis: Principle, Instrumentation, Working conditions, factors affecting separation and applications of the following: a) Paper electrophoresis b) Gel electrophoresis c) Capillary electrophoresis d) Zone electrophoresis e) Moving boundary electrophoresis f) Iso electric focusing.

b. X ray Crystallography: Production of X rays, Different X ray methods, Bragg's law, Rotating crystal technique, X ray powder technique, Types of crystals and applications of X- ray diffraction.

c. Thermal Techniques: Principle, instrumentation, advantage and disadvantages, Pharmaceutical applications of DSC, DTA & TGA.

d. Microscopic techniques: Principles and applications of Scanning Electron Microscopy and Transmission Electron Microscopy analysis. 14 Hours

REFERENCES

1. Spectrometric Identification of Organic compounds - Robert M Silverstein. 6th ed. John Wiley & Sons, 2004.
2. Principles of Instrumental Analysis - Douglas A Skoog, F. James Holler & Timothy A Nieman. 5th ed. Eastern Press, Bangalore, 1998.
3. Instrumental Methods of Analysis – Willards. 7th ed. CBS Publishers, New Delhi.
4. Practical Pharmaceutical Chemistry – Beckett and Stenlake. Vol 2. 4th ed. CBS Publishers, New Delhi
5. Organic Spectroscopy - William Kemp. 3rd ed. ELBS, 1991.
6. Quantitative Analysis of Drugs in Pharmaceutical Formulation – P.D. Sethi. 3rd ed. CBS Publishers, New Delhi, 1997.
7. Pharmaceutical Analysis - Modern Methods – Part B – J.W. Munson. Vol 11. Marcel- Dekker Series.
8. Spectroscopy of Organic Compounds - P.S. Kalsi. 2nd ed. Wiley Estern Ltd., Delhi.
9. Textbook of Pharmaceutical Analysis - K.A. Connors. 3rd ed. John Wiley & Sons.

MICROBIAL GENETICS AND CELLULAR BIOLOGY (MPB 102T)

Unit 1: Microbiology: Introduction – Prokaryotes and eukaryotes. Bacteria, fungi, actinomycetes and virus - structure, chemistry and morphology, cultural, physiological and reproductive features. Methods of isolation, cultivation and maintenance of pure cultures. Industrially important microorganisms - examples and applications. 12 Hours

Unit 2: Molecular biology: Structure of nucleus and chromosome, nucleic acids and composition, structure and types of DNA and RNA. Central dogma of molecular biology: Replication, transcription and translation. Gene regulation, Gene copy number, transcriptional control and translational control.

RNA processing, modification and maturation, RNA splicing, RNA editing, RNA amplification. Mutagenesis and repair mechanisms, types of mutants, application of mutagenesis in strain improvement, gene mapping of plasmids- types purification and application. Phage genetics, genetic organization, phage mutation and lysogeny. 12 Hours

Unit 3: Cell structure and function: Cell organelles, cytoskeleton & cell movements, basic aspects of cell regulation, bioenergetics and fuelling reactions of aerobics and anaerobics, secondary metabolism & its applications. Cell communication, cell cycle and apoptosis, mechanism of cell division. Cell junctions/adhesion and extra cellular matrix, germ cells and fertilization, histology – the life and death of cells in tissues.

Cell cycle and cytoskeleton: Cell division and its regulation, G-Protein c Coupled receptors, kinases, nuclear receptors, cytoskeleton & cell

movements, intermediate filaments. Apoptosis and oncogenes Programmed cell death, tumor cells, carcinogens & repair. Differentiation and developmental biology: Fertilization, events of fertilization, in vitro fertilization, embryonic germ cells, stem cells and their application. 12 Hours

Unit 4: Principles of microbial nutrition: Physical and chemical environment for microbial growth, Stability and degeneration of microbial cultures. Growth of animal cells in culture. General procedure for cell culture, nutrient composition, primary, established and transformed cell cultures, applications of cell cultures in pharmaceutical industry and research. Growth of viruses in cell culture propagation and enumeration. In vitro screening techniques- cytotoxicity, anti-tumor, anti-viral assays. 12 Hours

Unit 5: Microbial pathology: Identifying the features of pathogenic bacteria, fungi and viruses. Mechanism of microbial pathogenicity, etiology and pathology of common microbial diseases and currently recommended therapies for common bacterial, fungal & viral infections. Mechanism of action of antimicrobial agents and possible sites of chemotherapy. 12 Hours

REFERENCES

1. Pharmaceutical Microbiology - W.B. Hugo & A.D. Russel. Blackwell Scientific Publications, Oxford London.
2. Industrial Microbiology - Prescott & Dunn. CBS Publishers, New Delhi.
3. Microbiology – Pelczar & Chan Kreig. Tata McGraw Hill.
4. Molecular Biology - David Freifelder. 2nd ed. Narosa Publishing House.
5. Culture of Animal Cells – A Manual of Basic Techniques - R. Ian Freshney. 6th ed. John Wiley & Sons.
6. Molecular Cell Biology - David Baltimore. W.H. Freeman & Co Publishers.
7. Cell biology - Julio E Cells. Vol 1-3.
8. Bergeys Manual of Systematic Bacteriology, Williams and Wilkins - A Waverly Company.

BIOPROCESS ENGINEERING AND TECHNOLOGY (MPB 103T)

Unit 1: Introduction to fermentation technology: Basic principles of fermentation. Study of the design and operation of bioreactor. Ancillary parts and function, impeller design and agitation, power requirements on measurements and control of dissolved oxygen, carbon dioxide, temperature, pH and foam.

Types of bioreactor: CSTR, tower, airlift, bubble column, packed glass bead, hollow fiber, configuration and application. Computer control of fermentation process. System configuration and application 12 Hours

Unit 2: Mass transfer: Theory, diffusional resistance to oxygen requirements of microorganisms, measurements of mass transfer co-efficient and factor affecting them, effects of aeration and agitation on mass transfer, supply of air, air compressing, cleaning and sterilization of air and plenum ventilation, air sampling and testing standards for air purity.

Rheology: Rheological properties of fermentation system and their importance in bioprocessing. 12 Hours

Unit 3: Scale up of fermentation process: Principles, theoretical considerations, techniques used, media for fermentation, HTST sterilization, advantage and disadvantage, liquid sterilization.

Cultivation and immobilized culture system: Cultivation system - batch culture, continuous culture, synchronous cultures, fed batch culture. Graphical plot representing the above systems.

Introduction to immobilization: Techniques, immobilization of whole cell, immobilized culture system to prepare fine chemicals. Immobilization of enzymes and their applications in

the industry. Reactors for immobilized systems and perspective of enzyme engineering. 12 Hours

Unit 4: Scale down of fermentation process: Theory, equipment design and operation, methods of filtration, solvent extraction, chromatographic separation, crystallization turbidity analysis and cell yield determination, metabolic response assay, enzymatic assay, bioautographic techniques and disruption of cells for product recovery.

Isolation and screening: Primary and secondary, maintenance of stock culture, strain improvement for increased yield. 12 Hours

Unit 5: Bioprocessing of the industrially important microbial metabolites

- a) Organic solvents – alcohol and glycerol
- b) Organic acids - citric acids, lactic acids,
- c) Amino acids - glutamic acids, lysine, cyclic AMP and GMP
- d) Antibiotics - penicillin, streptomycin, griseofulvin,
- e) Vitamins - B₁₂, riboflavin and vitamin C

Biosynthetic pathways for some secondary metabolites, microbial transformation of steroids and alkaloids.

Regulations governing the manufacturing of biological products. 12 Hours

REFERENCES

1. Principles of Fermentation technology - Peter Stanbury, Allan Whitaker & Stephen Hall. Elsevier.
2. Industrial Microbiology - L.E. Casida. John Wiley & Sons.

3. Current protocols in Molecular Biology - F.M. Asubel. Vol 1 & 2. John Wiley Publishers.

4. Bioreactor Design and Product Yield - Biotol Board. Butterworth and Helhemann Publishers.

5. Industrial Microbiology - H. Patel. Macmillan India Limited.

ADVANCED PHARMACEUTICAL BIOTECHNOLOGY (MPB 104T)

Unit 1: Enzyme technology: Classification, general properties of enzymes, dynamics of enzymatic activity, sources of enzymes, extraction and purification, pharmaceutical, therapeutic and clinical application. Production of amyloglucosidase, glucose isomerase, amylase and trypsin.

12 Hours

Unit 2: Genetic engineering: Techniques of gene manipulation, cloning strategies, procedures, cloning vectors expression vectors, recombinant selection and screening, expression in E. coli and yeast. Site directed mutagenesis, polymerase chain reaction, and analysis of DNA sequences. Gene library and cDNA

Applications of the above technique in the production of regulatory proteins - interferon, interleukins, blood products - erythropoietin, vaccines - hepatitis-B, hormones – insulin.

12 Hours

Unit 3: Therapeutic peptides: Study on controlled and site specified delivery of therapeutic peptides and proteins through various routes of administration.

Transgenic animals: Production of useful proteins in transgenic animals and gene therapy.

Human genome: The human genome project - a brief study. Human chromosome – structure and classification, chromosomal abnormalities – syndromes. 12 Hours

Unit 4: Signal transduction: Introduction, cell signalling pathways, ion channels, sensors and effectors, ON and OFF mechanisms, spatial and temporal aspects of signalling, cellular process, development, cell cycle and proliferation, neuronal signalling, cell stress, inflammatory responses and cell death, signalling defects and diseases.

Oncogenes: Introduction, definition, various oncogenes and their proteins. 12 Hours

Unit 5: Microbial biotransformation: Biotransformation for the synthesis of chiral drugs and steroids.

Microbial biodegradation: Biodegradation of xenobiotics, chemical and industrial wastes, Production of single-cell protein. Applications of microbes in environmental monitoring.

Biosensors: Definition, characteristics of ideal biosensors, types of biosensors, biological recognition elements, transducers, application of biosensors. 12 Hours

REFERENCES

1. Biotechnology - The biological principles – M.D. Trevan, S. Boffey, K.H. Goulding & P.F. Stanbury.
2. Immobilization of Cells and Enzymes – Hosevear Kennadycabral & Bicker Staff
3. Principles of Gene Manipulating - R.W. Old & S.B. Primrose.
4. Molecular Cell Biology - Harvey Lodish, David Baltimore, Arnold Berk, S. Lawence Zipursky, Paul Matsudaira & James Darnell.
5. Modern Biotechnology - S.B. Primrose.
6. Gene Transfer and Expression Protocols - Methods in Molecular Biology - E.T. Murray. Vol 7.
7. Current Protocols in Molecular Biology - F.M. Asubel. Vo1 1 & 2. John Wiley Publishers.
8. Current Protocols in Cellular Biology, Vo1 1 & 2. John Wiley Publishers.
9. Principles of Human Genetics - Curt Stern. Published by W.H. Freeman.

PHARMACEUTICAL BIOTECHNOLOGY PRACTICAL - I (MPB 105P)

1. Experiments based on HPLC
2. Isolation and purification of microorganism from the soil
3. Microbial contamination of water and biochemical parameters.
4. Determination of minimum inhibitory concentration by gradient plate technique and serial dilution method.
5. UV- survival curve and Dark repair
6. Sterility test for pharmaceutical preparations
7. Sub culturing of cells and cytotoxicity assays.
8. Construction of growth curve and determination of specific growth rate and doubling time
9. Fermentation process of alcohol and wine production
10. Fermentation of vitamins and antibiotics

PHARMACEUTICAL BIOTECHNOLOGY PRACTICAL - II (MPB 106P)

1. Whole cell immobilization engineering
2. Thermal death kinetics of bacteria

3. Replica plating
4. Bio-autography.
5. Isolation and estimation of DNA
6. Isolation and estimation of RNA
7. Isolation of plasmids
8. Agarose gel electrophoresis.
9. Transformation techniques
10. SDS – polyacrylamide gel electrophoresis for proteins
11. Polymerase chain reaction technique.

Second Semester

PROTEINS AND PROTEIN FORMULATIONS (MPB 201T)

Unit 1: Protein engineering: Concepts for protein engineering. Isolation and purification of proteins, Stability and activity based approaches of protein engineering, Chemical and Physical Considerations in Protein and Peptide Stability, Different methods for protein engineering, gene shuffling, and direct evolution. 12 Hours

Unit 2: Peptidomimetics: Introduction, classification; Conformationally restricted peptides, design, pseudopeptides, peptidomimetics and transition state analogs; Biologically active template; Amino acid replacements; Peptidomimetics and rational drug design; CADD techniques in peptidomimetics; Development of non peptide peptidomimetics. 12 Hours

Unit 3: Proteomics: Protein identification and characterization: Methods/strategies, protein identification, de novo protein characterization, isotope labelling, N- and C-terminal tags. 2-Dimensional gel electrophoresis. Methods including immobilized pH gradients (IPGs), resolution, reproducibility and image analysis, future developments 12 Hours

Unit 4: Protein formulation: Different strategies used in the formulation of DNA and proteins, Analytical and biophysical parameters of proteins and DNA in pre - formulation, liposomes, neon-spears, neon-particulate system, PEGylation, biological activity, biophysical characterization techniques, forced degradation studies of protein. 12 Hours

Unit 5: Methods of protein sequencing: Various methods of protein sequencing, characterisation, Edman degradation, tryptic and/or chymotryptic peptide mapping. 12 Hours

REFERENCES

1. Molecular Cell Biology - H. Lodhishet Al. W. H. Freeman and Company
2. Protein Purification – Hand Book – Amersham. Pharmacia Biotech

3. Fundamentals of Protein Structure and Function - Engelbert Buxbaum. Springer Science
4. Protein Engineering and Design - Sheldon J Park & Jennifer R Cochran. CRC Press.
5. Protein Purification, Principle and Practice - Robert K Skopes. Springer Link.
6. Proteins-Structure and Function - David Whitford. John Wiley & Sons.
7. Protein Formulation and Delivery - James Swarbrick. Informa Healthcare USA, Inc.
8. Formulation, Characterization, and Stability of Protein Drugs - Rodney Pearlman & Y. John Wan., Kluwer Academic Publishers.

IMMUNOTECHNOLOGY (MPB 202T)

Unit 1: Fundamental aspects of immunology: Introduction, cells and organs of the immune system, cellular basis of Immune response, primary and secondary lymphoid organs, antigen antibody and their structure. Types of immune responses, anatomy of immune response. Overview of innate and adaptive Immunity. Humoral immunity. Lymphocytes and their activation. Structure and function of immunoglobulins, idiotypes and anti idiotypic antibodies. Cell mediated Immunity. Thymus derived lymphocytes (T cells) – their ontogeny and types, MHC complex, antigen presenting cells (APC), mechanisms of T cell activation, macrophages, dendritic cells, langerhans cells, mechanism of phagocytosis 12 Hours

Unit 2: Immune regulation and tolerance: Complement activation and types and their biological functions, cytokines and their role in immune response.

Hypersensitivity: Hypersensitivity Types I-IV, Hypersensitivity reactions and treatment. Autoimmune diseases 12 Hours

Unit 3: Vaccine technology: Vaccine and their types, conventional vaccines, novel methods for vaccine production, antiidiotype vaccine, DNA vaccine, genetically engineered vaccine, iscoms, synthetic peptides, and immunodiagnosics. Stem cell technology applications to immunology. 12 Hours

Unit 4: Hybridoma technology: Hybridoma techniques – fusion methods for myeloma cells and B- lymphocytes, selection and screening techniques. Production and purification of monoclonal antibodies and their applications in pharmaceutical industry. 12 Hours

Unit 5: Immunological disorder: Autoimmune disorders and types, pathogenic mechanisms, treatment, experimental models of auto immune diseases, primary and secondary immunodeficiency disorders.

Immunodiagnosis: Antigen antibody interaction – Precipitation reaction, agglutination reactions, principles and applications of ELISA, radio immuno assay, Western blot analysis, immune-electrophoresis, immuno fluorescence, chemiluminescence assay, complement fixation reaction. 12 Hours

REFERENCES

1. Immunology – an Introduction - J. Kubey.
2. Immunodiagnosics - S.C. Rastogi. New Age International.
3. Immunology and Immunotechnology - Ashim Chakravarthy. Oxford University Press.
4. Molecular Immunology - E. Benjamini.

BIOINFORMATICS AND COMPUTATIONAL BIOTECHNOLOGY (MPB 203T)

Unit 1: Introduction to bioinformatics: Definition and history of bioinformatics, internet and bioinformatics, introduction to data mining. Applications of data mining to bioinformatics,

biological database. Protein and nucleic acid databases. Structural data bases. Collecting and storing the sequence and applications of bioinformatics. 12 Hours

Unit 2: Sequence analysis: Sequence alignment, pair wise alignment techniques, multiple sequence analysis, multiple sequence alignment; Flexible sequence similarity searching with the FAST3 program package, the use of CLUSTAL W and CLUSTAL X for the multiple sequence alignment. Tools used for sequence analysis. 12 Hours

Unit 3: Protein informatics: Introduction; Force field methods; Energy, buried and exposed residues, side chains and neighbours; Fixed regions, hydrogen bonds, mapping properties onto surfaces; Fitting monomers, R & S fit of conformers, assigning secondary structures; Sequence alignment-methods, evaluation, scoring; Protein completion, backbone construction and side chain addition; Small peptide methodology, software accessibility, building peptides; Protein displays; Substructure manipulations, annealing.

Protein structure prediction: Protein folding and model generation; Secondary structure prediction, analyzing secondary structures; Protein loop searching, loop generating methods, loop analysis; Homology modeling, concepts of homology modeling, potential applications, description, methodology, homologous sequence identification; Align structures, align model sequence; Construction of variable and conserved regions, threading techniques, Topology fingerprint approach for prediction, evaluation of alternate models; Structure prediction on a mystery sequence, structure aided sequence techniques of structure prediction, structural profiles, alignment algorithms, mutation tables, prediction, validation, sequence

based methods of structure prediction, prediction using inverse folding, fold prediction; Significance analysis, scoring techniques, sequence- sequence scoring.

Docking: Docking problems, methods for protein- ligand docking, validation studies and applications; Screening small molecule databases, docking of combinatorial libraries, input data, analyzing docking results. 12 Hours

Unit 4: Diversity of genomes: Prokaryotic and eukaryotic gene families. Genome analysis: Introduction, gene prediction methods, gene mapping and applications - genetic and physical mapping, integrated map, sequence assembly and gene expression. Completed genomes: Bacterium, nematode, plant and human Evolution of genomes, lateral or horizontal transfer among genomes, transcriptome and proteome-general account

Phylogenetic analysis. Evolutionary change in nucleotide sequences, rates and patterns of nucleotide substitution, models for nucleotide substitution, construction of phylogenetic tree, genome annotation technique. 12 Hours

Unit 5: Target searching and drug designing: Target and lead, timeline for drug development, target discovery, target modulators, in silico gene expression, microarray, and lead discovery, libraries of ligands, active site analysis, and prediction of drug quality. 12 Hours

REFERENCES

1. Bioinformatics Sequence and Genome Analysis - David W Mount. CBS Publishers, New Delhi.
2. Bioinformatics - Concepts Skill and Applications - S.C. Rastogi, Namata Mendiaratta & Parag Rastogi. CBS Publishers, New Delhi.
3. Protein Structure and Molecular Properties - T.E. Creighton. W.H. Freeman and Company.
4. Bioinformatics; A Practical Guide to the Analysis of Genes and Proteins - Andreas D Baxeavanis & B.F. Francis Ouellette. John Wiley & Sons.
5. Introduction to Bioinformatics - Arthur M Lesk. Oxford University Press.
6. Bioinformatics: A Practical Approach - Shui Qing Ye. Chapman & Hall/CRC.
7. Bioinformatics for DNA Sequence Analysis - David Posada. Humana Press.
8. Introduction to Bioinformatics - A.M. Lesk. Oxford University Press.
9. Bioinformatics - S.I. Letovsky. Kluwer Academic Publishers.
10. Bioinformatics - P. Baldi & S. Brunak. The MIT Press.

BIOLOGICAL EVALUATION OF DRUG THERAPY (MPB 204T)

Unit 1: Biological standardization: General principles, scope and limitation of bio-assay, bioassay of some official drugs.

Preclinical drug evaluation: Preclinical drug evaluation of its biological activity, potency and toxicity-Toxicity test in animals including acute, sub-acute and chronic toxicity, ED₅₀ and LD₅₀ determination, special toxicity test like teratogenecity and mutagenecity.

Guidelines for toxicity studies: Various guidelines for toxicity studies. Animal experiments assessing safety of packaging materials. 12 Hours

Unit 2: Pyrogens: Sources, chemistry and properties of bacterial pyrogens and endotoxins, official pyrogen tests. Microbiological assay. Assay of antibiotics and vitamins. Biological evaluation of drugs. Screening and evaluation (including principles of screening, development of models for diseases: In vivo models / in vitro models / cell line study). 12 Hours

Unit 3: Biologic medicines in development for various diseases - by therapeutic category: genetic disorders, eye related disorders, digestive disorders, diabetes related conditions, cardiovascular disease, cancer related conditions, blood disorders, autoimmune disorders, infectious diseases, neurologic disorders, skin diseases, organ transplantation.

Biologic medicines in development for various diseases by product category: Antisense, vaccines, recombinant hormones/proteins, monoclonal antibodies (MAB), interferons, growth factors, gene therapy, RNA interference. 12 Hours

Unit 4: Regulatory aspects of drugs, biologics and medical devices: An introduction to the regulations and documents necessary for approval of a medical product. Regulatory consideration for pre-clinical testing and clinical testing of drugs, biologics and medical devices. New Drug Applications for Global Pharmaceutical Product Approvals 12 Hours

Unit 5: Bioavailability: Objectives and consideration in bio-availability studies of biopharmaceuticals, concept of equivalents, measurements of bio-availability. Determination of the rate of absorption, bioequivalence and its importance, regulatory aspects of bio- availability and bioequivalence studies for conventional dosage forms and controlled drug delivery systems of biopharmaceuticals.

Pharmacokinetics: Basic consideration, Pharmacokinetic models, Application of Pharmacokinetics in new drug development of Biopharmaceuticals and designing of dosage forms and Novel drug delivery systems of Biopharmaceuticals. 12 Hours

REFERENCES

1. Standardization and Control of Biologicals Produced by Recombinant DNA Technology -

F.T. Perkins & W. Hennesen. International Association of Biological Standardization.

2. Biological Standardization - J.H. Burn. Oxford University Press.
3. Drug Discovery and Evaluation in Pharmacology assay - Vogel
4. Design and Analysis of Animal Studies in Pharmaceutical Development - Chow, Shein & Ching.
5. Animal and Clinical Pharmacologic Techniques in Drug Evaluation - Nodine & Siegler.
6. Screening Methods in Pharmacology - R.A. Turner, Vol 1 & 2.

PHARMACEUTICAL BIOTECHNOLOGY PRACTICAL - III (MPB 205P)

1. Protein identification
2. Protein characterization
3. Recombinant DNA technology
4. Protein formulations
5. Database searching
6. Sequence analysis methods
7. Protein structure prediction
8. Gene annotation methods
9. Phylogenetic analysis
10. Preparation of DNA for PCR applications – Isolation, purity and quantification
11. Introduction to PCR – working of PCR, programming
12. Introduction to RT-PCR – working, programming
13. Primer design using software
14. Gene DNA amplification by random / specific primers
15. Western Blotting

PHARMACOLOGY (MPL)

First Semester

MODERN PHARMACEUTICAL ANALYTICAL TECHNIQUES (MPH 101T)

(Note: Common paper for MPA, MPC, MPH, MPB, MPL, MPG, MQA, & MIP, specializations)

Unit 1: a. UV-visible spectroscopy: Introduction, theory, laws and instrumentation associated with UV-visible spectroscopy, choice of solvents and solvent effect and applications of UV-visible spectroscopy.

b. IR spectroscopy: Theory, modes of molecular vibrations, sample handling, instrumentation of dispersive and Fourier-Transform IR Spectrometer, factors affecting vibrational frequencies and applications of IR spectroscopy, data interpretation.

c. Spectrofluorimetry: Theory of fluorescence, factors affecting fluorescence (characteristics of drugs that can be analyzed by fluorimetry), quenchers, instrumentation and Applications of fluorescence spectrophotometer.

d. Flame emission spectroscopy and Atomic absorption spectroscopy: Principle, instrumentation, interferences and applications. 12 Hours

Unit 2: NMR spectroscopy: Quantum numbers and their role in NMR, Principle, Instrumentation, Solvent requirement in NMR, Relaxation process, NMR signals in various compounds, Chemical shift, Factors influencing chemical shift, Spin-Spin coupling, Coupling constant, Nuclear magnetic double resonance, Brief outline of principles of FT-NMR and ¹³C NMR. Applications of NMR spectroscopy. 10 Hours

Unit 3: Mass Spectroscopy: Principle, Theory, Instrumentation of Mass Spectroscopy, Different types of ionization like electron impact, chemical, field, FAB and MALDI, APCI, ESI, APPI Analyzers of Quadrupole and Time of Flight, Mass fragmentation and its rules, Meta stable ions, Isotopic peaks and Applications of Mass spectroscopy. 10 Hours

Unit 4: Chromatography: Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution, isolation of drug from excipients, data interpretation and applications of the following:

a) Thin Layer chromatography b) High Performance Thin Layer Chromatography c) Ion exchange chromatography d) Column chromatography e) Gas chromatography f) High Performance Liquid chromatography g) Ultra High Performance Liquid chromatography h) Affinity chromatography i) Gel Chromatography. 14 Hours

Unit 5: a. Electrophoresis: Principle, Instrumentation, Working conditions, factors affecting separation and applications of the following: a) Paper electrophoresis b) Gel electrophoresis

c) Capillary electrophoresis d) Zone electrophoresis e) Moving boundary electrophoresis f) Iso electric focusing.

b. X ray Crystallography: Production of X rays, Different X ray methods, Bragg's law, Rotating crystal technique, X ray powder technique, Types of crystals and applications of X-ray diffraction.

c. Thermal Techniques: Principle, instrumentation, advantage and disadvantages, Pharmaceutical applications of DSC, DTA & TGA.

d. Microscopic techniques: Principles and applications of Scanning Electron Microscopy and Transmission Electron Microscopy analysis. 14 Hours

REFERENCES

1. Spectrometric Identification of Organic compounds - Robert M Silverstein. 6th ed. John Wiley & Sons, 2004.
2. Principles of Instrumental Analysis - Douglas A Skoog, F. James Holler & Timothy A. Nieman. 5th ed. Eastern Press, Bangalore, 1998.
3. Instrumental Methods of Analysis – Willards. 7th ed. CBS Publishers, New Delhi.
4. Practical Pharmaceutical Chemistry – Beckett and Stenlake. Vol 2. 4th ed. CBS Publishers, New Delhi
5. Organic Spectroscopy - William Kemp. 3rd ed. ELBS, 1991.
6. Quantitative Analysis of Drugs in Pharmaceutical Formulation – P.D. Sethi. 3rd ed. CBS Publishers, New Delhi, 1997.
7. Pharmaceutical Analysis - Modern Methods – Part B – J.W. Munson. Vol 11. Marcel- Dekker Series.
8. Spectroscopy of Organic Compounds - P.S. Kalsi. 2nd ed. Wiley Eastern Ltd., Delhi.
9. Textbook of Pharmaceutical Analysis - K.A. Connors. 3rd ed. John Wiley & Sons.

ADVANCED PHARMACOLOGY – I ((MPL 102T)

Unit 1: General pharmacology: Drug receptor concepts, relationship between drug concentration and effect, Structural and functional families of the receptors, quantification of drug receptor interaction. Basic concepts of pharmacokinetics. Types of adverse effects. 12 Hours

Unit 2: Neurohumoral transmission in peripheral nervous system: Neurotransmitters of autonomic nervous system, nonadrenergic and noncholinergic transmitters. Pharmacology of autonomic nervous system, parasympathomimetics, parasympatholytics, sympathomimetics, sympatholytics. Pharmacology of local anaesthetics. 12 Hours

Unit 3: Neurohumoral transmission of central nervous system- neurotransmitters of central nervous system (Detailed study of dopaminergic, serotonergic, GABA, adrenergic, glutamate, cholinergic pathways). Pharmacology of drugs acting on central nervous system- general anaesthetics, sedatives, hypnotics, antianxiety, antidepressants, antipsychotics, antiepileptics, antimaniacs, opioid and non-opioid analgesics. 12 Hours

Unit 4: Cardiovascular pharmacology: Diuretics, antihypertensives, antianginal drugs, antiarrhythmics, antihyperlipidemics, cardiotonics, coagulants, anticoagulants, fibrinolytics, antiplatelet agents, hematinics. 12 Hours

Unit 5: Neurodegenerative disorders: Parkinsonism, Alzheimer's disease, Huntington's disease, concepts of free radical generation. Introduction to free radical induced disorders (diabetes, asthma, gastric ulcer, cardiovascular disorder). 12 Hours

REFERENCES

1. Goodman and Gillman's: The Pharmacological Basis of Therapeutics - Laurence L Brunton, Randa Hilal-Dandan & Björn C Knollmann. 13th ed. Mc Graw Hill Education.
2. Principles of Pharmacology: The Pathophysiologic Basis of Drug Therapy - David E Golan, Armen H Tashjian Jr, Ehrin J Armstrong & April W Armstrong. Wolters, Kluwer-Lippincott Williams & Wilkins Publishers.
3. Oxford Textbook of Clinical Pharmacology - Graham Smith.
4. Avery Drug Treatment - Trevor M Speight & Nicholas H G Holford.
5. Dipiro Pharmacology, Pathophysiological approach.
6. Robbins & Cortan Pathologic Basis of Disease. 9th ed. (Robbins Pathology)
7. Essentials of Medical Pharmacology – K.D. Tripathi.
8. Modern Pharmacology with Clinical Applications - R. Craig Charles & E. Stitzel Robert. Lippincott.
9. Modern Pharmacology – C.R. Craig & R.E. Stitzel. Little Brown & Company.
10. Green Pathophysiology for Pharmacists.
11. A Complete Text Book of Medical Pharmacology - S.K. Srivastava. APC Avichal Publishing.

PHARMACOKINETICS AND DRUG METABOLISM (MPL 103T)

Unit 1: ADME: Transfer of drugs through biological membranes (BBB, placental barrier), role of P- glycoprotein in drug absorption. Gastrointestinal, percutaneous and rectal absorption, factors affecting drug absorption, absorption kinetics, distribution kinetics (plasma protein binding, tissue binding). 12 Hours

Unit 2: Drug metabolism: Microsomal and non-microsomal biotransformation of drugs (liver, kidney and intestine), human cytochrome P450 enzymes, substrates, inducers and inhibitors. In vitro drug metabolism (liver microsomes, liver S9 fraction and hepatocytes). Physiological, pathological and genetic factors affecting drug metabolism. 12 Hours

Unit 3: Routes of drug excretion, factors affecting drug excretion, enterohepatic recirculation, significance of elimination rate constant, elimination half-life. 12 Hours

Unit 4: Clinical pharmacokinetics, population pharmacokinetic, PK-PD modeling, therapeutic drug monitoring (TDM), and drug-drug interactions, drug food and predictions of drug-drug interactions. 12 Hours

Unit 5: Toxicokinetics: Toxicokinetic evaluation in pre-clinical studies, importance and applications of toxicokinetic studies, alternative methods to animal toxicity studies. 12 Hours

REFERENCES

1. Biopharmaceutics and Pharmacokinetics - An Introduction - Robert E Notari.
2. Drug metabolism - Bernard Testa & Peter Jenner.
3. Selected Chapters from: Principles of Drug Action - Gldstein, Aranow & Kalman.
4. Drug Interaction - D.G. Grahme Smith
5. Remington – The Science and Practice of Pharmacy – Loyd V Allen. 22nd ed.
6. Goodman and Gillman's The Pharmacological Basis of Therapeutics. 10th ed.
7. Hand book of Clinical Pharmacokinetics - Gibaldi and Prescott.
8. Applied Biopharmaceutics and Pharmacokinetics - Leon Shargel & Andrew B C Yu.
9. Clinical Pharmacokinetics & Pharmacodynamics - Malcolm Rowland & Tozer. 4th ed. Lippincott Publications.
10. Applied Biopharmaceutics and Pharmacokinetics, Pharmacodynamics and Drug Metabolism for Industrial Scientists.
11. Hand Book of Essential Pharmacokinetics, Pharmacodynamics & Drug Metabolism for Industrial Scientists.

CELLULAR AND MOLECULAR PHARMACOLOGY (MPL 104T)

Unit 1: Cell biology: Structure and functions of cell and its organelles, Genome organization. Gene expression and its regulation, importance of siRNA and micro RNA, gene mapping and gene sequencing, Cell cycles and its regulation. Cell death– events, regulators, intrinsic and extrinsic pathways of apoptosis. Necrosis and autophagy. 12 Hours.

Unit 2: Cell signaling, intercellular and intracellular signaling pathways. Classification of receptor family and molecular structure ligand gated ion channels; G-protein coupled receptors, tyrosine kinase receptors and nuclear receptors. Secondary messengers: cyclic AMP, cyclic GMP, calcium ion inositol 1,4,5-trisphosphate, (IP3), NO, and diacylglycerol. Detailed study of following intracellular signaling pathways: cyclicAMP signaling pathway, mitogen- activated protein kinase (MAPK) signaling, Janus kinase

(JAK)/signal transducer and activator of transcription (STAT) signaling pathway. 12 Hours

Unit 3: Principles of recombinant DNA technology - restriction enzymes, various types of vectors. Applications of recombinant DNA technology. ELISA and Western blotting Gene therapy- Various types of gene transfer techniques, clinical applications and recent advances in gene therapy. 12 Hours

Unit 4: Gene mapping and cloning of disease gene. Genetic variation and its role in health/ pharmacology. Pharmacogenomics, polymorphisms affecting drug metabolism, Genetic variation in drug transporters, Genetic variation in G protein coupled receptors. 12 Hours

Unit 5: Cell culture techniques: Basic equipment used in cell culture lab. Cell culture media, various types of cell culture, general procedure for cell cultures; isolation of cells, subculture, cryopreservation, characterization of cells and their application. Principles and applications of cell viability assays, glucose uptake assay, calcium influx assays, principles and applications of flow cytometry. Biosimilars. 12 Hours

REFERENCES

1. Molecular Biology of The Cell - Bruce Alberts and et al. 5th ed. Garland Science.
2. Cell and Molecular Biology - E.D.P. De Robertis & E.M.F. De Robertis Jr. 8th ed. Wolter Publications.
3. Molecular Cell Biology - Harvey Lodish et al. 6th ed. W.H. Freeman & Company.
4. Molecular Biology and Biotechnology - John M Walker & Ralph Raple. 5th ed. RSC Publications.
5. A Concise Reference Advanced Molecular Biology - R.M. Twyman, Viva Books Pvt. Ltd.
6. Principles of Gene Manipulation and Genomics - S.B. Primrose & R.M. Twyman. 7th edn.
7. The Cell, A Molecular Approach - Geoffrey M Cooper.
8. Pharmacogenomics - J. Licinio & M.L. Wong
9. Handbook of Cell Signaling – A. Ralph et al. 2nd ed.
10. Molecular Pharmacology: From DNA to Drug Discovery - John Dickenson et al.
11. Basic Cell Culture Protocols - Cheril D Helgason & Cindy L Miller
12. Basic Cell Culture (Practical Approach) - J. M. Davis.
13. Animal Cell Culture: A Practical Approach - John R Masters.
14. Current Protocols in Molecular Biology - Frederick M. Ausuvel et al. Vol 1 to 6.

PHARMACOLOGY PRACTICAL – I (MPL 105P)

1. Enzyme based in vitro assays (MPO, AChEs, α amylase, α glucosidase)
2. Handling of laboratory animals
3. Various routes of drug administration.
4. Pharmacokinetic studies and data analysis of drugs given by different routes of administration using software
5. Enzyme inhibition and induction activity
6. Extraction of drug from various biological samples and estimation of drugs in biological fluids using different analytical techniques (UV)
7. Extraction of drug from various biological samples and estimation of drug in biological fluids using different analytical techniques (HPLC)
8. Predictions of drug - drug interactions using software

PHARMACOLOGY PRACTICAL – II (MPL 106P)

1. Functional observation battery tests (modified Irwin test).
2. Evaluation of CNS stimulant, depressant, anxiogenics and anxiolytic, anticonvulsant activity.
3. Evaluation of analgesic & anti-inflammatory.
4. Evaluation of local anesthetic, mydriatic and miotic activity.
5. Evaluation of diuretic activity.
6. Evaluation of antiulcer activity models
7. Estimation of glucose and lipid parameters in blood samples.
8. Estimation of lipid levels in tissues.
9. Oral glucose tolerance test, oral fat tolerance test.

Second Semester

ADVANCED PHARMACOLOGY – II (MPL 201T)

Unit 1: Chemotherapy: Basic concepts of chemotherapy, pharmacology of antibacterial resistance, pharmacology of antibacterial agents – α – lactams, aminoglycosides, tetracyclins, chloramphenicol, macrolide antibiotics, fluoroquinolones, antitubercular, antileprotic, antiprotozoal (antimalarial, asntiamoebics., etc.) and anthelmintics. 12 Hours

Unit 2: Antiviral, antifungal, anticancer drugs: Drugs acting on immune disorders (rhematoid arthritis, asthma, COPD), immunosuppressants. 12 Hours

Unit 3: Endocrine pharmacology: Pharmacology of hormones (hormones of hypothalamic pituitary axis), pancreatic hormones, pharmacology of antithyroid drugs, oral contraceptives, oral hypoglycemic drugs, corticosteroids, drugs affecting calcium regulation. 12 Hours

Unit 4: GIT pharmacology: Antiulcer drugs, antiemetics, antidiarrhoeals, drugs used for intestinal bowel disorders (IBD) and constipation.

Respiratory Pharmacology: Antiasthmatics, cough suppressants, expectorants and drugs used in COPD. 12 Hours

Unit 5: Autacoid pharmacology: Physiological and pathological role of histamines, serotonin, prostaglandins, kinins, interleukins, substance P, neuropeptides, NFKα. Pharmacology of antihistamines, 5 HT antagonists. Concept of chronopharmacology, circadian rhythm and its applications. 12 Hours

REFERENCES

1. Goodman and Gillman's The Pharmacological Basis of Therapeutics. 10th ed.
2. Principles of Pharmacology: The Pathophysiologic Basis of Drug Therapy - David E Golan, Armen H Tashjian Jr, Ehrin J Armstrong & April W Armstrong. Wolters, Kluwer-Lippincott Williams & Wilkins Publishers.
3. Basic and Clinical Pharmacology - B.G. Katzung
4. Rang and Dale's Pharmacology - James Ritter, Rod Flower, Graeme Henderson, Yoon Kong Loke, David MacEwan & Humphrey Rang
5. Text book of Therapeutics, Drug and Disease Management - E T. Herfindal & Gourley.
6. Robbins & Cortan Pathologic Basis of Disease, 9th ed. (Robbins Pathology)
7. A Complete Text Book of Medical Pharmacology - S.K. Srivastava. APC Avichal Publishing.
8. Essentials of Medical Pharmacology - K.D. Tripathi.
9. Principles of Pharmacology. The Pathophysiologic basis of drug Therapy - David E Golan, H. Armen, Tashjian Jr, J. Ehrin, Armstrong, W. April & Armstrong. Wolters, Kluwer-Lippincott Williams & Wilkins Publishers.
10. Relevant Research and Review articles

PHARMACOLOGICAL AND TOXICOLOGICAL SCREENING METHODS (MPL 202T)

Unit 1: Laboratory animals/Common laboratory animals: Description, handling and applications of different species and strains of animals. Transgenic animals: Production, maintenance and applications. Anesthesia and euthanasia of experimental animals, Maintenance and breeding of laboratory animals. CPCSEA, OECD, ICH, EPA guidelines to conduct experiments on animals. Good laboratory practice. Bioassay - Principles, scope and limitations and methods of Immunoassays. 12 Hours

Unit 2: Preclinical screening of new substances for the pharmacological activity using in vivo, in vitro, and other possible animal alternative models. General principles of preclinical screening. 12 Hours

CNS Pharmacology: Behavioral and muscle coordination, CNS stimulants and depressants, anxiolytics, anti-psychotics, anti epileptics and nootropics. Drugs for neurodegenerative diseases like Parkinsonism, Alzheimer's and multiple sclerosis. Screening of drugs acting on Autonomic Nervous System

Unit 3: Preclinical screening of new substances for the pharmacological activity using in vivo, in vitro, and other possible animal alternative models.

Respiratory pharmacology: Anti-asthmatics, drugs for COPD and anti-allergics.

Reproductive pharmacology: Aphrodisiacs and antifertility agents. Analgesics, anti-inflammatory and antipyretic agents. Gastrointestinal drugs: Anti-ulcer, anti-emetic, anti-diarrheals and laxative. 12 Hours

Unit 4: Preclinical screening of new substances for the pharmacological activity using in vivo, in vitro, and other possible animal alternative models.

Cardiovascular pharmacology: Antihypertensives, antiarrhythmics, antianginal, antiatherosclerotic agents and diuretics. Drugs for metabolic disorders like anti-diabetic, anti-dyslipidemic agents. Anti-cancer agents. Hepatoprotective screening methods. 12 Hours

Unit 5: Toxicity studies (acute, sub acute and chronic) oral, inhalation and dermal toxicity studies. Reproductive toxicity – Teratogenicity, genotoxicity (Ames test, in vitro, in vivo micronucleus, chromosomal aberrations) carcinogenicity. Introduction to IND Studies. 12 Hours

REFERENCES

1. Biological Standardization - J.H. Burn, D.J. Finney & I.G. Goodwin.
2. Screening Methods in Pharmacology - A. Robert Turner.
3. Evaluation of Drugs Activities - Laurence & Bachrach.
4. Fundamentals of Experimental Pharmacology - M.N. Ghosh.
5. Pharmacological Experiments on Intact Preparations - Churchill Livingstone
6. Drug Discovery and Evaluation – H.G. Vogel.
7. Experimental Pharmacology - R.K. Goyal.
8. Handbook of Experimental Pharmacology – S.K. Kulkarni
9. Practical Pharmacology and Clinical Pharmacy - S.K. Kulkarni, 3rd ed.
10. Screening Methods in Pharmacology - Robert A Turner.
11. Rodents for Pharmacological Experiments - Tapan Kumar Chatterjee.

12. Practical Manual of Experimental and Clinical Pharmacology - Bikash Medhi & Ajay Prakash.

13. Methods in Pharmacology - Arnold Schwartz.

14. Preclinical Evaluation of New Drugs - S.K. Guta.

15. Animal Models in Cardiovascular Research - David R Gross, 2nd ed. Kluwer Academic Publishing.

16. OECD Test Guidelines.

17. Relevant Research and Review articles and guidelines

PRINCIPLES OF DRUG DISCOVERY (MPL 203T)

Unit 1: An overview of modern drug discovery process: Target identification, target validation, lead identification and lead Optimization. Economics of drug discovery. Target Discovery and validation. 12 Hours

Unit 2: Role of Genomics, proteomics and bioinformatics. Role of nucleic acid microarrays, protein microarrays, antisense technologies, siRNAs, antisense oligonucleotides, zinc finger proteins. Role of transgenic animals in target validation. Lead identification - combinatorial chemistry & high throughput screening, in silico lead discovery techniques. Assay development for hit identification. 12 Hours

Unit 3: Rational drug design - Traditional vs. rational drug design. Methods followed in traditional drug design. High throughput screening, Concepts of rational drug design. 12 Hours

Unit 4: Rational drug design methods: Structure and pharmacophore based approaches. Molecular docking - rigid docking, flexible docking, manual docking; Docking based screening. De novo drug design. Quantitative analysis of structure activity relationship. 12 Hours

Unit 5: Prodrug design: Basic concept, prodrugs to improve patient acceptability. Drug solubility, drug absorption and distribution, site specific drug delivery and sustained drug action. Rationale of prodrug design and practical consideration of prodrug design. 12 Hours

REFERENCES

1. Target Discovery and Validation Reviews and Protocols - Emerging Molecular Targets and Treatment Options - Mouldy Sioud. Vol 2. Humana Press Inc., 2007.
2. Silico Technologies in Drug Target Identification and Validation - Darryl León. Scott Markel In., 2006. Taylor and Francis Group, LLC.
3. Disease Gene Identification: Methods and Protocols - Johanna K DiStefano. Springer New York Dordrecht Heidelberg, London.
4. QSAR: Hansch Analysis and Related Approaches: Methods and Principles in Medicinal Chemistry - Hugo Kubiny. Wiley-VCH.

5. Structure - Based Ligand Design: Methods and Principles in Medicinal Chemistry - Klaus Gubernator & Hans-Joachim Böhm. Wiley-VCH.

6. Rational Drug Design: Novel Methodology and Practical Applications - Abby L Parrill.

M. Rami Reddy. ACS Symposium Series; American Chemical Society: Washington, DC, 1999.

7. New Drug Development Design, Methodology and Analysis - J. Rick Turner. John Wiley & Sons, Inc., New Jersey.

8. Relevant Research and Review articles and guidelines

CLINICAL RESEARCH AND PHARMACOVIGILANCE (MPL 204T)

Unit 1: Regulatory perspectives of clinical trials: Origin and principles of International Conference on Harmonization - Good Clinical Practice (ICH-GCP) guidelines.

Ethical committee: Institutional Review Board, ethical guidelines for biomedical research and human participant - Schedule Y. ICMR informed consent process: structure and content of an informed consent process, ethical principles governing informed consent process.

12 Hours

Unit 2: Clinical trials: Types and design of experimental study- RCT and non RCT.

Observation study: Cohort, case control, cross sectional clinical trial study - Team roles and responsibilities of clinical trial personnel: Investigator, Study Coordinator, Sponsor, Contract Research Organization and its management. 12 Hours

Unit 3: Clinical trial documentation: Guidelines to the preparation of documents, preparation of protocol, Investigator Brochure, Case Report Forms, Clinical Study Report.

Clinical trial monitoring - Safety monitoring in clinical trial adverse drug reactions: Definition and types. Detection and reporting methods. Severity and seriousness assessment. Predictability and preventability assessment, Management of adverse drug reactions;

Terminologies of ADR. 12 Hours

Unit 4: Basic aspects, terminologies and establishment of pharmacovigilance: History and progress of pharmacovigilance. Significance of safety monitoring. Pharmacovigilance in India and international aspects, WHO international drug monitoring programme, WHO and Regulatory terminologies of ADR, evaluation of medication safety, establishing pharmacovigilance centres in hospitals, industry and national programmes related to pharmacovigilance. Roles and responsibilities in pharmacovigilance, guidelines for ADR reporting, Argus, Aris G Pharmacovigilance, Vigi Flow. Statistical methods for evaluating medication

safety data. Methods, ADR reporting and tools used in pharmacovigilance. 12 Hours

Unit 5: Pharmacoepidimology and pharmacoeconomics: Definition and scope, measurement of outcomes, Pharmacoepidimology methods, Definition evaluation and applications of pharmacoeconomic methods. 12 Hours

REFERENCES

1. Central Drugs Standard Control Organization - Good Clinical Practices, Guidelines for Clinical Trials on Pharmaceutical Products in India. New Delhi: Ministry of Health, 2001.

2. International Conference on Harmonization of Technical requirements for registration of Pharmaceuticals for human use. ICH Harmonized Tripartite Guideline. Guideline for Good Clinical Practice. E6; May 1996.

3. Ethical Guidelines for Biomedical Research on Human Subjects 2000. Indian Council of Medical Research, New Delhi.

4. Textbook of Clinical Trials - David Machin, Simon Day & Sylvan Green. John Wiley and Sons, March 2005.

5. Clinical Data Management – R.K. Rondels, S.A. Varley & C.F. Webbs. 2nd ed. Wiley Publications, Jan 2000.

6. Handbook of Clinical Research - Julia Lloyd & Ann Raven. Churchill Livingstone.

7. Principles of Clinical Research - Giovanna di Ignazio & Di Giovannaand Haynes.

8. Relevant Research and Review articles and guidelines

PHARMACOLOGY PRACTICAL – III (MPL 205P)

1. Recording of rat BP, heart rate and ECG

2. Recording of rat ECG

3. Drug absorption studies by averted rat ileum preparation

4. Acute oral toxicity studies as per OECD guidelines

5. Acute dermal toxicity studies as per OECD guidelines

6. Repeated dose toxicity studies- Serum biochemical, haematological, urine analysis, functional observation tests and histological studies

8. Protocol design for clinical trial.(3 Nos.)

9. To record the DRC of agonist using suitable isolated tissues preparation

10. To study the effects of antagonist/potentiating agents on DRC of agonist using suitable isolated tissue preparation

11. To determine to the strength of unknown sample by matching bioassay by using suitable tissue preparation

12. To determine to the strength of unknown sample by interpolation bioassay by using suitable tissue preparation

13. To determine to the strength of unknown sample by bracketing bioassay by using suitable tissue preparation

14. To determine to the strength of unknown sample by multiple point bioassay by using suitable tissue preparation

15. Estimation of PA2 values of various antagonists using suitable isolated tissue preparations

16. To study the effects of various drugs on isolated heart preparations
Note: Minimum 10 Experiments from the above is mandatory

PHARMACOGNOSY (MPG)

First Semester

MODERN PHARMACEUTICAL ANALYTICAL TECHNIQUES (MPA 101T)

(Note: Common paper for MPA, MPC, MPH, MPB, MPL, MPG, MQA, & MIP, specializations)

Unit 1: a. UV-visible spectroscopy: Introduction, theory, laws and instrumentation associated with UV-visible spectroscopy, choice of solvents and solvent effect and applications of UV-visible spectroscopy.

b. IR spectroscopy: Theory, modes of molecular vibrations, sample handling, instrumentation of dispersive and Fourier-Transform IR Spectrometer, factors affecting vibrational frequencies and applications of IR spectroscopy, data interpretation.

c. Spectrofluorimetry: Theory of fluorescence, factors affecting fluorescence (characteristics of drugs that can be analysed by fluorimetry), quenchers, instrumentation and Applications of fluorescence spectrophotometer.

d. Flame emission spectroscopy and Atomic absorption spectroscopy: Principle, instrumentation, interferences and applications. 12 Hours

Unit 2: NMR spectroscopy: Quantum numbers and their role in NMR, Principle, Instrumentation, Solvent requirement in NMR, Relaxation process, NMR signals in various compounds, Chemical shift, Factors influencing chemical shift, Spin-Spin coupling, Coupling constant, Nuclear magnetic double resonance, Brief outline of principles of FT-NMR and ¹³C NMR. Applications of NMR spectroscopy. 10 Hours

Unit 3: Mass Spectroscopy: Principle, Theory, Instrumentation of Mass Spectroscopy, Different types of ionization like electron impact, chemical, field, FAB and MALDI, APCI, ESI, APPI Analyzers of Quadrupole and Time

of Flight, Mass fragmentation and its rules, Meta stable ions, Isotopic peaks and Applications of Mass spectroscopy. 10 Hours

Unit 4: Chromatography: Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution, isolation of drug from excipients, data interpretation and applications of the following:

a) Thin Layer chromatography b) High Performance Thin Layer Chromatography c) Ion exchange chromatography d) Column chromatography e) Gas chromatography f) High Performance Liquid chromatography g) Ultra High Performance Liquid chromatography h) Affinity chromatography i) Gel Chromatography. 14 Hours

Unit 5: a. Electrophoresis: Principle, Instrumentation, Working conditions, factors affecting separation and applications of the following: a) Paper electrophoresis b) Gel electrophoresis

c) Capillary electrophoresis d) Zone electrophoresis e) Moving boundary electrophoresis f) Iso electric focusing.

b. X ray Crystallography: Production of X rays, Different X ray methods, Bragg's law, Rotating crystal technique, X ray powder technique, Types of crystals and applications of X-ray diffraction.

c. Thermal Techniques: Principle, instrumentation, advantage and disadvantages, Pharmaceutical applications of DSC, DTA & TGA.

d. Microscopic techniques: Principles and applications of Scanning Electron Microscopy and Transmission Electron Microscopy analysis. 14 Hours

REFERENCES

1. Spectrometric Identification of Organic compounds - Robert M Silverstein. 6th ed. John Wiley & Sons, 2004.

2. Principles of Instrumental Analysis - Douglas A Skoog, F. James Holler & Timothy A. Nieman. 5th ed. Eastern Press, Bangalore, 1998.

3. Instrumental Methods of Analysis – Willards. 7th ed. CBS Publishers, New Delhi.

4. Practical Pharmaceutical Chemistry – Beckett and Stenlake. Vol 2. 4th ed. CBS Publishers, New Delhi

5. Organic Spectroscopy - William Kemp. 3rd ed. ELBS, 1991.

6. Quantitative Analysis of Drugs in Pharmaceutical Formulation – P.D. Sethi. 3rd ed. CBS Publishers, New Delhi, 1997.

7. Pharmaceutical Analysis - Modern Methods – Part B – J.W. Munson. Vol 11. Marcel- Dekker Series.

8. Spectroscopy of Organic Compounds - P.S. Kalsi. 2nd ed. Wiley Estern Ltd., Delhi.

9. Textbook of Pharmaceutical Analysis - K.A. Connors. 3rd ed. John Wiley & Sons.

ADVANCED PHARMACOGNOSY - I (MPG 102T)

Unit 1: Plant drug cultivation: General introduction to the importance of Pharmacognosy in herbal drug industry, Indian Council of Agricultural Research, Current Good Agricultural Practices, Current Good Cultivation Practices, Current Good Collection Practices, Conservation of medicinal plants- Ex-situ and In- situ conservation of medicinal plants. 12 Hours

Unit 2: Marine natural products: General methods of isolation and purification. Study of marine toxins, recent advances in research in marine drugs. Problems faced in research on marine drugs such as taxonomical identification, chemical screening and their solution. 12 Hours

Unit 3: Nutraceuticals: Current trends and future scope. Inorganic mineral supplements, vitamin supplements, digestive enzymes, dietary fibres, cereals and grains, health drinks of natural origin, antioxidants, polyunsaturated fatty acids, herbs as functional foods. Formulation and standardization of nutraceuticals, regulatory aspects, FSSAI guidelines. Sources, name of marker compounds and their chemical nature, medicinal uses and health benefits of following

i) Spirulina ii) Soya bean iii) Ginseng iv) Garlic v) Broccoli vi) Green and Herbal Tea vii) Flax seeds viii) Black cohosh ix) Turmeric. 12 Hours

Unit 4: Phytopharmaceuticals: Occurrence, isolation and characteristic features (chemical nature, uses in pharmacy, medicinal and health benefits) of following.

- a) Carotenoids – i) α and β - Carotene ii) Xanthophyll (Lutein)
- b) Limonoids – i) d-Limonene ii) α – Terpineol
- c) Saponins – i) Shatavarins
- d) Flavonoids – i) Resveratrol ii) Rutin iii) Hesperidin iv) Naringin v) Quercetin
- e) Phenolic acids- Ellagic acid
- f) Vitamins
- g) Tocotrienols and Tocopherols
- h) Andrographolide, Glycolipids, Gugulipids, Withanolides, Vascine, Taxol
- i) Miscellaneous 12 Hours

Unit 5: Pharmacovigilance of drugs of natural origin: WHO and AYUSH guidelines for safety monitoring of natural medicine. Spontaneous reporting schemes for biodrug adverse reactions, bio drug-drug and bio drug-food interactions with suitable examples. 12 Hours

REFERENCES

1. Pharmacognosy - G. E. Trease & W.C. Evans. Saunders Edinburgh, New York.

2. Pharmacognosy - Tyler, Brady & Robbers.

3. Modern Methods of Plant Analysis - Peach & M.V. Tracey. Vol 1 & 2

4. Text Book of Pharmacognosy - T.E. Wallis.

5. Marine Natural Products -Vol. 1 to 6.

6. Natural Products: A Lab Guide - Raphael Ikan. Academic Press, 1991.

7. Glimpses of Indian Ethano Pharmacology - P. Pushpangadam. U.L.F. Nyman & V. George. Tropical Botanic Garden & Research Institute, 1995.

8. Medicinal Natural Products (A Biosynthetic Approach) - Paul M Dewick. John Wiley & Sons Ltd., England, 1998.

9. Chemistry of Marine Natural Products - Paul J Schewer. 1973.

10. Herbal Drug Industry – R.D. Choudhary. Eastern Publisher, New Delhi, 1996.

11. Cultivation of Medicinal Plants - C.K. Atal & B.M. Kapoor.

12. Cultivation and Utilization of Aromatic Plants - C.K. Atal & B.M. Kapoor.

13. Cultivation of Medicinal and Aromatic Crops – A.A. Farooqui & B.S. Sreeram. University Press, 2001.

14. Natural Products from Plants - Peter B Kaufman. 1st ed. CRC Press, New York, 1998.

15. Recent Advances in Phytochemistry - Scikel Runeckles. Vol. 1 & 4. Appleton Century Crofts.

16. Text book of Pharmacognosy - C.K. Kokate, Purohit & Ghokhale. Nirali Prakasshan, 1996.

17. Pharmacognosy and Pharmacobiotechnology – Ashutoshkar. New Age Publications, New Delhi.

PHYTOCHEMISTRY (MPG 103T)

Unit 1: Biosynthetic pathways and radio tracing techniques: Constituents & their biosynthesis, isolation, characterization and purification with a special reference to their importance in herbal industries of following phytopharmaceuticals containing drugs:

a) Alkaloids: Ephedrine, quinine, strychnine, piperine, berberine, taxol, vinca alkaloids.

b) Glycosides: Digitoxin, glycyrrhizin, sennosides, bacosides, quercetin.

- c) Steroids: Hecogenin, guggulosterone and withanolides
- d) Coumarin: Umbelliferone.
- e) Terpenoids: Cucurbitacins 12 Hours

Unit 2: Drug discovery and development: History of herbs as source of drugs and drug discovery, the lead structure selection process, structure development, product discovery process and drug registration. Selection and optimization of lead compounds with suitable examples from the following sources: artemesin, morphine, taxol, andrographolides. Clinical studies emphasising on phases of clinical trials, protocol design for lead molecules. 12 Hours

Unit 3: Extraction and phytochemical studies: Recent advances in extractions with emphasis on selection of method and choice of solvent for extraction, successive and exhaustive extraction and other methods of extraction commonly used like microwave assisted extraction, methods of fractionation. Separation of phytoconstituents by latest CCCET, SCFE techniques including preparative HPLC and flash column chromatography. 12 Hours

Unit 4: Phytochemical finger printing: HPTLC and LCMS/GCMS applications in the characterization of herbal extracts. Structure elucidation of phytoconstituents. 12 Hours

Unit 5: Structure elucidation of the following compounds by spectroscopic techniques like UV, IR, MS, NMR (¹H, ¹³C)

- a) Carvone, citral, menthol;
- b) Luteolin, kaempferol;
- c) Nicotine, caffeine
- d) Glycyrrhizin. 12 Hours

REFERENCES

1. Organic chemistry - I.L. Finar. Vol.II
2. Pharmacognosy - G. E. Trease & W.C. Evans. Saunders Edinburgh, New York.
3. Pharmacognosy - Tyler, Brady & Robbers
4. Text Book of Pharmacognosy - T.E. Wallis.
5. Clark's isolation and Identification of drugs - A.C. Mottal.
6. Plant Drug Analysis - H. Wagner & S. Bladt. Springer, Berlin.
7. Wilson and Gisvolds text book of Organic Medicinal and Pharmaceutical Chemistry - R.F. George.
8. The Chemistry of Natural Products - R.H. Thomson. Springer International ed. 1994.

9. Natural Products Chemistry Practical Manual - Anees A Siddiqui & Seemi Siddiqui.

10. Organic Chemistry of Natural Products - Gurdeep R Chatwal. Vol. 1 & 2.

11. Chemistry of Natural Products – IWPAC, Vol. 1 onwards.

12. Modern Methods of Plant Analysis - Peach & M.V. Tracey, Vol. I & II

13. Medicinal Natural Products (A Biosynthetic Approach) - Paul M Dewick. John Wiley & Sons Ltd., England, 1998.

14. Chemistry of Natural Products - S.V. Bhat, B.A. Nagasampagi & S. Meenakshi. Narosa Publishing House, New Delhi.

15. Pharmacognosy & Phytochemistry of Medicinal Plants – J. Bruneton. 2nd ed. Intercept Ltd., New York, 1999.

INDUSTRIAL PHARMACOGNOSTICAL TECHNOLOGY (MPG 104T)

Unit 1: Herbal drug industry: Infrastructure of herbal drug industry involved in production of standardized extracts and various dosage forms. Current challenges in upgrading and modernization of herbal formulations. Entrepreneurship development, Project selection, project report, technical knowledge, capital venture, plant design, layout and construction. Pilot plant scale up techniques, case studies of herbal extracts. Formulation and production management of herbals. 12 Hours

Unit 2: Regulatory requirements for setting herbal drug industry: Global marketing management. Indian and international patent law as applicable herbal drugs and natural products. Export - Import (EXIM) policy, TRIPS. Quality assurance in herbal/natural drug products. Concepts of TQM, GMP, GLP, ISO-9000. 12 Hours

Unit 3: Monographs of herbal drugs: General parameters of monographs of herbal drugs and comparative study in IP, USP, Ayurvedic Pharmacopoeia, Siddha and Unani Pharmacopoeia, American Herbal Pharmacopoeia, British Herbal Pharmacopoeia, WHO guidelines in quality assessment of herbal drugs. 12 Hours

Unit 4: Testing of natural products and drugs: Herbal medicines - clinical laboratory testing. Stability testing of natural products, protocols. 12 Hours

Unit 5: Patents: Indian and international patent laws, proposed amendments as applicable to herbal/natural products and process. Geographical indication, copyright, patentable subject matters, novelty, non-obviousness, utility, enablement and best mode, procedure for Indian patent filing, patent processing, grant of patents, rights of patents, cases of patents,

opposition and revocation of patents, patent search and literature. Controllers of patents. 12 Hours

REFERENCES

1. Herbal Drug Industry - R.D. Choudhary. Eastern Publisher, New Delhi, 1996.
2. GMP for Botanicals - Regulatory and Quality Issues on Phytomedicine - Pulok K Mukharjee. 1st ed. Business Horizons Pharmaceutical Publisher, New Delhi, 2003.
3. Quality Control of Herbal Drugs - Pulok K Mukarjee, Business Horizons Pharmaceutical Publisher, New Delhi, 2002.
4. PDR for Herbal Medicines. Medicinal Economic Company, New Jersey, 2000.
5. Indian Herbal Pharmacopoeia - 2002, IDMA, Mumbai.
6. Text Book of Pharmacognosy - C.K. Kokate, Purohit & Gokhlae, Nirali Prakashan, New Delhi, 1996.
7. Text Book of Pharmacognosy and Phytochemistry - Vinod D. Rangar, Part I & II. Career Publication, Nasik, India, 2002.
8. Plant Drug Analysis - H. Wagner & S. Bladt. Springer, Berlin.
9. Standardization of Botanicals: Testing and Extraction Methods of Medicinal Herbs - V. Rajpal, Vol. I. Eastern Publisher, New Delhi, 2004.
10. Phytochemical Dictionary: Handbook of Bioactive Compounds from Plants - J.B. Harborne. 2nd ed. Taylor and Francis Ltd, UK, 1999.
11. Herbal Medicine: Expanded Commission E Monographs - M. Blumenthal. IST Edition, 2004.
12. Drug Formulation Manual - D.P.S. Kohli and D.H. Shah. Eastern Publisher, New Delhi, 1998.

PHARMACOGNOSY PRACTICAL - I (MPG I05P)

1. Analysis of Pharmacopoeial compounds of natural origin and their formulations by UV Vis spectrophotometer
2. Analysis of recorded spectra of simple phytoconstituents
3. Experiments based on Gas Chromatography
4. Estimation of sodium/potassium by flame photometry
5. Development of fingerprint of selected medicinal plant extracts commonly used in herbal drug industry viz. ashwagandha, tulsi, bael, amla, ginger, aloe, vidang, senna, lawsonia by TLC/HPTLC method.
6. Methods of extraction

PHARMACOGNOSY Practical – II (MPG 106P)

1. Phytochemical screening
2. Demonstration of HPLC - estimation of glycerrhizin
3. Monograph analysis of clove oil
4. Monograph analysis of castor oil
5. Identification of bioactive constituents from plant extracts
6. Formulation of different dosage forms and their standardisation

Semester 2

MEDICINAL PLANT BIOTECHNOLOGY (MPG 201T)

Unit 1: 1. Introduction to plant biotechnology: Historical perspectives, prospects for development of plant biotechnology as a source of medicinal agents. Applications in pharmacy and allied fields. Genetic and molecular biology as applied to pharmacognosy, study of DNA, RNA and protein replication, genetic code, regulation of gene expression, structure and complicity of genome, cell signalling, DNA recombinant technology. 12 Hours

Unit 2: Different tissue culture techniques: Organogenesis and embryogenesis, synthetic seed and monoclonal variation, protoplast fusion, hairy root multiple shoot cultures and their applications. Micro propagation of medicinal and aromatic plants. Sterilization methods involved in tissue culture, gene transfer in plants and their applications. 12 Hours

Unit 3: Immobilisation techniques & secondary metabolite production: Immobilization techniques of plant cell and its application on secondary metabolite production. Cloning of plant cell: Different methods of cloning and its applications. Advantages and disadvantages of plant cell cloning. Secondary metabolism in tissue cultures with emphasis on production of medicinal agents. Precursors and elicitors on production of secondary metabolites. 12 Hours

Unit 4 Biotransformation and transgenesis: Biotransformation, bioreactors for pilot and large scale cultures of plant cells and retention of biosynthetic potential in cell culture. Transgenic plants, methods used in gene identification, localization and sequencing of genes. Application of PCR in plant genome analysis. 12 Hours

Unit 5: Fermentation technology: Application of fermentation technology, production of ergot alkaloids, single cell proteins, enzymes of pharmaceutical interest. 12 Hours

REFERENCES

1. Plant Tissue Culture - Bhagwani, Vol. 5. Elsevier Publishers.
2. Plant Cell and Tissue Culture (Lab. Manual), JRMM. Yeoman.

3. Elements in Biotechnology - P.K. Gupta. Rastogi Publications, New Delhi.
4. An introduction to Plant Tissue Culture - M.K. Razdan. Science Publishers.
5. Experiments in Plant Tissue Culture - John HD & W.R. Lorin. Cambridge University Press.
6. Pharmaceutical Biotechnology - S.P. Vyas and V.K. Dixit. CBS Publishers, New Delhi.
7. Plant Cell and Tissue Culture - Jeffrey W. Pollard & John M Walker, Humana Press.
8. Plant Tissue Culture - Dixon, Oxford Press, Washington DC, 1985
9. Plant Tissue Culture - Street.
10. Pharmacognosy - G. E. Trease & W.C. Evans. Saunders Edinburgh, New York.
11. Biotechnology - Purohit & Mathur, Agro-Bio, 3rd Revised Edition.
12. Biotechnological Applications to Tissue Culture – Shargool & D. Peter. CKC Press.
13. Pharmacognosy - Varo E Tyler, Lynn R Brady & James E Robberrt. That Tjen, NGO.
14. Plant Biotechnology - Ciddi Veerasham.

ADVANCED PHARMACOGNOSY - II (MPG 202T)

Unit 1: Herbal remedies: Toxicity and regulations. Herbals vs. conventional drugs, efficacy of herbal medicine products, validation of herbal therapies, pharmacodynamic and pharmacokinetic issues. 12 Hours

Unit 2: Adulteration and deterioration: Introduction, types of adulteration/ substitution of herbal drugs, causes and measures of adulteration, sampling procedures, determination of foreign matter, DNA finger printing techniques in identification of drugs of natural origin, detection of heavy metals, pesticide residues, phytotoxin, microbial contamination in herbs and their formulations. 12 Hours

Unit 3: Ethnobotany and ethnopharmacology: Ethnobotany in herbal drug evaluation, impact of ethnobotany in traditional medicine, new development in herbals, bio-prospecting tools for drug discovery, role of ethnopharmacology in drug evaluation, reverse pharmacology.

12 Hours

Unit 4: Analytical profiles of herbal drugs: Andrographis paniculata, Boswellia serata, Coleus forskholii, Curcuma longa, Embelica officinalis, Psoralea corylifolia. 12 Hours

Unit 5: Biological screening of herbal drugs: Introduction and need for phyto-pharmacological screening, new strategies for evaluating natural

products. In vitro evaluation techniques for antioxidants, antimicrobial and anticancer drugs. In vivo evaluation techniques for anti- inflammatory, antiulcer, anticancer, wound healing, antidiabetic, hepatoprotective, cardio protective, diuretics and antifertility. Toxicity studies as per OECD guidelines. 12 Hours

REFERENCES

1. Glimpses of Indian Ethano Pharmacology - P. Pushpangadam. U.L.F. Nyman & V. George. Tropical Botanic Garden & Research Institute, 1995.
2. Natural Products: A Lab Guide - Raphael Ikan. Academic Press.
3. Pharmacognosy - G. E. Trease & W.C. Evans. Saunders Edinburgh, New York.
4. Pharmacognosy - Tyler, Brady & Robbers. Lee & Febiger.
5. Modern Methods of Plant Analysis - Peach & M.V. Tracey. Vol I & II. Springer Publishers.
6. Herbal Drug Industry – R.D. Choudhary, Eastern Publishers, New Delhi.
7. Text book of Pharmacognosy - C.K. Kokate, Purohit & Ghokhale. Nirali Prakasshan, 1996.
8. Text Book of Pharmacognosy - T.E. Wallis.
9. Quality Control of Herbal Drugs - Pulok K Mukarjee. Business Horizons Pharmaceutical Publisher, New Delhi, 2002.
10. Indian Herbal Pharmacopoeia, IDMA, Mumbai.
11. Text Book of Pharmacognosy and Phytochemistry - Vinod D. Rangar, Part I & II. Career Publication, Nasik, India, 2002.
12. Plant Drug Analysis - H. Wagner & S. Bladt. Springer, Berlin.
13. Standardization of Botanicals: Testing and Extraction Methods of Medicinal Herbs - V. Rajpal. Vol 1. Eastern Publisher, New Delhi, 2004.
14. Herbal Medicine - Expanded Commission E Monographs - M. Blumenthal.

INDIAN SYSTEMS OF MEDICINE (MPG 203T)

Unit 1: Fundamental concepts of Ayurveda, Siddha, Unani and Homoeopathy systems of medicine. Different dosage forms of the Indian system of medicine (ISM).

Ayurveda: Ayurvedic Pharmacopoeia. Analysis of formulations and bio crude drugs with references to: Identity, purity and quality. Siddha: Gunapadam (Siddha Pharmacology), raw drugs/Dhatu/Jeevam in Siddha system of medicine, purification process (Suddhi). 12 Hours

Unit 2: Naturopathy, Yoga and Aromatherapy practices a) Naturopathy - Introduction, basic principles and treatment modalities. b) Yoga - Introduction and Streams of Yoga. Asanas, Pranayama, Meditations and Relaxation techniques. c) Aromatherapy – Introduction, aroma oils for common problems, carrier oils. 12 Hours

Unit 3: Formulation development of various systems of medicine. Salient features of the techniques of preparation of some of the important class of formulations as per Ayurveda, Siddha, Homeopathy and Unani Pharmacopoeia and texts. Standardization, shelf life and stability studies of ISM formulations. 12 Hours

Unit 4: Schedule T – Good Manufacturing Practice of ISM. Components of GMP (Schedule – T) and its objectives, infrastructural requirements, working space, storage area, machinery and equipment, standard operating procedures, health and hygiene, documentation and records. Quality assurance in ISM formulation industry - GAP, GMP and GLP. Preparation of documents for new drug application and export registration. Challenges in monitoring the safety of herbal medicines: Regulation, quality assurance and control, National/Regional Pharmacopoeias. 12 Hours

Unit 5: TKDL, Geographical indication Bill, Government bills in AYUSH, ISM, CCRAS, CCRS, CCRH, CCRU 12 Hours

REFERENCES

1. Ayurvedic Pharmacopoeia, The Controller of Publications, Civil Lines, Govt. of India, New Delhi.
2. Hand Book on Ayurvedic Medicines - H. Panda. National Institute of Industrial Research, New Delhi.
3. Ayurvedic System of Medicine - Kaviraj Nagendranath Sengupata. Sri Satguru Publications, New Delhi.
4. Ayurvedic Pharmacopoeia - Formulary of Ayurvedic Medicines. IMCOPS, Chennai.
5. Homeopathic Pharmacopoeia - Formulary of Homeopathic Medicines. IMCOPS, Chennai.
6. Homeopathic Pharmacy: An Introduction & Hand Book - Steven B Kayne. Churchill Livingstone, New York.
7. Indian Herbal Pharmacopoeia. IDMA, Mumbai.
8. British Herbal Pharmacopoeia. British Herbal Medicine Association, UK.
9. GMP for Botanicals - Regulatory and Quality Issues on Phytomedicine - Pulok K Mukharjee. Business Horizons, New Delhi.
10. Indian System of Medicine and Homeopathy in India. Planning and Evaluation Cell, Govt. of India, New Delhi.

11. Essential of Food and Nutrition – Swaminathan. Bappco, Bangalore.

12. Clinical Dietetics and Nutrition - F.P. Antia. Oxford University Press, Delhi.

13. Yoga - The Science of Holistic Living - V.K. Yoga & Vivekananda Yoga. Prakashna Publishing, Bangalore.

HERBAL COSMETICS (MPG 204T)

Unit 1: Introduction: Herbal/natural cosmetics. Classification & Economic aspects.

Regulatory Provisions in relation to manufacture of cosmetics: License, GMP, offences & Penalties, Import & Export of herbal/natural cosmetics. Industries involved in the production of herbal/natural cosmetics. 12 Hours

Unit 2: Commonly used herbal cosmetics, raw materials, preservatives, surfactants, humectants, oils, colors and some functional herbs. Preformulation studies, compatibility studies, possible interactions between chemicals and herbs, design of herbal cosmetic formulation. 12 Hours

Unit 3: Herbal Cosmetics: Physiology and chemistry of skin and pigmentation, hairs, scalp, lips and nail, cleansing cream, lotions, face powders, face packs, lipsticks, bath products, soaps and baby product. Preparation and standardisation of tonic, bleaches, dentifrices (mouth washes & tooth pastes), cosmetics for nails. 12 Hours

Unit 4: Cosmeceuticals of herbal and natural origin: Hair growth formulations, shampoos, conditioners, colorants & hair oils, fairness formulations, vanishing & foundation creams, anti-sun burn preparations, moisturizing creams, deodorants. 12 Hours

Unit 5: Analysis of cosmetics, toxicity screening and test methods: Quality control and toxicity studies as per Drugs and Cosmetics Act. 12 Hours

REFERENCES

1. Herbal Cosmetics (Hand book) - H. Panda. Asia Pacific Business Press Inc., New Delhi.
2. Modern Cosmetics - E.G. Thomson. Universal Publishing Corporation, Mumbai.
3. Cosmetics: Formulation, Manufacturing & Quality Control - P.P. Sharma. Vandana Publications, New Delhi.
4. Handbook of Aromatic Plants – K.B. Supriya. Pointer Publishers, Jaipur.
5. Aromatic Plants (Horticulture Science Series) – P. Skaria. New India Publishing Agency, New Delhi.

6. Aromatherapy (A Complete Guide to the Healing Art) - Kathi Keville & Mindy Green. Sri Satguru Publications, New Delhi.

7. Herbal Cosmetics & Ayurvedic Medicines (EOU) – P.K. Chattopadhyay. National Institute of Industrial Research, Delhi.

8. Cosmetics Science and Technology - Balsam MS & Edward Sagarin. Wiley Interscience, New York.

PHARMACOGNOSY PRACTICAL – III (MPG 205P)

1. Isolation of nucleic acid from cauliflower heads
2. Isolation of RNA from yeast
3. Quantitative estimation of DNA
4. Immobilization technique
5. Establishment of callus culture
6. Establishment of suspension culture
7. Estimation of aldehyde contents of volatile oils
8. Estimation of total phenolic content in herbal raw materials
9. Estimation of total alkaloid content in herbal raw materials
10. Estimation of total flavonoid content in herbal raw materials
11. Preparation and standardization of various simple dosage forms from Ayurvedic, Siddha, Homoeopathy and Unani formulary
12. Preparation of certain Aromatherapy formulations
13. Preparation of herbal cosmetic formulation such as lip balm, lipstick, facial cream, herbal hair and nail care products
14. Evaluation of herbal tablets and capsules
15. Preparation of sunscreen, UV protection cream, skin care formulations.
16. Formulation & standardization of herbal cough syrup

PHARMACEUTICAL REGULATORY AFFAIRS (MRA)

First Semester

GOOD REGULATORY PRACTICES (MRA 101T)

Unit 1: Current Good Manufacturing Practices (cGMP): Introduction, US cGMP Part 210 and Part 211. EC principles of GMP (Directive 91/356/EEC) Article 6 to Article 14 and WHO cGMP guidelines GAMP-5; Medical device and IVDs Global Harmonization Task Force (GHTF) Guidance docs. 12 Hours

Unit 2: Good Laboratory Practices (GLP): Introduction, USFDA GLP Regulations (Subpart A to Subpart K). Controlling the GLP inspection process, documentation, audit, goals of Laboratory Quality Audit, Audit tools.

Future of GLP regulations, relevant ISO and Quality Council of India (QCI) Standards. 12 Hours

Unit 3: Good Automated Laboratory Practices (GALP): Introduction to GALP, principles of GALP, GALP requirements, SOPs of GALP, Training Documentation, 21 CFR Part 11, General check list of 21 CFR Part 11, Software Evaluation checklist, relevant ISO and QCI Standards. 12 Hours

Unit 4: Principles, personnel, documentation, premises and equipment, deliveries to customers, returns, self-inspection, provision of information, stability testing principles, WHO Good Distribution Practices. USP GDP (Supply chain integrity), relevant CDSCO guidance and ISO standards. 6 Hours

Unit 5: Quality management systems: Concept of quality, Total Quality Management, quality by design, six sigma concept, Out of Specifications (OOS), change controls.

Validation: Types of validation, Types of qualification, validation master plan (VMP), analytical method validation. validation of utilities, [compressed air, steam, water systems, heat ventilation and air conditioning (HVAC)] and cleaning validation. The International Council for Harmonization (ICH) process, ICH guidelines to establish quality, safety and efficacy of drug substances and products, ISO 13485, Schedule M-III and other relevant CDSCO regulatory guidance documents.

ICH Guidelines: Emphasis on Q2, Q3, Q7, Q8, Q9, Q10 & Q11 (draft Form) 18 Hours

REFERENCES

1. Good Laboratory Practice Regulations - Sandy Weinberg, 4th ed. Drugs and The Pharmaceutical Sciences, Vol.168.
2. How to Practice GLP – P.P. Sharma. Vandana Publications.
3. Laboratory Auditing for Quality and Regulatory Compliance - Donald C Singer. Drugs and The Pharmaceutical Sciences, Vol. 150.
4. Drugs & Cosmetics Act, Rules & Amendments, Government of India.
5. Good Pharmaceutical Manufacturing Practice, Rationale and Compliance - John Sharp. CRC Press.
6. Establishing a cGMP Laboratory Audit System, A Practical Guide - David M Bleisner. Wiley.

DOCUMENTATION AND REGULATORY WRITING (MRA 102T)

Unit 1: Documentation in pharmaceutical industry: Exploratory Product Development Brief (EPDB) for drug substance and drug product, Product Development Plan (PDP), Product Development Report (PDR), master formula record, batch manufacturing record and its calculations, batch

reconciliation, batch packaging records, print pack specifications, distribution records, Certificate of Analysis (CoA), site master file and Drug Master Files (DMF). 12 Hours

Unit 2: Dossier preparation and submission: Introduction and overview of dossiers, contents and organization of dossier, binders and sections, compilation and review of dossier. Paper submissions, overview and modules of CTD, electronic CTD submissions; Electronic submission: Planning electronic submission, requirements for submission, regulatory bindings and requirements. Tool and Technologies, electronic dossier submission process and validating the submission, Electronic Submission Gateway (ESG). Non eCTD electronic submissions (NeeS), Asian CTD formats (ACTD) submission. Organizing, process and validation of submission. Submission in Sugam system of CDSCO. Pharmaceutical Inspection & Convention Scheme and Pharmaceutical Inspection & Cooperation Scheme (PIC/S), ASEAN Pharmaceutical harmonization on initiative. 12 Hours

Unit 3: Audits: Introduction, definition, summary, types of audits, GMP compliance audit, audit policy, internal and external audits, second party audits, external third party audits, Auditing strategies, preparation and conducting audit, audit analysis, audit report, audit follow up. Auditing/inspection of manufacturing facilities by regulatory agencies. Timelines for audits/inspection. GHTF study group 4 guidance document. ISO 13485. 12 Hours

Unit 4: Inspections: Pre-approval inspections, inspection of pharmaceutical manufacturers, inspection of drug distribution channels, quality systems requirements for national good manufacturing practice inspectorates, inspection report, model certificate of good manufacturing practices, root cause analysis, corrective and preventive action (CAPA) 12 Hours

Unit 5: Product life cycle management: ICH life cycle management (Q12), post approval labeling changes, lifecycle management, FDA inspection and enforcement, Establishment Inspection Report (EIR), warning letters, recalls, seizure and injunctions. ISO risk management standard. 12 Hours

REFERENCES

1. Laboratory Auditing for Quality and Regulatory Compliance - Donald C Singer, Raluca- Ioana Stefan & Jacobus F Van Staden. Taylor and Francis, 2005.
2. Handbook of Microbiological Quality Control - Rosamund M Baird, Norman A Hodges & Stephen P Denyar. CRC Press, 2000.
3. Juran's Quality Handbook - Joseph M Juran & Joseph A De Feo. 6th ed. ASQ Publications.

4. Compliance Auditing for Pharmaceutical Manufacturers - Karen Ginsbury & Gil Bismuth. Interpharm/CRC, Boca Raton, London New York, Washington D.C.

5. Pharmaceutical Manufacturing Handbook: Regulations and Quality - Shayne Cox Gad. Wiley-Interscience, A John Wiley and Sons, Inc., Publications.

6. Implementing Juran's Road Map for Quality Leadership: Benchmarks and Results - Al Endres. Wiley, 2000.

7. Understanding, Managing and Implementing Quality: Frameworks, Techniques and Cases - Jiju Antony. David Preece, Routledge, 2002.

8. Organizing for High Performance: Employee Involvement, TQM, Reengineering, and Knowledge Management in the Fortune 1000: The CEO Report - Edward E Lawler III, Susan Albers Mohrman & George Benson. Jossey-Bass, 2001.

9. Corporate Culture and the Quality Organization - James W Fairfield-Sonn. Quorum Books, 2000.

10. The Quality Management Sourcebook: An International Guide to Materials and Resources By Christine Avery & Diane Zabel. Routledge, 1997.

11. The Quality Toolbox - Nancy R Tague. 2nd ed. ASQ Publications.

12. Root Cause Analysis, The Core of Problem Solving and Corrective Action - Duke Okes. ASQ Publications.

13. International Medical Device Regulators Forum (IMDRF) Medical Device Single Audit Program (MDSAP).

CLINICAL RESEARCH REGULATIONS (MRA 103T)

Unit 1: Clinical drug development process: Different types of clinical studies. Phases of clinical trials, clinical trial protocol. Phase 0 studies, Phase I and subtype studies (single ascending, multiple ascending, dose escalation, methods, food effect studies, drug– drug interaction, PK endpoints. Phase II studies (proof of concept or principle studies to establish efficacy). Phase III studies (Multi ethnicity, global clinical trial, registration studies). Phase IV studies (Post marketing studies - PMS), clinical investigation and evaluation of medical devices & IVDs different types of studies, key concepts of medical device, clinical evaluation, key concepts of clinical investigation. 12 Hours

Unit 2: Ethics in clinical research: Historical perspectives: Nuremberg code, thalidomide study, Nazis Trials, Tuskegee Syphilis Study, The Belmont Report, The declaration of Helsinki. Origin of International Conference on Harmonization – Good Clinical Practice (ICH-GCP) guidelines. The ethics of randomized clinical trials. The role of placebo in clinical trials. Ethics of clinical research in special population. Institutional

Review Board/Independent Ethics Committee/Ethics Committee – composition, roles, responsibilities, review and approval process and ongoing monitoring of safety data. Data safety monitoring boards. Responsibilities of sponsor, CRO, and investigator in ethical conduct of clinical research. Ethical principles governing informed consent process. Patient information sheet and informed consent form the informed consent process and documentation. 12 Hours

Unit 3: Regulations governing clinical trials in India: Clinical research regulations in India – Schedule Y & Medical Device Guidance USA: Regulations to conduct drug studies in USA (FDA). NDA505(b)(1) of the FD&C Act (Application for approval of a new drug) NDA505(b)(2) of the FD&C Act (Application for approval of a new drug that relies, at least in part, on data not developed by the applicant). ANDA 505(j) of the FD&C Act (Application for approval of a generic drug product). FDA Guidance for Industry - Acceptance of foreign clinical studies. FDA Clinical Trials Guidance Document: Good Clinical Practice EU: Clinical Research regulations in European Union (EMA). 12 Hours

Unit 4: Clinical research related guidelines: Good Clinical Practice Guidelines (ICHGCP E6), Indian GCP Guidelines. ICMR Ethical Guidelines for biomedical research. CDSCO guidelines GHF study group 5 guidance documents, Regulatory guidance on efficacy and safety ICH Guidance's · E4 – Dose response information to support drug registration. E7 – Studies in support of general population: geriatrics. E8 – General considerations of clinical trials. E10 – Choice of control groups and related issues in clinical trials. E 11 – Clinical investigation of medicinal products in the pediatric population. General biostatistics principle applied in clinical research. 12 Hours

Unit 5: USA & EU Guidance: FDA Guidance. CFR 21 Part 50: Protection of human subjects. CFR 21 Part 54: Financial disclosure by clinical investigators. CFR 21 Part 312: IND Application. CFR 21 Part 314: Application for FDA Approval to market a new drug. CFR 21 Part 320: Bioavailability and bioequivalence requirements. CFR 21 Part 812: Investigational device exemptions. CFR 21 Part 822: Post-market surveillance. FDA safety reporting requirements for INDs and BA/BE Studies. FDA Med Watch. Guidance for industry: Good pharmacovigilance practices and pharmacoepidemiologic assessment.

European Union: EMA Guidance, EU Directives 2001 EudraLex (EMA) Volume 3 – Scientific guidelines for medicinal products for human use. EU Annual Safety Report (ASR) Volume 9A – Pharmacovigilance for medicinal products for human use. EU MDD with respect to clinical research · ISO 14155. 12 Hours

REFERENCES

1. Clinical Trials and Human Research: A Practical Guide to Regulatory Compliance - Fay A Rozovsky & Rodney K Adams.

2. FDA Regulatory Affairs: a Guide for Prescription Drugs, Medical Devices, and Biologics - Douglas J Pisano & David Mantus. CRC Press, USA.

3. New Drug Approval Process: The Global Challenge – Guarino & A. Richard. Marcel Dekker Inc.

4. HIPAA and Human Subjects Research: A Question and Answer Reference Guide - J.D. Mark Barnes & J.D. Jennifer Kulynych.

5. Principles and Practices of Clinical Research, John I Gallin & Frederick P Ognibene. 2nd ed.

6. Reviewing Clinical Trials: A Guide for the Ethics Committee - Johan P E Karlberg & Marjorie A Speers. Hong Kong.

7. International Pharmaceutical Product Registration: Aspects of Quality, Safety and Efficacy - Anthony C Cartwright. Taylor & Francis Inc., USA.

Regulations and Legislation for Drugs & Cosmetics, Medical Devices, Biologicals, Herbals, Food & Nutraceuticals In India and Intellectual Property Rights (MRA 104T)

Unit 1: Drugs Biologicals & Herbals, and Food & Nutraceuticals Acts and Rules (with latest amendments): 1) Drugs and Cosmetics Act 1940 and Rules 1945: Schedule M, DPCO & NPPA. 2) Other relevant provisions (rules schedules and guidelines for approval of Drugs & Cosmetics, Medical Devices, Biologicals & Herbals, and Food & Nutraceuticals in India Other relevant Acts: Narcotic Drugs and Psychotropic Substances Act; Pharmacy Act, 1948; Drugs and Magic Remedies (Objectionable Advertisements) Act, 1955; Prevention of Cruelty to Animals Act. 12 Hours

Unit 2: Regulatory requirements and approval procedures for Drugs & Cosmetics Medical Devices, Biologicals & Herbals, and Food & Nutraceuticals CDSCO (Central Drug Standard Control Organization) and State Licensing Authority: Organization, Responsibilities. Rules, regulations, guidelines and standards for regulatory filing of Drugs & Cosmetics, Medical Devices, Biologicals & Herbals, and Food & Nutraceuticals. Format and contents of Regulatory dossier filing Clinical trial/investigations. 12 Hours

Unit 3: Indian Pharmacopoeial Standards, BIS standards and ISO and other relevant standards. Regulations for packaging material, packaging requirements & labeling requirements as per Rules 94, 95, 96, 97 & 105 D & C Rules 1945. 12 Hours

Unit 4: Bioavailability and bioequivalence data (BA &BE), BCS classification of drugs, regulatory requirements for bioequivalence study. Stability requirements: ICH and WHO guidelines for drug testing in

animals/preclinical studies animal testing: Rationale for conducting studies, CPCSEA guidelines. Ethical guidelines for human participants. ICMR-DBT guidelines for stem cell research. 12 Hours

Unit 5: Intellectual property rights: Patent, trademark, copyright, industrial designs and geographical indications, Indian patent scenario, IPR vs regulatory affairs. 12 Hours

REFERENCES

1. Manual of Patent Practice & Procedure - The Patent Office of India. 3rd ed.
2. Patent Failure How Judges, Bureaucrats, and Lawyers put Innovators at Risk - James Bessen & Michael J Meurer.
3. Principles and Practice of Clinical Trial Medicine - Richard Chin & Bruce Y. Lee.
4. Ethical Guidelines for Biomedical Research on Human Participants - Indian Council of Medical Research, New Delhi, 2006.
5. CPCSEA Guidelines for Laboratory Animal Facility by Committee for the Purpose of Control and Supervision on Experiments on Animals (CPCSEA).
6. ICH E6 Guidelines – Good Clinical Practice - ICH Harmonised Tripartite.
7. Guidance for Industry on Submission of Clinical Trial Application for Evaluating Safety and Efficacy by CDSCO (Central Drug Standard Control Organisation).
9. Guidance for Industry on Requirement of Chemical & Pharmaceutical Information including Stability Study Data before approval of clinical trials / BE studies by CDSCO.
10. Guidelines for Import and Manufacture of Medical Devices – CDSCO.
11. Guidelines from official website of CDSCO.

REGULATORY AFFAIRS PRACTICAL – I (MRA 105P)

1. Case studies (4 Nos.) of each of Good Pharmaceutical Practices
2. Documentation for in- process and finished products Quality control tests for Solid, liquid, Semisolid and Sterile preparations
3. Preparation of SOPs, Analytical reports (Stability and validation)
4. Protocol preparation for documentation of various types of records (BMR, MFR, DR)
5. Labeling comparison between brand & generics
6. Preparation of clinical trial protocol for registering trial in India
7. Registration for conducting BA/ BE studies in India

8. Import of drugs for research and developmental activities
9. Preparation of regulatory dossier as per Indian CTD format and submission in SUGAM
10. Registering for different Intellectual Property Rights in India
11. GMP Audit Requirements as per CDSCO
12. Preparation and documentation for Indian Patent application
13. Preparation of checklist for registration of IND as per ICH CTD format
14. Preparation of checklist for registration of NDA as per ICH CTD format
15. Preparation of checklist for registration of ANDA as per ICH CTD format

REGULATORY AFFAIRS PRACTICAL – II (MRA 106P)

1. Case studies on response with scientific rationale to USFDA Warning Letter
2. Preparation of submission check list of IMPD for EU submission
3. Comparison study of marketing authorization procedures in EU
4. Comparative study of DMF system in US, EU and Japan
5. Preparation of regulatory submission using eCTD software
6. Preparation of Clinical Trial Application (CTA) for US submission
7. Preparation of Clinical Trial Application (CTA) for EU submission
8. Comparison of Clinical Trial Application requirements of US, EU and Japan of a dosage form
9. Regulatory requirements check list for conducting clinical trials in India
10. Regulatory requirements check list for conducting clinical trials in Europe
11. Regulatory requirements check list for conducting clinical trials in USA
12. Writing Stability Protocols as per ICH
13. Writing Validation Protocol of Water & AHU Systems
14. Writing & Compiling a Dossier
15. Writing & Compiling Site Master File

Second Semester

REGULATORY ASPECTS OF DRUGS & COSMETICS (MRA 201T)

Unit 1: USA & Canada: Organization and functions of FDA. Federal register and Code of register and Code of Federal Regulations (CFR), History and evolution of United States Federal, Food, Drug and Cosmetic Act (FFDCA), Hatch Waxman act and Orange book, Purple book, Drug

Master Files (DMF) system in US. Regulatory approval process for Investigational New Drug (IND), New Drug Application (NDA), Abbreviated New Drug Application (ANDA), Supplemental New Drug Application (sNDA). Regulatory requirements for orphan drugs and combination products, Changes to an approved NDA/ANDA. Regulatory considerations for manufacturing, packaging and labeling of pharmaceuticals in USA. Legislation and regulations for import, manufacture, distribution and sale of cosmetics in USA and Canada. 12 Hours

Unit 2: European Union & Australia: Organization and structure of EMA & EDQM, General guidelines, Active Substance Master Files (ASMF) system in EU. Content and approval process of IMPD. Marketing authorization procedures in EU (centralized procedure, decentralized procedure, mutual recognition procedure and national procedure). Regulatory considerations for manufacturing, packaging and labeling of pharmaceuticals in EU, Eudralex directives for human medicines, variations & extensions, compliance of European

Pharmacopoeia (CEP)/Certificate of Suitability (CoS), Marketing Authorization (MA) transfers, Qualified Person (QP) in EU. Legislation and regulations for import, manufacture, distribution and sale of cosmetics in European Union & Australia. 12 Hours

Unit 3: Emerging market: Introduction, countries covered, study of the world map, study of various committees across the globe (ASEAN, APEC, EAC, GCC, PANDRH, SADC). WHO GMP, Regulatory Requirements for registration of drugs and post approval requirements in WHO through prequalification programme, Certificate of Pharmaceutical Product (CoPP) - General and country specific (India, South Africa, Egypt, Algeria and Morocco, Nigeria, Kenya and Botswana. 12 Hours

Unit 4: Brazil, ASEAN, CIS and GCC Countries: ASIAN Countries, introduction to ACTD, regulatory requirements for registration of drugs and post approval requirements in China and South Korea & Association of Southeast Asian Nations (ASEAN) region i.e., Vietnam, Malaysia, Philippines, Singapore and Thailand. 12 Hours

Unit 5: CIS (Commonwealth Independent States): Regulatory prerequisites related to marketing authorization requirements for drugs and post approval requirements in CIS countries i.e. Russia, Kazakhstan and Ukraine and sale of cosmetics in Brazil, ASEAN, CIS and GCC Countries. 12 Hours

REFERENCES

1. Generic Drug Product Development: Solid Oral Dosage Forms - Leon Shargel. Marcel Dekker Series, Vol. 143.
2. The Pharmaceutical Regulatory Process - Ira R Berry. Marcel Dekker Series, Vol.144.

3. Guidebook for Drug Regulatory Submissions - Sandy Weinberg. John Wiley & Sons. Inc.

4. New Drug Approval Process: Accelerating Global Registrations - Richard A Guarino, Vol 190. 5th ed. Drugs and the Pharmaceutical Sciences.

5. Drugs and the Pharmaceutical Sciences. Vol.185. Informa Health Care Publishers.

6. Drugs: From Discovery to Approval – N.G. Rick. 2nd ed.

7. New Drug Development: A Regulatory Overview - Mark Mathieu. 8th ed.

8. Pharmaceutical Risk Management - Jeffrey E Fetterman, Wayne L Pines & Gary H Slatko.

9. Preparation and Maintenance of the IND Application in eCTD Format - William K Sietsema.

10.

http://www.who.int/medicines/areas/quality_safety/regulation_legislation/ListMRAWebsites

11. Roadmap to an ASEAN economic community - Denis Hew. ISEAS Publications. Singapore, 2005.

12. ASEAN - Rodolfo C. Severino. ISEAS Publications, Singapore.

13. Building a Future with Brics: The Next Decade for Offshoring - Mark Kobayashi-Hillary.

14. Outsourcing to India: The Offshore Advantage - Mark Kobayashi-Hillary. Springer Trade Performance and Regional Integration of the CIS Countries - Lev Freinkman.

15. The World Bank, Washington DC.

16. Global Pharmaceutical Policy: Ensuring Medicines for Tomorrow's World - Frederick M Abbott & Graham Dukes. Edward Elgar Publishing Inc.

17. The Gulf Cooperation Council: A Rising Power and Lessons for ASEAN by Linda Low & Lorraine Carlos Salazar. ISEAS Publishing.

18. Doing Business in the Asean Countries - Balbir Bhasin. Business Expert Press.

19. Realizing the ASEAN Economic Community: A Comprehensive Assessment - Michael G Plummer & Chia Siow Yue. Published by Institute of Southeast Asian studies, Singapore.

20. Country Specific Guidelines from official websites.

REGULATORY ASPECTS OF HERBAL AND BIOLOGICS (MRA 202T)

Unit 1: **India:** Introduction, applicable regulations and guidelines , principles for development of similar biologics. Data requirements for preclinical studies, data requirements for clinical trial application, data requirements for market authorization application. Post market data for similar biologics, pharmacovigilance. GMP and GDP. 12 Hours

Unit 2: USA & European Union: Introduction to biologics; biologics, biological and biosimilar, different biological products, difference between generic drug and biosimilars, laws, regulations and guidance on biologics/biosimilars, development and approval of biologics and biosimilars (IND, PMA, BLA, NDA, 510(k), pre-clinical and clinical development considerations, advertising, labeling and packing of biologics in USA and EU. 12 Hours

Unit 3: Vaccine regulations in India, US and European Union: Clinical evaluation, marketing authorization, registration or licensing, quality assessment, pharmacovigilance, additional requirements. Blood and blood products regulations in India, US and European Union. 12 Hours

Unit 4: Regulatory Requirements of Blood and/or its components including blood products, label requirements, ISBT (International Society of Blood Transfusion) and IHN (International Haemo vigilance Network). 12 Hours

Unit 5: Herbal Products: Quality, safety and legislation for herbal products in India, USA and European Union. 12 Hours

REFERENCES

1. FDA Regulatory Affairs: A Guide for Prescription Drugs, Medical Devices, and Biologics - Douglas J. Pisano & David S Mantus. Taylor and Francis, 2008.
2. Biological Drug Products: Development and Strategies - Wei Wang. Wiley, 2013.
3. Development of Vaccines: From Discovery to Clinical Testing - Manmohan Singh. Wiley, 2011.
4. www.who.int/biologicals/en
5. www.fda.gov/Biologics Blood Vaccines/Guidance Compliance Regulatory Information/
6. www.ihn-org.com
7. www.isbtweb.org
8. Guidelines on Similar Biologics: Regulatory Requirements for Marketing Authorization in India
9. www.cdscn.nic.in
10. www.ema.europa.eu/scientific-guidelines/Biologics

REGULATORY ASPECTS OF MEDICAL DEVICES (MRA 203T)

Unit 1: Medical devices: Introduction, definition, risk based classification and essential principles of medical devices and IVDs. Differentiating medical devices, IVDs and combination products from that of pharmaceuticals. History of medical device regulation. Product Life cycle of medical devices and classification of medical devices.

IMDRF/GHTF: Introduction, organizational structure, purpose and functions, regulatory guidelines, working groups, Summary Technical Document (STED), Global Medical Device Nomenclature (GMDN). 12 Hours

Unit 2: Ethics: Clinical investigation of medical devices, clinical investigation plan for medical devices. Good clinical practice for clinical investigation of medical devices (ISO 14155:2011), Quality system regulations of medical devices (ISO 13485), Quality risk management of medical devices (ISO 14971). Validation and verification of medical device, adverse event reporting of medical device. 12 Hours

Unit 3: USA: Introduction, classification, regulatory approval process for medical devices (510k). Premarket notification, Pre Market Approval (PMA), Investigational Device Exemption (IDE) and in vitro diagnostics, Quality System Requirements (21 CFR Part 820), labeling requirements (21 CFR Part 801). Post marketing surveillance of MD and Unique Device Identification (UDI). Basics of in vitro diagnostics, classification and approval process. 12 Hours

Unit 4: European Union: Introduction, classification, regulatory approval process for medical devices (Medical Device Directive, Active Implantable Medical Device Directive) and in vitro diagnostics (In Vitro Diagnostics Directive). CE certification process. Basics of in vitro diagnostics, classification and approval process. 12 Hours

Unit 5: ASEAN, China & Japan: Medical devices and IVDs, regulatory registration procedures. Quality system requirements and clinical evaluation and investigation. IMDRF study groups and guidance documents. Medical Devices Act, 2017 Regulations. 12 Hours

REFERENCES

1. Medical Product Regulatory Affairs: Pharmaceuticals, Diagnostics, Medical Devices - John J Tobin & Gary Walsh.
2. Medical Device Development: A Regulatory Overview - Jonathan S Kahan.
3. Compliance Handbook for Pharmaceuticals, Medical Devices and Biologics - Carmen Medina.
4. Country Specific Guidelines from official websites.

REGULATORY ASPECTS OF FOOD AND NUTRACEUTICALS (MRA 204T)

Unit 1: Nutraceuticals: Introduction, history of Food and Nutraceutical Regulations, meaning of nutraceuticals, dietary supplements, functional foods, medical foods. Scope and opportunities in nutraceutical market. 12 Hours

Unit 2: Global aspects: WHO guidelines on nutrition. NSF International, its role in the dietary supplements and nutraceuticals industries, NSF certification, NSF standards for food and dietary supplements. Good Manufacturing Practices for nutraceuticals, Hazard Analysis & Critical Control Point (HACCP). 12 Hours

Unit 3: India: Food Safety and Standards Act, Food Safety and Standards Authority of India: Organization and functions, regulations for import, manufacture and sale of nutraceutical products in India. Recommended dietary allowances (RDA) in India. 12 Hours

Unit 4: USA: US FDA Food Safety Modernization Act, Dietary Supplement Health and Education Act. U.S. regulations for manufacture and sale of nutraceuticals and dietary supplements. Labeling requirements and label claims for dietary supplements, Recommended dietary allowances (RDA) in the U.S. 12 Hours

Unit 5: European Union: European Food Safety Authority (EFSA), Organization and Functions. EU directives and regulations for manufacture and sale of nutraceuticals and dietary supplements. Nutrition labeling. European regulation on novel foods and novel food ingredients. Recommended dietary allowances (RDA) in Europe. 12 Hours

REFERENCES

1. Regulation of Functional Foods and Nutraceuticals: A Global Perspective - Clare M Hasler. Wiley Online Library.
2. Nutraceutical and Functional Food Regulations in the United States and Around the World - Debasis Bagchi. Academic Press, Elsevier.
3. <http://www.who.int/publications/guidelines/nutrition/en/>
4. [http://www.europarl.europa.eu/RegData/etudes/STUD/2015/536324/IPOLSTU\(2015\)536324_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/STUD/2015/536324/IPOLSTU(2015)536324_EN.pdf)
5. Handbook of Nutraceuticals - Yashwant Pathak. CRC Press.
6. Food Regulation: Law, Science, Policy and Practice - Neal D Fortin. Wiley.
7. Country Specific Guidelines from official websites.

REGULATORY AFFAIRS PRACTICAL – III (MRA 205P)

Case studies on:

1. Change Management/ Change control. Deviations
2. Corrective & Preventive Actions (CAPA)
3. Documentation of raw materials analysis as per official monographs
4. Preparation of audit checklist for various agencies
5. Preparation of submission to FDA using eCTD software

8. Preparation of submission to EMA using eCTD software
9. Preparation of submission to MHRA using eCTD software
10. Preparation of Biologics License Applications (BLA)
11. Preparation of documents required for Vaccine Product Approval
12. Comparison of clinical trial application requirements of US, EU and India of Biologics.
13. Preparation of Check list for Registration of Blood and Blood Products
14. Registration requirement comparison study in 5 emerging markets (WHO) and preparing check list for market authorization
15. Registration requirement comparison study in emerging markets (BRICS) and preparing check list for market authorization
16. STED Application for Class III Devices
17. Audit Check list for Medical Device Facility
18. Clinical Investigation Plan for Medical Devices.

First Semester

MODERN PHARMACEUTICAL ANALYTICAL TECHNIQUES (MQA 101T)

(Note: Common paper for MPA, MPC, MPH, MPB, MPL, MPG, MQA, & MIP, specializations)

Unit 1: a. UV-visible spectroscopy: Introduction, theory, laws and instrumentation associated with UV-visible spectroscopy, choice of solvents and solvent effect and applications of UV-visible spectroscopy.

b. IR spectroscopy: Theory, modes of molecular vibrations, sample handling, instrumentation of dispersive and Fourier-Transform IR Spectrometer, factors affecting vibrational frequencies and applications of IR spectroscopy, data interpretation.

c. Spectrofluorimetry: Theory of fluorescence, factors affecting fluorescence (characteristics of drugs that can be analyzed by fluorimetry), quenchers, instrumentation and Applications of fluorescence spectrophotometer.

d. Flame emission spectroscopy and Atomic absorption spectroscopy: Principle, instrumentation, interferences and applications. 12 Hours

Unit 2: NMR spectroscopy: Quantum numbers and their role in NMR, Principle, Instrumentation, Solvent requirement in NMR, Relaxation process, NMR signals in various compounds, Chemical shift, Factors influencing chemical shift, Spin-Spin coupling, Coupling constant, Nuclear magnetic double resonance, Brief outline of principles of FT-NMR and ¹³C NMR. Applications of NMR spectroscopy. 10 Hours

Unit 3: Mass Spectroscopy: Principle, Theory, Instrumentation of Mass Spectroscopy, Different types of ionization like electron impact, chemical, field, FAB and MALDI, APCI, ESI, APPI Analyzers of Quadrupole and Time of Flight, Mass fragmentation and its rules, Meta stable ions, Isotopic peaks and Applications of Mass spectroscopy. 10 Hours

Unit 4: Chromatography: Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution, isolation of drug from excipients, data interpretation and applications of the following:

a) Thin Layer chromatography b) High Performance Thin Layer Chromatography c) Ion exchange chromatography d) Column chromatography e) Gas chromatography f) High Performance Liquid chromatography g) Ultra High Performance Liquid chromatography h) Affinity chromatography i) Gel Chromatography. 14 Hours

Unit 5: a. Electrophoresis: Principle, Instrumentation, Working conditions, factors affecting separation and applications of the following: a) Paper electrophoresis b) Gel electrophoresis

c) Capillary electrophoresis d) Zone electrophoresis e) Moving boundary electrophoresis f) Iso electric focusing.

b. X ray Crystallography: Production of X rays, Different X ray methods, Bragg's law, Rotating crystal technique, X ray powder technique, Types of crystals and applications of X- ray diffraction.

c. Thermal Techniques: Principle, instrumentation, advantage and disadvantages, Pharmaceutical applications of DSC, DTA & TGA.

d. Microscopic techniques: Principles and applications of Scanning Electron Microscopy and Transmission Electron Microscopy analysis. 14 Hours

REFERENCES

1. Spectrometric Identification of Organic compounds - Robert M Silverstein. 6th ed. John Wiley & Sons, 2004.
2. Principles of Instrumental Analysis - Douglas A Skoog, F. James Holler & Timothy A. Nieman. 5th ed. Eastern Press, Bangalore, 1998.
3. Instrumental Methods of Analysis – Willards. 7th ed. CBS Publishers, New Delhi.
4. Practical Pharmaceutical Chemistry – Beckett and Stenlake. Vol 2. 4th ed. CBS Publishers, New Delhi
5. Organic Spectroscopy - William Kemp. 3rd ed. ELBS, 1991.
6. Quantitative Analysis of Drugs in Pharmaceutical Formulation – P.D. Sethi. 3rd ed. CBS Publishers, New Delhi, 1997.
7. Pharmaceutical Analysis - Modern Methods – Part B – J.W. Munson. Vol 11. Marcel- Dekker Series.

8. Spectroscopy of Organic Compounds - P.S. Kalsi. 2nd ed. Wiley Eastern Ltd., Delhi.

9. Textbook of Pharmaceutical Analysis - K.A. Connors. 3rd ed. John Wiley & Sons.

QUALITY MANAGEMENT SYSTEM (MQA 102T)

Unit 1: Introduction to quality: Evolution of quality, definition of quality, dimensions of quality, mission and vision statements, quality policy, quality objectives, strategic planning and implementation, McKinsey 7s Model, competitive analysis. Management commitment to quality.

Customer focus: Meaning of customer and customer focus, classification of customers, customer focus, customer perception of quality, factors affecting customer perception, customer requirements, meeting customer needs and expectations, customer satisfaction and customer delight, handling customer complaints, understanding customer behaviour, concept of internal and external customers. Case studies.

Cost of Quality: Cost of quality, categories of cost of quality, models of cost of quality, optimising costs, preventing cost of quality. 12 Hours

Unit 2: Pharmaceutical quality management: Basics of quality management, Total Quality Management (TQM), principles of six sigma, ISO 9001:2015. ICH Q10, Knowledge management, quality metrics, operational excellence and quality management review. OSHAS guidelines, NABL certification and accreditation, CFR-21 part 11, WHO-GMP requirements. 12 Hours

Unit 3: Six sigma system inspection model: quality management system, production system, facility and equipment system, laboratory control system, materials system, packaging and labelling system. Concept of self inspection.

Quality systems: Change management/ change control. deviations, Out of Specifications (OOS), Out of Trend (OOT). Complaints - evaluation and handling, investigation and determination of root cause, Corrective & Preventive Actions (CAPA). Returns and recalls, Vendor qualification, annual product reviews, batch review and batch release. Concept of IPQC, area clearance/line clearance. 12 Hours

Unit 4: Drug stability: ICH guidelines for stability testing of drug substances and drug products. Study of ICH Q8. Quality by design and process development report. Quality risk management: Introduction, risk assessment, risk control, risk review, risk management tools (FMEA, fish bone diagram), HACCP, risk ranking and filtering according to ICH Q9 guidelines. 12 Hours

Unit 5: Statistical process control (SPC): a) Definition and importance of SPC. Quality measurement in manufacturing, statistical control charts - concepts and general aspects, Advantages of statistical control, process

capability, estimating inherent or potential capability from a control chart analysis, measuring process control and quality improvement, pursuit of decreased process variability. b) regulatory compliance through quality management and development of quality culture benchmarking: Definition of benchmarking, reasons for benchmarking, types of benchmarking, benchmarking process, advantages of benchmarking, limitations of benchmarking. 12 Hours

REFERENCES

1. Juran's Quality Handbook - Joseph M Juran & Joseph A De Feo. 6th ed. ASQ Publications.
2. Implementing Juran's Road Map for Quality Leadership and Results - Al Endres. John Wiley & Sons.
3. Understanding, Managing and Implementing Quality: Frameworks, Techniques and Cases - Jiju Antony. David Preece, Routledge, 2002.
4. Organizing for High Performance: Employee Involvement, TQM, Reengineering, and Knowledge Management in the Fortune 1000: The CEO Report - Edward E Lawler, Susan Albers Mohrman & George Benson. Jossey-Bass, 2001.
5. Corporate Culture and the Quality Organization - James W Fairfield-Sonn.
6. The Quality Management Sourcebook: An International Guide to Materials and Resources - Christine Avery & Diane Zabel. Routledge, 1997.
7. The Quality Toolbox - Nancy R. Tague. 2nd ed. ASQ Publications.
8. Root Cause Analysis, The Core of Problem Solving and Corrective Action - Duke Okes. ASQ Publications, 2009.
9. Pharmaceutical QA and Management - Quality Management System for APIs – K.P. Bhusari.

PHARMACEUTICAL VALIDATION (MQA 103T)

(Note: Common paper for MPA and MQA specializations)

Unit 1: Introduction to validation: Definition of calibration, qualification and validation, scope, frequency and importance. Difference between calibration and validation. Calibration of weights and measures. Advantages of validation, scope of validation, organization for validation, validation master plan, types of validation, streamlining of qualification & validation process and validation master plan.

Qualification: User requirement specification, design qualification, factory acceptance test (FAT)/site acceptance test (SAT), installation qualification, operational qualification, performance qualification, re-qualification (Maintaining status-calibration preventive maintenance, change management). 12 Hours

Unit 2: Qualification of analytical instruments/Equipment: Training & qualification of analyst. qualification of UV-visible spectrophotometer, FTIR, DSC, GC, HPLC, HPTLC, and dissolution test apparatus. 10 Hours

Unit 3: Validation of utility systems: Pharmaceutical water system, HVAC system, compressed air and nitrogen. Facility qualification, AHU validation, clean room validation.

Cleaning validation: Cleaning method development, sampling techniques, validation of analytical method used in cleaning. Cleaning of equipment, cleaning of facilities. Cleaning in place (CIP). Validation of facilities in sterile and non-sterile plant.

Computerized system validation: Electronic records and digital significance-21 CFR part 11 and GAMP 5, LIMS, audit trail and data integrity. 12 Hours

Unit 4: Process validation: Concept, process and documentation of process validation. Prospective, concurrent & retrospective validation, re validation criteria, process validation of various formulations (coated tablets, capsules, ointment/creams, liquid orals and aerosols).

Aseptic filling: Media fill validation, USFDA guidelines on process validation- A life cycle approach.

Analytical method validation: General principles, validation of analytical method as per ICH guidelines (Q2A) and USP. Preparation & qualification of working standards and reference standards. 12 Hours

Unit 5: General principles of intellectual property: Concepts of intellectual property (IP), intellectual property protection (IPP), intellectual property rights (IPR); economic importance, mechanism for protection of intellectual property – patents, copyright, trademark; factors affecting choice of IP protection; penalties for violation; role of IP in pharmaceutical industry; global ramification and financial implications. Filing a patent application; patent application forms and guidelines. Types of patent applications-provisional and non-provisional, PCT and convention patent applications; International patenting requirement procedures and costs; rights and responsibilities of a patentee; practical aspects regarding maintaining of a patent file; patent infringement meaning and scope. Significance of transfer of technology (TOT), IP and ethics-positive and negative aspects of IPP; societal responsibility, avoiding unethical practices. 14 Hours

REFERENCES

1. Pharmaceutical Process Validation - B. T. Loftus & R. A. Nash. Drugs and Pharm Sci. Series, Vol. 129, 3rd ed. Marcel Dekker.
2. The Theory & Practice of Industrial Pharmacy, 3rd ed. Leon Lachman, Herbert A Lieberman & Joseph L Kanig, Varghese Publishing House, Bombay.

3. Validation of Aseptic Pharmaceutical Processes - Carleton & Agalloco. 2nd ed. Marcel Dekker.

4. Pharmaceutical Process Scale-Up - Michael Levin, Drugs and Pharm. Sci. Series, Vol. 157, 2nd ed. Marcel Dekker.

5. Validation Standard Operating Procedures: A Step by Step Guide for Achieving Compliance in the Pharmaceutical, Medical Device, and Biotech Industries, Syed Imtiaz Haider.

6. Validation of Pharmaceutical Processes: Sterile Products - Frederick J Carlton and James Agalloco. 2nd ed. Marcel Dekker.

7. Pharmaceutical Equipment Validation: The Ultimate Qualification Handbook, Phillip A Cloud, Interpharm Press.

8. Analytical Method Validation and Instrument Performance Verification - Chung Chan, Heiman Lam, Y.C. Lee, Yue. Zhang. Wiley Inter Science.

PRODUCT DEVELOPMENT AND TECHNOLOGY TRANSFER (MQA 104T)

Unit 1: Principles of drug discovery and development: Introduction, clinical research process. Development and informational content for Investigational New Drug Application (IND), New Drug Application (NDA), Abbreviated New Drug Application (ANDA), Supplemental New Drug Application (SNDA), Scale Up Post Approval Changes (SUPAC) and Bulk active chemical Post approval changes (BACPAC). Post marketing surveillance, product registration guidelines – CDSCO, USFDA. 12 Hours

Unit 2: Pre-formulation studies: Introduction/concept, organoleptic properties, purity, impurity profiles, particle size, shape and surface area.

Solubility: Methods to improve solubility of drugs, surfactants and their importance, co- solvency. Techniques for the study of crystal properties and polymorphism. Pre-formulation protocol, stability testing during product development. 12 Hours

Unit 3: Pilot plant scale up: Concept, significance, design, layout of pilot plant scale up study, operations, large scale manufacturing techniques (formula, equipment, process, stability and quality control) of solids, liquids, semisolid and parenteral dosage forms. New era of drug products: opportunities and challenges. 12 Hours

Unit 4: Pharmaceutical packaging: Pharmaceutical dosage forms and their packaging requirements. Pharmaceutical packaging materials, medical device packaging, external packaging, aseptic packaging systems, container closure systems, issues facing modern drug packaging, selection and evaluation of pharmaceutical packaging materials-safety to the drug product/drug substance.

Quality control tests: Containers, closures and secondary packing materials. 12 Hours Unit 5:

Technology transfer: Development of technology by R & D, technology transfer from R & D to production, optimization and production, qualitative and quantitative technology models. documentation in technology transfer: development report, technology transfer plan and exhibit. 12 Hours

REFERENCES

1. The Theory & Practice of Industrial Pharmacy, 3rd ed. Leon Lachman, Herbert A. Lieberman & Joseph L Kanig, Varghese Publishing House, Bombay.

2. Good Manufacturing of Pharmaceuticals (A Plan for Total Quality Control) - Sidney H Willig, Murray M, Tuckerman & Williams Hitchings IV. 3rd ed. Bhalani Publishing House, Mumbai.

3. Pharmaceutical Dosage Forms : Tablets - Herbert A. Lieberman and Leon Lachman, Volume 1 - 3. Marcel Dekker, Inc.

4. Biopharmaceutics and Clinical Pharmacokinetics - Milo Gibaldi. 3rd ed. Pharma Book Syndicate.

5. Remington – The Science and Practice of Pharmacy – Loyd V Allen. 22nd ed.

6. The Pharmaceutical Sciences - The Pharma Path Way - D.A. Sawant. Pragathi Books Pvt. Ltd.

7. Pharmaceutical Packaging Technology - D.A. Dean & E.R. Evans. Taylor & Francis, London.

8. The process of New Drug Discovery and Development - Charles G Smith, James T & O. Donnell. CRC Press.

9. Pharmaceutical Product Development - Vandana V Patrevala, John I Disouza & Maharukh T Rustomji. CRC Press.

10. Dissolution, Bioavailability and Bio-Equivalence - H.M. Abdou. Mack Publishing.

11. Guide Book for Drug Regulatory Submissions - Sandy Weinberg.

PHARMACEUTICAL QUALITY ASSURANCE PRACTICAL – I (MQA 105P)

1. Analysis of Pharmacopoeial compounds in bulk and in their formulations (tablet/ capsules/ semisolids) by UV- Vis spectrophotometer.

2. Simultaneous estimation of multi-drug component containing formulations by UV spectrophotometry.

3. Experiments based on HPLC

4. Experiments based on gas chromatography

5. Estimation of riboflavin/quinine sulphate by fluorimetry

6. Estimation of sodium/potassium by flame photometry or AAS
7. Case studies on
 - Total Quality Management
 - Six Sigma
 - Change Management/ Change control. Deviations,
 - Out of Specifications (OOS)
 - Out of Trend (OOT)
 - Corrective & Preventive Actions (CAPA)
 - Deviations
8. Development of Stability study protocol
9. Estimation of process capability.

PHARMACEUTICAL QUALITY ASSURANCE PRACTICAL - II (MQA 106P)

1. In process and finished product quality control tests for tablets, capsules, parenterals and semisolid dosage forms.
2. Assay of raw materials as per official monographs
3. Testing of related and foreign substances in drugs and raw materials
4. To carry out pre-formulation study for tablets, parenterals (2 experiments).
5. To study the effect of pH on the solubility of drugs, (1 experiment)
6. Quality control tests for Primary and secondary packaging materials
7. Accelerated stability studies (1 experiment)
8. Improved solubility of drugs using surfactant systems (1 experiment)
9. Improved solubility of drugs using co-solvency method (1 experiment)
10. Determination of pKa and Log p of drugs.

Second Semester

HAZARDS AND SAFETY MANAGEMENT (MQA 201T)

Unit 1: Multidisciplinary nature of environmental studies: Natural resources, renewable and non-renewable resources, natural resources and associated problems: a) Forest resources; b) Water resources; c) Mineral resources; d) Energy resources; e) Land resources

Ecosystems: Concept of an ecosystem and structure and function of an ecosystem. Environmental hazards: Hazards based on air, water, soil and radioisotopes. 12 Hours

Unit 2: Air based hazards: Sources, types of hazards, air circulation maintenance industry for sterile area and non sterile area.

Preliminary Hazard Analysis (PHA) Fire protection system: Fire prevention, types of fire extinguishers and critical Hazard management system. 12 Hours

Unit 3: Chemical based hazards: Sources of chemical hazards, hazards of organic synthesis, sulphonating hazard, organic solvent hazard, control measures for chemical hazards. Management of combustible gases, toxic gases and oxygen displacing gases management. Regulations for chemical hazard, management of over exposure to chemicals and TLV concept. 12 Hours

Unit 4: Fire and explosion: Introduction, industrial processes and hazards potential, mechanical electrical, thermal and process hazards. Safety and hazards regulations. Fire protection system, fire prevention, types of fire extinguishers and critical hazard management system, mechanical and chemical explosion, multiphase reactions, transport effects and global rates. Preventive and protective management from fires and explosion, electrical passivation, ventilation, and sprinkling, proofing, relief systems - relief valves, flares, scrubbers. 12 Hours

Unit 5: Hazard and risk management: Self-protective measures against workplace hazards. Critical training for risk management. Process of hazard management, ICH guidelines on risk assessment and risk management methods and tools. Factory act and rules, fundamentals of accident prevention, elements of safety programme and safety management. Physico-chemical measurements of effluents, BOD, COD. Determination of some contaminants, effluent treatment procedure, role of emergency services. 12 Hours

REFERENCES

1. Environmental Science - Y.K. Sing. New Age International Pvt. Publishers, Bangalore.
2. Quantitative Risk Assessment in Chemical Process Industries. American Institute of Chemical Industries, Centre for Chemical Process Safety.
3. The Biodiversity of India - Bharucha Erach. Mapin Publishing Pvt. Ltd., Ahmedabad.
4. Hazardous Chemicals: Safety Management and Global Regulations - T.S.S. Dikshith. CRC Press.

AUDITS AND REGULATORY COMPLIANCE (MQA 202T)

Unit 1: Introduction: Objectives, types of audit, management of audit, responsibilities, planning process, information gathering, administration, classification of deficiencies. 12 Hours

Unit 2: Role of quality systems and audits in pharmaceutical manufacturing environment: cGMP regulations, quality assurance functions, quality systems approach. Management responsibilities, resource, manufacturing operations, evaluation activities, transitioning to quality system approach. Audit checklist for drug industries, continuous process verification. 12 Hours

Unit 3: Auditing of vendors and production department: Bulk pharmaceutical chemicals and packaging material vendor audit, warehouse and weighing. Dry Production: Granulation, tableting, coating, capsules, sterile production and packaging. Audits of large volume parenterals, small volume parenterals, sterile dry powders and lyophilised product manufacturing. 12 Hours

Unit 4: Auditing of microbiological laboratory: Auditing the manufacturing process. Product and process information. General areas of interest in the building raw materials. Water, packaging materials. 12 Hours

Unit 5: Auditing of quality assurance and engineering department: quality assurance maintenance. Critical systems: HVAC, water, water for injection systems, ETP. 12 Hours

REFERENCES

1. Compliance Auditing for Pharmaceutical Manufacturers - Karen Ginsbury & Gil Bismuth. Interpharm /CRC, Boca Raton, London, New York, Washington D.C.
2. Pharmaceutical Manufacturing Handbook, Regulations and Quality - Shayne Cox Gad. Wiley-Interscience, A John Wiley and Sons, Inc., Publications.
3. Handbook of Microbiological Quality Control - Rosamund M Baird, Norman A Hodges & Stephen P Denyar. CRC Press, 2000.
4. Laboratory Auditing for Quality and Regulatory Compliance - Donald C Singer, Raluca- Ioana Stefan & Jacobus F Van Staden. Taylor and Francis, 2005.

QUALITY CONTROL AND QUALITY ASSURANCE (MQA 203T)

(Common paper for MPA and MQA specializations)

Unit 1: Introduction: Concept and evolution of quality control and quality assurance. Good laboratory practice, GMP, overview of ICH guidelines - QSEM, with special emphasis on Q- series guidelines.

Good laboratory practices: Scope of GLP, definitions, quality assurance unit, protocol for conduct of non-clinical testing.

CPCSEA guidelines: Control on animal house, report preparation and documentation. 12 Hours

Unit 2: cGMP guidelines according to schedule M, USFDA (inclusive of CDER and CBER) Pharmaceutical Inspection Convention (PIC), WHO and EMEA covering: Organization and personnel responsibilities, training, hygiene and personal records, drug industry location, design, construction and plant lay out, maintenance, sanitation, environmental control, utilities and maintenance of sterile areas, clean room validation, control of contamination, sterility assurance, AHU system & qualification, and Good Warehousing Practice. 12 Hours

Unit 3: Developing specification (ICH Q6 and Q3), sampling methods for raw and packing materials. Purchase specifications, vendor qualification and maintenance of stores for various materials.

Testing of primary packing materials as per IP & USP: Glass containers, plastics, rubber.

Analysis of raw materials, packaging materials: In-process quality control and finished products quality control for following formulations in pharma industry according to Indian, US and British pharmacopoeias: tablets, capsules, ointments, suppositories, creams, parenterals, ophthalmic and surgical products. Quality control test for containers, closures and secondary packing materials. 12 Hours

Unit 4: Documentation in pharmaceutical industry: Three tier documentation, policy, procedures and work instructions, and records (Formats), basic principles - how to maintain, retention and retrieval etc. Standard operating procedures (how to write), Master Formula Record, Batch Manufacturing Record, quality audit plan and reports. Specification and test procedures, protocols and reports. distribution records. Electronic data handling. Concepts of controlled and uncontrolled documents. Submission documents for regulators DMFs, as Common Technical Document and Electronic Common Technical Documentation (CTD, eCTD). 12 Hours

Unit 5: Manufacturing operations and controls: Sanitation of manufacturing premises, mix-ups and cross contamination, processing of intermediates and bulk products, packaging operations, IPQC, release of finished product, process deviations, charge-in of components, time limitations on production, drug product inspection, expiry date calculation, calculation of yields, production record review, change control, sterile products, aseptic process control, packaging. 12 Hours

REFERENCES

1. Quality Assurance Guide by Organization of Pharmaceutical Procedures of India. 3rd Revised ed. Vol I & II, Mumbai, 1996.
2. Good Laboratory Practice Regulations - Sandy Weinberg Vol 69. 2nd ed. Marcel Dekker.

3. Quality Assurance of Pharmaceuticals - A Compendium of Guidelines and Related Materials. Vol 1 & 2. 2nd ed. WHO Publications, 1999.

4. How to Practice GMP's – P.P. Sharma, Vandana Publications, Agra, 1991.

5. The International Pharmacopoeia – General Methods of Analysis and Quality Specification for Pharmaceutical Substances, Excipients and Dosage forms. Vol 1-5. 3rd ed. WHO, Geneva, 2005.

6. Good Laboratory Practice Regulations – Allen F. Hirsch. Vol 38, Marcel Dekker.

7. ICH guidelines

8. ISO 9000 and Total Quality Management

9. The Drugs and Cosmetics Act 1940 – Deshpande & Nilesh Gandhi. 4th ed. Susmit Publishers.

10. QA Manual – D.H. Shah. 1st ed. Business Horizons, 2000.

11. Good Manufacturing Practices for Pharmaceuticals; A Plan for Total Quality Control – Sidney H Willig. Vol. 52. 3rd ed. Marcel Dekker.

12. GMP/ISO Quality Audit Manual for Healthcare Manufacturers and Their Suppliers - Steinborn L. Vol 1 - With Checklists and Software Package. 6th ed. Taylor & Francis.

13. Quality Systems and Controls for Pharmaceuticals – D.K. Sarker. John Wiley & Sons, 2008.

PHARMACEUTICAL MANUFACTURING TECHNOLOGY (MQA 204T)

Unit 1: Pharmaceutical industry developments: Legal requirements and licenses for API and formulation industry. Plant location and plant layout, factors influencing. Special provisions, storage space requirements, sterile and aseptic area layout.

Production planning: General principles, production systems, calculation of standard cost, process planning, routing, loading, scheduling, dispatching of records, production control. 12 Hours

Unit 2: Aseptic process technology: Manufacturing, manufacturing flowcharts, in process-quality control tests for dosage forms: Ointment, suspension and emulsion, dry powder, solutions, sterile dosage forms (small volume & large volume).

Advanced sterile product manufacturing technology: Area planning & environmental control, wall and floor treatment, fixtures and machineries, change rooms, personnel flow, utilities & utilities equipment location, engineering and maintenance.

Process automation in pharmaceutical industry: With specific reference to manufacturing of sterile semisolids, Small Volume Parenterals & Large

Volume Parenterals (SVP & LVP), Monitoring of parenteral manufacturing facility, Cleaning in Place (CIP), Sterilization in Place (SIP), prefilled syringe, powdered jet, needle free injections, and Form Fill Seal Technology (FFS).

Lyophilization technology: Principles, process, equipment 12 Hours

Unit 3: Non sterile manufacturing process technology: Manufacturing, manufacturing flowcharts, in-process-quality control tests for non-sterile solid dosage forms: Tablets (compressed & coated), capsules (hard & soft).

Advanced non-sterile solid product manufacturing technology: Process automation in pharmaceutical industry with specific reference to manufacturing of tablets and coated products.

Improved tablet production: Tablet production process, granulation and palletization equipment, continuous and batch mixing, rapid mixing granulators, rota granulators, spheronizers and marumerisers, and other specialized granulation and drying equipments. Problems encountered.

Coating technology: Process, equipments, particle coating, fluidized bed coating, application techniques. Problems encountered. 12 Hours

Unit 4: Containers and closures for pharmaceuticals: Types, performance, assuring quality of glass; types of plastics used, drug plastic interactions, biological tests, modification of plastics by drugs; different types of closures and closure liners; film wrapper; blister packs; bubble packs; shrink packaging; foil /plastic pouches, bottle seals, tape seals, breakable seals and sealed tubes; quality control of packaging material and filling equipment, flexible packaging, product package compatibility, transit worthiness of package, Stability aspects of packaging. Evaluation of stability of packaging material. 12 Hours

Unit 5: Quality by design (QbD) and process analytical technology (PAT): Current approach and its limitations. Why QbD is required, advantages, elements of QbD, terminology: QTPP. CMA, CQA, CPP, RLD, design space, design of experiments, risk assessment and mitigation

/minimization. Quality by Design, formulations by design, QbD for drug products, QbD for drug substances, QbD for excipients, analytical QbD. FDA initiative on process analytical technology. PAT as a driver for improving quality and reducing costs: quality by design (QbD), QA, QC and GAMP. PAT guidance, standards and regulatory requirements. 12 Hours

REFERENCES

1. The Theory & Practice of Industrial Pharmacy, 3rd ed. Leon Lachman, Herbert A.

Lieberman & Joseph L Karig, Varghese Publishing House, Bombay.

2. Martin's Physical Pharmacy and Pharmaceutical Sciences - Patrick J Sinko. 6th ed. BI Publications Pvt. Ltd.

3. Pharmaceutical Dosage Forms : Tablets - Herbert A Lieberman & Leon Lachman, Volume 1 - 3. Marcel Dekker, Inc.
4. Modern Pharmaceutics - Gilbert S Banker & Christopher T. Rhodes. 4th ed.
5. Good Manufacturing of Pharmaceuticals (A Plan for Total Quality Control) - Sidney H Willig, M. Murray, Tuckerman & Williams Hitchings IV. 3rd ed. Bhalani Publishing House, Mumbai.
6. Indian Pharmacopoeia-2018. Controller of Publication. Delhi.
7. British Pharmacopoeia. British Pharmacopoeia Commission Office, London, 2017.
8. United States Pharmacopoeia. United States Pharmacopoeial Convention, Inc, USA, 2019.
9. Pharmaceutical Packaging Technology – D.A. Dean, E.R. Evans & I.H. Hall. 1st ed. Taylor & Francis, London.
10. Pharmaceutical Packaging Handbook - Edward J Bauer. Informa Health Care USA Inc., 2009.
11. Pharmaceutical Manufacturing Handbook - Shaybe Cox Gad. John Wiley and Sons.

PHARMACEUTICAL QUALITY ASSURANCE PRACTICAL – III (MQA 205P)

1. Organic contaminants residue analysis by HPLC
2. Estimation of Metallic contaminants by Flame photometer
3. Identification of antibiotic residue by TLC
4. Estimation of Hydrogen Sulphide in Air.
5. Estimation of Chlorine in Work Environment.
6. Sampling and analysis of SO₂ using Colorimetric method
7. Qualification of following Pharma equipment
 - Autoclave
 - Hot air oven
 - Powder Mixer (Dry)
 - Tablet Compression Machine
8. Validation of an analytical method for a drug
9. Validation of a processing area
10. Qualification of at least two analytical instruments
11. Cleaning validation of one equipment
12. Qualification of Pharmaceutical Testing Equipment (Dissolution testing apparatus, Friability Apparatus, Disintegration Tester)

13. Check list for Bulk Pharmaceutical Chemicals vendors
 14. Check list for tableting production.
 15. Check list for sterile production area
 16. Check list for Water for injection.
 17. Design of plant layout: Sterile and non-sterile
 18. Case study on application of QbD
 19. Case study on application of PAT
- INDUSTRIAL PHARMACY (MIP)

First Semester

MODERN PHARMACEUTICAL ANALYTICAL TECHNIQUES (MIP 101T)

(Note: Common Paper for MPA, MPC, MPH, MPB, MPL, MPG, MQA, & MIP, specializations)

Unit 1: a. UV-visible spectroscopy: Introduction, theory, laws and instrumentation associated with UV-visible spectroscopy, choice of solvents and solvent effect and applications of UV-visible spectroscopy.

b. IR spectroscopy: Theory, modes of molecular vibrations, sample handling, instrumentation of dispersive and Fourier-Transform IR Spectrometer, factors affecting vibrational frequencies and applications of IR spectroscopy, data interpretation.

c. Spectrofluorimetry: Theory of fluorescence, factors affecting fluorescence (characteristics of drugs that can be analyzed by fluorimetry), quenchers, instrumentation and Applications of fluorescence spectrophotometer.

d. Flame emission spectroscopy and Atomic absorption spectroscopy: Principle, instrumentation, interferences and applications. 12 Hours

Unit 2: NMR spectroscopy: Quantum numbers and their role in NMR, Principle, Instrumentation, Solvent requirement in NMR, Relaxation process, NMR signals in various compounds, Chemical shift, Factors influencing chemical shift, Spin-Spin coupling, Coupling constant, Nuclear magnetic double resonance, Brief outline of principles of FT-NMR and ¹³C NMR. Applications of NMR spectroscopy. 10 Hours

Unit 3: Mass Spectroscopy: Principle, Theory, Instrumentation of Mass Spectroscopy, Different types of ionization like electron impact, chemical, field, FAB and MALDI, APCI, ESI, APPI Analyzers of Quadrupole and Time of Flight, Mass fragmentation and its rules, Meta stable ions, Isotopic peaks and Applications of Mass spectroscopy. 10 Hours

Unit 4: Chromatography: Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution, isolation of drug from excipients, data interpretation and applications of the following:

a) Thin Layer chromatography b) High Performance Thin Layer Chromatography c) Ion exchange chromatography d) Column chromatography e) Gas chromatography f) High Performance Liquid chromatography g) Ultra High Performance Liquid chromatography h) Affinity chromatography i) Gel Chromatography. 14 Hours

Unit 5: a. Electrophoresis: Principle, Instrumentation, Working conditions, factors affecting separation and applications of the following: a) Paper electrophoresis b) Gel electrophoresis c) Capillary electrophoresis d) Zone electrophoresis e) Moving boundary electrophoresis f) Iso electric focusing.

b. X ray Crystallography: Production of X rays, Different X ray methods, Bragg's law, Rotating crystal technique, X ray powder technique, Types of crystals and applications of X- ray diffraction.

c. Thermal Techniques: Principle, instrumentation, advantage and disadvantages, Pharmaceutical applications of DSC, DTA & TGA.

d. Microscopic techniques: Principles and applications of Scanning Electron Microscopy and Transmission Electron Microscopy analysis. 14 Hours

REFERENCES

1. Spectrometric Identification of Organic compounds - Robert M Silverstein. 6th ed. John Wiley & Sons, 2004.
2. Principles of Instrumental Analysis - Douglas A Skoog, F. James Holler & Timothy A. Nieman. 5th ed. Eastern Press, Bangalore, 1998.
3. Instrumental Methods of Analysis – Willards. 7th ed. CBS Publishers, New Delhi.
4. Practical Pharmaceutical Chemistry – Beckett and Stenlake. Vol 2. 4th ed. CBS Publishers, New Delhi
5. Organic Spectroscopy - William Kemp. 3rd ed. ELBS, 1991.
6. Quantitative Analysis of Drugs in Pharmaceutical Formulation – P.D. Sethi. 3rd ed. CBS Publishers, New Delhi, 1997.
7. Pharmaceutical Analysis - Modern Methods – Part B – J.W. Munson. Vol 11. Marcel- Dekker Series.
8. Spectroscopy of Organic Compounds - P.S. Kalsi. 2nd ed. Wiley Estern Ltd., Delhi.
9. Textbook of Pharmaceutical Analysis - K.A. Connors. 3rd ed. John Wiley & Sons.

ADVANCED BIOPHARMACEUTICS & PHARMACOKINETICS (MIP 102T)

(Common paper for MPH and MIP specializations)

Unit 1: Drug absorption from the gastrointestinal tract and other routes of administration: Mechanisms and factors affecting drug absorption from different routes, influence of pH– partition theory on drug absorption. Factors

affecting dissolution rate and its process, Noyes- Whitney equation. dissolution testing methods for solids - tablets, capsules and for suspensions. Correlation of in vivo and in vitro dissolution data. 12 Hours

Unit 2: Biopharmaceutical considerations in drug product design and in vitro drug product performance. Introduction - biopharmaceutical factors affecting bioavailability, rate limiting steps in drug absorption, physicochemical nature of drug, formulation factors affecting drug product performance. In vitro dissolution and drug release testing, dissolution test apparatus and methods as per IP and USP for different types of drug delivery systems, design of dissolution testing for conventional and controlled release products. Data handling and correction factor, bio relevant media, similarity and dissimilarity factors f_1 & f_2 , alternative methods of dissolution testing, problems of variable control in dissolution testing performance of drug products. Drug product stability during dissolution testing, in vitro evaluation of drug release from different dosage forms. 12 Hours

Unit 3: Pharmacokinetics: Basic considerations, pharmacokinetic models, compartment modeling: one compartment model - IV bolus, IV infusion, extra-vascular. Multi compartment models in brief, calculation of parameters in two compartment models. Non-linear pharmacokinetics: causes of non-linearity, Michaelis – Menten equation, estimation of k_m and V_{max} . Concept of clearance and its applications. Problems related to the above. 12 Hours

Unit 4: Drug Product Performance: Bioavailability and bioequivalence, drug product performance, purpose of bioavailability studies, relative and absolute availability. Methods, protocol design for assessing bioavailability, bioequivalence studies, design and evaluation of bioequivalence studies, study designs, cross over study designs, evaluation of the data, bioequivalence

example, study submission and drug review process. In vitro - in vivo correlations in protocol design, levels of correlation, biopharmaceutical classification system, methods. Permeability: Generic biologics (biosimilar drug products), clinical significance of bioequivalence studies. 12 Hours

Unit 5: Application of pharmacokinetics: Modified-release drug products, targeted drug delivery systems and biotechnological products. Significance of pharmacokinetic and pharmacodynamic drug interactions in the design of the modified release products. 12 Hours

REFERENCES

1. Pharmacokinetics - Milo Gibaldi. 2nd ed.
2. Applied Biopharmaceutics and Pharmacokinetics - Leon Shargel. 5th ed.

3. Biopharmaceutics and Clinical Pharmacokinetics - Robert E. Notari. 4th ed.
4. Modern Pharmaceutics - Gilbert S. Banker, Christopher T. Rhodes. 4th ed.
5. Clinical Pharmacokinetics & Pharmacodynamics - Malcolm Rowland & Tozer. 4th ed. Lippincott Publications.
6. Drug Disposition and Pharmacokinetics - Stephen H Curry. 3rd ed.
7. Current Concepts in the Pharmaceutical Sciences: Biopharmaceutics - James Swarbrick
8. Current Concepts in the Pharmaceutical Sciences: Dosage Form Design and Bioavailability - James Swarbrick.

NOVEL DRUG DELIVERY SYSTEMS (MIP 103T)

Unit 1: Concept & Models for NDDS: Classification of rate controlled drug delivery systems (DDS), rate programmed release, activation modulated & feedback regulated DDS, effect of system parameters in controlled drug delivery, computation of desired release rate and dose for controlled release DDS, pharmacokinetic design for DDS – intermittent, zero order & first order release. Carriers for drug delivery: Polymers/co-polymers, introduction, classification, characterization, polymerization techniques, application in CDDS/NDDS, biodegradable & natural polymers. 12 Hours

Unit 2: Study of various DDS: Concepts, design, formulation & evaluation of controlled release oral DDS, mucoadhesive DDS (buccal, nasal, pulmonary) pulsatile, colon specific, liquid sustained release systems, ocular delivery systems Transdermal drug delivery systems: Theory, design, formulation & evaluation including iontophoresis and other latest developments in skin delivery systems. 12 Hours

Unit 3: Targeted drug delivery systems: Importance, concept, biological process and events involved in drug targeting, design, formulation & evaluation, methods in drug targeting – nanoparticles, liposomes, niosomes, pharmacosomes, resealed erythrocytes, microspheres, magnetic microspheres. Specialized pharmaceutical emulsions – multiple emulsions, micro-emulsions. 12 Hours

Unit 4: Protein/peptide drug delivery systems: Concepts, delivery techniques, formulation, stability testing, causes of protein destabilization, stabilization methods. Biotechnology in drug delivery systems: Brief review of major areas-recombinant DNA technology, monoclonal antibodies, gene therapy. 12 Hours

Unit 5: New trends for personalized medicine: Introduction, definition, pharmacogenetics, categories of patients for personalized medicines: customized drug delivery systems, bioelectronic medicines, 3D printing of pharmaceuticals, telepharmacy. Sub micron cosmeceuticals: Biology,

formulation science and evaluation of various cosmetics for skin, hair, nail, eye etc. and their regulatory aspects. 12 Hours

REFERENCES

1. Novel Drug Delivery Systems - Y.W. Chein. Vol 50, Marcel Dekker, NY.
2. Controlled Drug Delivery: Fundamentals and Applications – Joseph R Robinson & Vincent H L Lee. Vol 29. Marcel Dekker, NY.
3. Transdermal Controlled Systemic Medications – Y.W. Chein. Vol 31. Marcel Dekker, New York.
4. Bioadhesive Drug Delivery Systems - E. Mathiowitz. Vol 98. Marcel Dekker, NY.
5. Nasal System Drug Delivery - K.S.E. Su. Vol 39. Marcel Dekker, NY.
6. Drug Delivery Devices – P. Tyle. Vol 32. Marcel Dekker, NY.
7. Polymers for Controlled Drug Delivery - P.J. Tarcha. CRC Press.
8. Pharmaceutical Biotechnology - S.P.Vyas and V.K. Dixit. CBS Publishers, New Delhi.
9. Biotechnology of Industrial Antibiotics - E.J. Vandamme. Marcel Dekker, NY.
10. Protein Formulation & Delivery - E.J. McNally. Vol 99. Marcel Dekker, NY.
11. Drug Targeting - M.H. Rubinstein. John Wiley, NY.

INTELLECTUAL PROPERTY RIGHTS (MIP 104T)

Unit 1: Patents: Definition, need for patenting, types of patents. Conditions to be satisfied by an invention to be patentable, Introduction to patent search. Parts of patents. Filing of patents. The essential elements of patent; Guidelines for preparation of laboratory note book, Non-obviousness in patent. 12 Hours

Unit 2: Role of GATT, TRIPS, and WIPO 12 Hours

Unit 3: Brief introduction to Trademark protection and WHO Patents. IPR's and its types, Major bodies regulating Indian Pharmaceutical sector. 12 Hours

Unit 4: Brief introduction to CDSCO. WHO, USFDA, EMEA, TGA, MHRA, MCC, ANVISA 12 Hours

Unit 5: Regulatory requirements for contract research organization. Regulations for biosimilars. 12 Hours

REFERENCES

1. Pharmaceutical Process Validation - Fra R Berry & Robert A Nash. Vol 57. 2nd ed. Marcel Dekker, NY.
2. Applied Production and Operation Management – James R Evans. 4th ed.

3. GMP for Pharmaceuticals Material Management - K.K. Ahuja. CBS Publishers, New Delhi.
4. ISO 9000-Norms and explanations
5. GMP for Pharmaceuticals: A Plan for Total Quality Control – S.H. Willing. Marcel Dekker.

INDUSTRIAL PHARMACY PRACTICAL - I (MIP 105P)

1. Analysis of pharmacopoeial compounds and their formulations by UV-visible spectrophotometer
2. Estimation of riboflavin/quinine sulphate by fluorimetry
3. Estimation of sodium/potassium by flame photometry
4. Effect of surfactants on the solubility of drugs
5. Effect of pH on the solubility of drugs
6. Stability testing of solution and solid dosage forms for photo degradation
7. Stability studies of drugs in dosage forms at 25°C, 60% RH 40°C, 75% RH
8. Compatibility evaluation of drugs and excipients (DSC & FTIR).
9. Preparation and evaluation of different polymeric membranes

INDUSTRIAL PHARMACY PRACTICAL - II (MIP 106P)

1. Formulation and evaluation of sustained release oral matrix tablet/oral reservoir system
2. Formulation and evaluation of microspheres/microcapsules
3. Formulation and evaluation of transdermal drug delivery systems
4. Design and evaluation of face wash, body wash, creams, lotions, shampoo, toothpaste, lipstick
5. Electrophoresis of protein solution
6. Preparation and evaluation of liposome delivery system
7. Experiments based on HPLC/GC
8. Simultaneous estimation of multi component containing formulations by UV spectrophotometry

Second Semester

SCALE UP AND TECHNOLOGY TRANSFER (MIP 202T)

Unit 1: Pilot plant design: Basic requirements for design, facility, equipment selection, for tablets, capsules, liquid orals, parenteral and semisolid preparations.

Scale up: Importance, technology transfer from R & D to pilot plant to plant scale, process scale up for tablets, capsules, liquid orals, semisolids, parenteral, NDDS products – stress on formula, equipment, product uniformity, stability, raw materials, physical layout, input, in- process and

finished product specifications, problems encountered during transfer of technology 12 Hours

Unit 2: Validation: General concepts, types, procedures & protocols, documentation. Validation Management Forum (VMF). Analytical method validation. Cleaning validation and vendor qualification. 12 Hours

Unit 3: Equipment qualification: Importance, IQ, OQ, PQ for equipment – autoclave, dry heat sterilization, membrane filter, rapid mixer granulator, cone blender, fluidized bed dryer, tablet compression machine, liquid filling and sealing machine. Aseptic room validation. 12 Hours

Unit 4: Process validation: Importance, validation of mixing, granulation, drying, compression, tablet coating, liquid filling and sealing, sterilization, water process systems, environmental control. 12 Hours

Unit 5: Industrial safety: Hazards – fire, mechanical, electrical, chemical and pharmaceutical, their monitoring & prevention systems. Industrial effluent testing and treatment. Control of environmental pollution. 12 Hours

REFERENCES

1. Pharmaceutical Process Validation - Fra R. Berry & Robert A. Nash. Vol 57. 2nd ed. Marcel Dekker, NY.
2. Pharmaceutical Production Facilities, Design and Applications – G.C. Cole. Taylor and Francis.
3. Pharmaceutical Project Management - T.Kennedy. Vol 86. Marcel Dekker, NY.
4. The Theory & Practice of Industrial Pharmacy, 3rd ed. Leon Lachman, Herbert A Lieberman & Joseph L Karig, Varghese Publishing House, Bombay.
5. Tablet Machine Instruments in Pharmaceuticals – P.R. Watt. John Wiley & Sons.
6. Pharmaceutical Dosage Forms: Tablets - Herbert A Lieberman & Leon Lachman, Volume 1 - 3. Marcel Dekker, Inc.
7. Pharmaceutical Dosage Forms : Disperse Systems - Herbert A Lieberman, Martin M Rieger & Gilbert S Banker, Vol 1 – 3. Informa Healthcare.
8. Pharmaceutical Dosage Forms : Parenteral Medication – Sandeep Nema & John Ludwig, Vol 1 – 3. 3rd ed. Informa Healthcare.
9. Pharmaceutical Production and Management – C.V.S. Subrahmanyam. Vallabh Prakashan, Dehli, 2007.

PHARMACEUTICAL PRODUCTION TECHNOLOGY (MIP 202T)

Unit 1: Improved tablet production: Tablet production process, unit operation improvements, granulation and pelletization equipment, continuous and batch mixing, rapid mixing granulators, rota granulators,

spheronizers and marumerisers, and other specialized granulation and drying equipments. Problems encountered.

Coating Technology: Process, equipments, particle coating, fluidized bed coating, application techniques. Problems encountered. 12 Hours

Unit 2: Parenteral production: Area planning and environmental control, wall and floor treatment, fixtures and machineries, change rooms, personnel flow, utilities & utilities equipment location, engineering and maintenance. 12 Hours

Unit 3: Lyophilization and spray drying technology: Principles, process, freeze-drying and spray drying equipment. 12 Hours

Unit 4: Capsule production: Production process, improved capsule manufacturing and filling machines for hard and soft gelatin capsules. Layout and problems encountered.

Disperse systems production: Production processes, applications of mixers, mills, disperse equipment including fine solids dispersion, problems encountered. 12 Hours

Packaging technology: Types of packaging materials, machinery, labeling, package printing for different dosage forms. 12 Hours

Unit 5: Air handling systems: Study of air handling units (AHUs), humidity and temperature control, air filtration systems, dust collectors.

Water treatment process: Techniques and maintenance – RO, DM, ultra – filtration, water for injection. 12 Hours

REFERENCES

1. The Theory & Practice of Industrial Pharmacy, 3rd ed. Leon Lachman, Herbert A. Lieberman, Joseph. L. Karig, Varghese Publishing House, Bombay.
2. Modern Pharmaceutics - Gilbert S. Banker, Christopher T. Rhodes. 4th ed.
3. Pharmaceutical Dosage Forms: Tablets - Herbert A. Lieberman and Leon Lachman, Volume 1 - 3. Marcel Dekker, Inc..
4. Pharmaceutical Dosage Forms : Disperse Systems - Herbert A Lieberman, Martin M Rieger & Gilbert S Banker, Vol 1 – 3. Informa Healthcare.
5. Pharmaceutical Dosage Forms : Parenteral Medication – Sandeep Nema & John Ludwig, Vol 1 – 3. 3rd ed. Informa Healthcare.
6. Pharmaceutical Production Facilities, Design and Applications – G.C. Cole. Taylor and Francis.
7. Product Design and Testing of Polymeric Materials - N.P. Chezerisionoff.
8. Pharmaceutical Project Management - T.Kennedy. Vol 86. Marcel Dekker, NY.

9. Packaging of Pharmaceutical and Health Care - H. Lockhart & F.A. Paine.

10. Quality Control of Packaging Materials in the Pharmaceutical Industry – Kenneth Harburn. Marcel Dekker, NY.

11. Freeze drying / Lyophilization of Pharmaceuticals & Biological Products - L. Ray. Vol 96. Marcel Dekker, NY.

12. Tablet Machine Instruments in Pharmaceuticals – P.R. Watt. John Wiley & Sons.

ENTREPRENEURSHIP MANAGEMENT (MIP 203T)

Unit 1: Conceptual frame work: Concept need and process in entrepreneurship development. Role of enterprise in national and global economy. Types of enterprises, merits and demerits. Government policies and schemes for enterprise development. Institutional support in enterprise development and management. 12 Hours

Unit 2: Entrepreneur: Entrepreneurial motivation, dynamics of motivation. Entrepreneurial competency, concepts. Developing entrepreneurial competencies, requirements and understanding the process of entrepreneurship development, self-awareness, interpersonal skills, creativity, assertiveness, achievement, factors affecting entrepreneur role. 12 Hours

Unit 3: Launching and organizing an enterprise: Environment scanning, information, sources, schemes of assistance, problems. Enterprise selection, market assessment, enterprise feasibility study, SWOT analysis. Resource mobilization - finance, technology, raw material, site and manpower. Costing and marketing management and quality control. Feedback, monitoring and evaluation. 12 Hours

Unit 4: Growth strategies and networking: Performance appraisal and assessment. Profitability and control measures, demands and challenges. Need for diversification. Future growth – techniques of expansion and diversification, vision strategies. Concept and dynamics. methods, Joint venture, co-ordination and feasibility study. 12 Hours Unit 5:

Preparing project proposal to start on new enterprise project work – feasibility report. Planning, resource mobilization and implementation. 12 Hours

REFERENCES

1. Entrepreneurship for Women in India - M.M.P. Akhauri. NIESBUD, New Delhi, 1990.
2. The Women Entrepreneurs - R.D. Hisrich, & C.G. Brush. D.C. Health & Co., Toranto, 1996.

3. Entrepreneurship: Starting, Developing and Managing a New Enterprise – Robert A Hisrich & Michael P Peters. 4th ed. McGraw Hill Education, 1997.

4. Practice of Entrepreneurship – G.G. Meredith, Robert E Nelson & Philip A Neck. ILO, Geneva, 1982.

5. Women Entrepreneurship – Developing New Entrepreneurs - V.C. Patel. Entrepreneurship Development Institute of India, Ahmedabad, 1987.

PHARMACEUTICAL FORMULATION DEVELOPMENT (MIP 204T)

Unit 1: Preformulation studies: Molecular optimization of APIs (drug substances), crystal morphology and variations, powder flow, structure modification, drug-excipient compatibility studies, methods of determination. 12 Hours

Unit 2: Formulation additives: Study of different formulation additives, factors influencing their incorporation, role of formulation development and processing, new developments in excipient science. Design of experiments – factorial design for product and process development. 12 Hours

Unit 3: Solubility: Importance, experimental determination, phase-solubility analysis, pH-solubility profile, solubility techniques to improve solubility and utilization of analytical methods – cosolvency, salt formation, complexation, solid dispersion, micellar solubilization and hydrotrophy. 12 Hours

Unit 4: Dissolution: Theories, mechanisms of dissolution, in-vitro dissolution testing models – sink and non-sink. Factors influencing dissolution and intrinsic dissolution studies. Dissolution test apparatus – designs, dissolution testing for conventional and controlled release products. Data handling and correction factor. Biorelevant media, in vitro and in vivo correlations, levels of correlations. 12 Hours

Unit 5: Product stability: Degradation kinetics, mechanisms, stability testing of drugs and pharmaceuticals, factors influencing-media effects and pH effects, accelerated stability studies, interpretation of kinetic data (API & tablets). Solid state stability and shelf life assignment. Stability protocols, reports and ICH guidelines. 12 Hours

REFERENCES

1. The Theory & Practice of Industrial Pharmacy, 3rd ed. Leon Lachman, Herbert A Lieberman & Joseph L Karig. Varghese Publishing House, Bombay.

2. Martin's Physical Pharmacy and Pharmaceutical Sciences - Patrick J Sinko. 6th ed. BI Publications Pvt. Ltd.

3. Pharmaceutical Dosage Forms: Tablets - Herbert A Lieberman & Leon Lachman. Volume 1 - 3. Marcel Dekker, Inc.

4. Pharmaceutical Preformulation: The Physicochemical Properties of Drug Substances - Ellis Horwood Ltd., England, 1998.

5. Techniques of Solubilization of Drugs – S.H. Yalkowsky. Vol - 12. Marcel Dekker Inc., New York, 1981.

6. Pharmaceutical Dissolution Testing – J. Dressman & J. Kramer. Saurah Printers Pvt. Ltd., New Delhi, 2005.

7. Drug Stability Principles and Practices – J.T. Carstensen & C.T. Rhodes. CBS Publishers, New Delhi, 2005.

8. Stability of Drugs and Dosage Forms – S. Yoshioka & V.J. Stella. Springer (India) Pvt. Ltd., New Delhi, 2006.

9. Modern Pharmaceutics - Gilbert S. Banker, Christopher T Rhodes. 4th ed.

10. Stability Testing of Drug Products - W. Grimm.

11. International Stability Testing – D.J. Mazzo. Eastern Press Pvt. Ltd., Bangalore,

12. Indian Pharmacopoeia-2018. Controller of Publication. Delhi.

13. British Pharmacopoeia. British Pharmacopoeia Commission Office, London, 2017.

14. United States Pharmacopoeia. United States Pharmacopoeial Convention, Inc, USA, 2019.

17. Encyclopedia of Pharmaceutical Technology – James Swarbrick. Vol 1-3.

18. Pharmaceutical Preformulation: The Physicochemical Properties of Drug Substances -J. I. Wells. Ellis Horwood Ltd. England, 1988.

INDUSTRIAL PHARMACY PRACTICAL - III (MIP 205P)

1. Improvement of dissolution characteristics of slightly soluble drug by Solid dispersion technique

2. Comparison of dissolution of two different marketed products /brands

3. Protein binding studies of a highly protein bound drug & poorly protein bound drug

4. Bioavailability studies of paracetamol (Animal)

5. Pharmacokinetic and IVIVC data analysis by WinNolin® software

6. In vitro cell studies for permeability and metabolism

7. Formulation and evaluation of tablets

8. Formulation and evaluation of capsules

9. Formulation and evaluation of injections

10. Formulation and evaluation of emulsion

11. Formulation and evaluation of suspension

12. Formulation and evaluation of enteric coating tablets
13. Preparation and evaluation of a freeze dried formulation
14. Preparation and evaluation of a spray formulation

PHARMACY PRACTICE (MPP)

First Semester

CLINICAL PHARMACY PRACTICE (MPP 101T)

Unit 1: Introduction to clinical pharmacy: Definition, evolution and scope of clinical pharmacy. International and national scenario of clinical pharmacy practice, pharmaceutical care.

Clinical pharmacy services: Ward round participation, Drug therapy review - drug therapy monitoring including medication order review, chart endorsement, clinical review and pharmacist interventions. 12 Hours

Unit 2: Clinical pharmacy services: Patient medication history interview, basic concept of medicine and poison information services. Basic concept of pharmacovigilance, hemovigilance, materiovigilance and active surveillance of adverse events following immunization (AEFI). Patient medication counselling, drug utilization evaluation. Documentation of clinical pharmacy services, quality assurance of clinical pharmacy services. 12 Hours

Unit 3: Patient data analysis & practice skills: Patient's case history – its structure and significances in drug therapy management. Common medical abbreviations and terminologies used in clinical practice. Communication skills - verbal and non-verbal communications, their applications in patient care services. 12 Hours

Unit 4: Lab data interpretation: Hematological tests, renal function tests, liver function tests. Tests associated with cardiac disorders, pulmonary function tests, thyroid function tests. Fluid and electrolyte balance, microbiological culture sensitivity tests. 12 Hours

Unit 5: Medicines information services: Definition and need for medicine information service, medicine information resources. Systematic approach in answering medicine information queries. Preparation of verbal and written response. Establishing a drug information centre.

Poison information service: Definition, need, organization and functions of poison information centre. 12 Hours

REFERENCES

1. A Textbook of Clinical Pharmacy Practice – Essential Concepts and Skills – G. Parthasarathi, Karin Nyfort-Hansen & Milap Nahata.
2. Practice Standards and Definitions - The Society of Hospital Pharmacists of Australia
3. Basic Skills in Interpreting Laboratory Data – L.T. Scott. American Society of Health System Pharmacists Inc.

4. Relevant review articles from recent medical and pharmaceutical literature.

PHARMACOTHERAPEUTICS-I (MPP 102T)

Etiopathogenesis and pharmacotherapy of diseases associated with following systems:

Unit 1: Cardiovascular system: Hypertension, congestive cardiac failure, acute coronary syndrome, arrhythmias, hyperlipidemias. 12 Hours

Unit 2: Respiratory system: Asthma, chronic obstructive airways disease, drug induced pulmonary diseases

Endocrine system: Diabetes, thyroid diseases 12 Hours Unit 3:

Gastrointestinal system: Peptic ulcer diseases, reflux esophagitis, inflammatory bowel diseases, jaundice & hepatitis. 12 Hours

Unit 4: Gastrointestinal system: Cirrhosis, diarrhea and constipation, drug-induced liver disease.

Hematological diseases: Anemia, deep vein thrombosis, drug induced hematological disorders. 12 Hours

Unit 5: Bone and joint disorders: Rheumatoid arthritis, Osteoarthritis, Gout, Osteoporosis

Dermatological Diseases: Psoriasis, eczema and scabies, impetigo, drug induced skin disorders

Ophthalmology: Conjunctivitis, glaucoma 12 Hours

REFERENCES

1. Clinical Pharmacy and Therapeutics - Roger & Walker. Churchill Livingstone Publication
2. Pharmacotherapy: A Pathophysiologic Approach - Joseph T DiPiro et al. Appleton & Lange.
3. Robbins and Cotran Pathologic Basis of Disease – Kumar, Abbas & Fausto. 8th ed. Elsevier Publications.
4. Clinical Pharmacy and Therapeutics - Eric T Herfindal. Williams and Wilkins Publications.
5. Koda-Kimble & Young's Applied Therapeutics: The clinical Use of Drugs - K.A. Brian et al. Lippincott Williams and Wilkins.
6. Pharmacotherapy Principles and Practice – M.A. Chisholm-Burns, T.L. Schwinghammer
B.G. Wells, P.M. Malone, J.M. Kolesar & Joseph P Dipiro. McGraw Hill Publications.
7. Essentials of Pathophysiology: Concepts of Altered Health States - Carol Mattson Porth. Lippincott Williams and Wilkins

8. Harrison's. Principles of Internal Medicine - McGraw Hill Publication.

9. Relevant review articles from recent medical and pharmaceutical literature

HOSPITAL & COMMUNITY PHARMACY (MPP 103T)

Unit 1: Hospital pharmacy: Definition, classification, organizational structure. Relationship of hospital pharmacy department with other departments. Legal requirements, work load statistics, Infrastructural requirements. Hospital pharmacy budget and hospital pharmacy management.

Hospital drug policy: Pharmacy & Therapeutics Committee, Infection Control Committee, Research & Ethics Committee, Management of medicines as per NABH. 12 Hours

Unit 2: Hospital formulary guidelines and its development. Developing therapeutic guidelines. Drug procurement process, and methods of inventory control. Methods of drug distribution, intravenous admixtures, hospital waste management. 12 Hours

Unit 3: Education and training: Training of technical staff, training and continuing education for pharmacists, pharmacy students, medical staff and students, nursing staff and students, formal and informal meetings and lectures, drug and therapeutics newsletter.

Community pharmacy practice: Definition, roles & responsibilities of community pharmacists, and their relationship with other health care providers.

Community pharmacy management: Legal requirements to start community pharmacy, site selection, layout and design, drug display, super drug store model, accounts and audits. Good dispensing practices, different software and databases used in community pharmacies. Entrepreneurship in community pharmacy. 12 Hours

Unit 4: Prescription: Legal requirements & interpretation, prescription related problems responding to symptoms of minor ailments: Head ache, pyrexia, menstrual pains, food and drug allergy.

OTC medication: Rational use of over the counter medications. Medication counseling and use of patient information leaflets.

Medication adherence: Definition, factors influencing adherence behavior, strategies to improve medication adherence. Patient referrals to the doctors. ADR monitoring in community pharmacies. 12 Hours

Unit 5: Health promotion: Definition and health promotion activities, family planning, health screening services, first aid, prevention of communicable and non-communicable diseases, smoking cessation, child & mother care.

National Health Programs: Role of community pharmacist in malaria and TB control programs

Home medicines review program: Definition, objectives, guidelines, method and outcomes Research in community pharmacy practice. 12 Hours

REFERENCES

1. Hospital Pharmacy – W.E. Hassan. Lea and Febiger Publications.
2. Textbook of Hospital Pharmacy – M.C. Allwood & Blackwell.
3. Avery's Drug Treatment. Adis International Limited.
4. Community Pharmacy Practice – Ramesh Adepu. BSP Publishers, Hyderabad
5. Remington – The Science and Practice of Pharmacy – Loyd V Allen. 22nd ed.
6. Relevant review articles from recent medical and pharmaceutical literature

CLINICAL RESEARCH (MPP 104T)

Unit 1: Drug development process: Introduction, various approaches to drug discovery, investigational new drug application submission.

Ethics in biomedical research: Ethical issues in biomedical research, principles of ethics in biomedical research. Ethical committee [institutional review board] - its constitution and functions. Challenges in implementation of ethical guidelines, ICH GCP guidelines and ICMR guidelines in conduct of clinical trials, drug safety reporting. 12 Hours

Unit 2: Types and designs used in clinical research: Planning and execution of clinical trials, Various phases of clinical trials. Bioavailability and bioequivalence studies. Randomization techniques (simple randomization, restricted randomization, blocking method and stratification). Types of research designs based on controlling method (experimental, quasi experimental, and observational methods) time sequences (prospective and retrospective). Sampling methods (cohort study, case control study and cross sectional study). Health outcome measures (clinical & physiological, humanistic and economic)

Clinical trial study team: Roles and responsibilities of Investigator, Study Coordinator, Sponsor, Monitor, Contract Research Organization. 12 Hours

Unit 3: Clinical trial documents: Guidelines to the preparation of following documents: Protocols, investigator's brochure, informed consent form, case report forms, contracts and agreements, dairy cards.

Clinical trial start up activities: Site feasibility studies, site/investigator selection, pre- study visit, investigator meeting, clinical trial agreement

execution, ethics committee document preparation and submission. 12 Hours

Unit 4: Investigational product: Procurement and storage of investigation product

Filing procedures: Essential documents for clinical trial, trial master file preparation and maintenance, investigator site file, pharmacy file, site initiation visit, conduct, report and follow up

Preparation and conduct of monitoring visit: Review of source documents, CRF, ICF, IP storage, accountability and reconciliation, study procedure, ec communications, safety reporting, monitoring visit reporting and follow-up

Close-out visit: Study related documents collection, archival requirement, investigational product reconciliation and destruction, close-out visit report. 12 Hours

Unit 5: Quality assurance and quality control in clinical trials: Types of audits, audit criteria, audit process, responsibilities of stakeholders in audit process, audit follow-up and documentation, audit resolution and preparing for FDA inspections, fraud and misconduct management

Infrastructure and system requirement for data management: Electronic data capture systems, selection and implementation of new systems, system validation and test procedures, coding dictionaries, data migration and archival. Clinical trial data management: Standard operating procedures, data management plan, CRF & data base design considerations, study set-up, data entry, CRF tracking and corrections, data cleaning, managing laboratory and ADR data, data transfer and database lock, quality control and quality assurance in CDM, data mining and warehousing. 12 Hours

REFERENCES

1. Principles and Practice of Pharmaceutical Medicine - Lionel D Edward, Andrew J Flether, Anthony W Fos & Peter D Sloaier. 2nd ed. Wiley Publications.
2. Handbook of Clinical Research - Julia Lloyd & Ann Raven. Churchill Livingstone.
3. Principles of Clinical Research - Giovanna di Ignazio, Di Giovanna & Haynes.
4. Textbook of Clinical Trials - David Machin, Simon Day & Sylvan Green. John Wiley & Sons.
5. Clinical Data Management – R.K. Rondels, S.A. Varley & C.F. Webbs. 2nd ed. Wiley Publications, 2000.
6. Goodman and Gillman's: The Pharmacological Basis of Therapeutics - Laurence L Brunton, Randa Hilal-Dandan, Björn C Knollmann, 13th ed. Mc Graw Hill Education.

7. Central Drugs Standard Control Organization. Good Clinical Practices - Guidelines for Clinical Trials on Pharmaceutical Products in India. New Delhi: Ministry of Health & Family Welfare.

8. International Council for Harmonization of Technical requirements for Pharmaceuticals

for human use - ICH Harmonized Tripartite Guideline - Guideline for Good Clinical Practice. E6; May 1996.

9. Ethical Guidelines for Biomedical Research on Human Subjects. Indian Council of Medical Research, New Delhi.

10. Relevant review articles from recent medical and pharmaceutical literature.

PHARMACY PRACTICE PRACTICAL – I (MPP 105P)

1. Treatment Chart Review (one)
2. Medication History Interview (one)
3. Patient Medication Counseling (two)
4. Drug Information Query (two)
5. Poison Information Query (one)
6. Lab Data Interpretation (two)
7. ABC Analysis of a given list of medications (one)

PHARMACY PRACTICE PRACTICAL – II (MPP 106P)

1. Presentation of clinical cases of various disease conditions adopting pharmaceutical Care Plan Model (eight)
2. Preparation of content of a medicine, with proper justification, for the inclusion in the hospital formulary (one)
3. Formulation and dispensing of a given IV admixtures (one)
4. Preparation of a patient information leaflet (two)
5. Preparation of study protocol(one)
6. Preparation of informed consent form(one)

Second Semester

PRINCIPLES OF QUALITY USE OF MEDICINES (MPP 201T)

Unit 1: Introduction to Quality Use of Medicines (QUM): Definition and principles of QUM, key partners and responsibilities of the partners, building blocks in QMC, evaluation process in QUM, communication in QUM, cost effective prescribing. 12 Hours

Unit 2: Evidence based medicine: Definition, concept of evidence based medicine, approach and practice of evidence based medicine in clinical settings.

Essential drugs: Definition, need, concept of essential drug. National essential drug policy and list.

Rational drug use: Definition, concept and need for rational drug use, rational drug prescribing, role of pharmacist in rational drug use. 12 Hours

Unit 3: QUM in various settings: Hospital settings, ambulatory care/residential care, role of health care professionals in promoting the QUM, strategies to promote the QUM, impact of QUM on E-health, integrative medicine and multidisciplinary care. QUM in special population: Pediatric prescribing, geriatric prescribing, prescribing in pregnancy and lactation, prescribing in immune compromised and organ failure patients. 12 Hours

Unit 4: Regulatory aspects of QUM in India: Regulation including scheduling, regulation of complementary medicines, regulation of OTC medicines, professional responsibility of pharmacist, role of industry in QUM in medicine development. 12 Hours

Unit 5: Medication errors: Definition, categorization and causes of medication errors. Detection and prevention of medication errors. Role of pharmacist in monitoring and management of medication errors.

Pharmacovigilance: Definition, aims and need for pharmacovigilance. Types, predisposing factors and mechanism of adverse drug reactions (ADRs), detection, reporting and monitoring of ADRs, causality assessment of ADRs, management of ADRs, role of pharmacist in pharmacovigilance. 12 Hours

REFERENCES

1. A Textbook of Clinical Pharmacy Practice – Essential Concepts and Skills – G. Parthasarathi, Karin Nyfort-Hansen & Milap Nahata.
2. Mann's Pharmacovigilance – E.B. Andrews & N. Moore.
3. Pharmacotherapy: A Pathophysiologic Approach – J.T. Dipiro, R.L. Talbert & G.C. Yee.
4. Evidence-Based Medicine: How to Practice and Teach It – S.E. Straus, W.S. Richardson, P. Glasziou & R.B. Haynes.
5. Medication Errors – M.R. Cohen.
6. Online:
 - http://medicinesaustralia.com.au/files/2012/05/MA_QUM_External_Reduced.pdf
 - <http://curriculum.racgp.org.au/statements/quality-use-of-medicines/>
 - http://www.rug.nl/research/portal/files/14051541/Chapter_2.pdf
7. Relevant review articles from recent medical and pharmaceutical literature.

PHARMACOTHERAPEUTICS - II (MPP 202T)

Unit 1: Nervous system: Epilepsy, Parkinson's disease, stroke, headache, Alzheimer's disease, neuralgias and pain pathways and pain management. 12 Hours

Unit 2: Psychiatric disorders: Schizophrenia, depression, anxiety disorders, sleep disorders, drug induced psychiatric disorders renal system: acute renal failure, chronic renal failure, renal dialysis, drug induced renal disease. 12 Hours

Unit 3: Infectious diseases: General guidelines for the rational use of antibiotics and surgical prophylaxis, urinary tract infections, respiratory tract infections, gastroenteritis, tuberculosis, malaria, bacterial endocarditis, septicemia. 12 Hours

Unit 4: Infectious diseases: meningitis, HIV and opportunistic infections, rheumatic fever, dengue fever, H1N1, helmentiasis, fungal infections, gynecological disorders, dysmenorrhea, hormone replacement therapy. 12 Hours

Unit 5: Oncology: General principles of cancer chemotherapy, pharmacotherapy of breast cancer, lung cancer, head & neck cancer, hematological malignancies, management of nausea and vomiting, palliative care. 12 Hours

REFERENCES

1. Clinical Pharmacy and Therapeutics - Roger & Walker. Churchill Livingstone Publication
2. Pharmacotherapy: A Pathophysiologic Approach - Joseph T. DiPiro et al. Appleton & Lange.
3. Pathologic basis of disease – S.L. Robins. W.B. Saunders Publication.
4. Clinical Pharmacy and Therapeutics - Eric T. Herfindal. Williams and Wilkins Publication.
5. Koda-Kimble & Young's Applied Therapeutics: The clinical Use of Drugs - K.A. Brian et al. Lippincott Williams and Wilkins.
6. Pharmacotherapy Principles and Practice – M.A. Chisholm-Burns, T.L. Schwinghammer B.G. Wells, P.M. Malone, J.M. Kolesar & Joseph P Dipiro. McGraw Hill Publications.
7. Essentials of Pathophysiology: Concepts of Altered Health States - Carol Mattson Porth. Lippincott Williams and Wilkins
8. Harrison's. Principles of Internal Medicine - McGraw Hill Publication.
9. Relevant review articles from recent medical and pharmaceutical literature

CLINICAL PHARMACOKINETICS AND THERAPEUTIC DRUG MONITORING (MPP 203T)

Unit 1: Introduction to clinical pharmacokinetics: Compartmental and non-compartmental models, renal and non-renal clearance, organ extraction and models of hepatic clearance, estimation and determinants of bioavailability, multiple dosing, calculation of loading and maintenance doses.

Designing of dosage regimens: Determination of dose and dosing intervals, conversion from intravenous to oral dosing, nomograms and tabulations in designing dosage regimen. 12 Hours

Unit 2: Pharmacokinetics of drug interaction: Pharmacokinetic drug interactions, inhibition and induction of drug metabolism, inhibition of biliary excretion

Pharmacogenetics: Genetic polymorphism in drug metabolism, Cytochrome P-450 isoenzymes, genetic polymorphism in drug transport and drug targets, pharmacogenetics and pharmacokinetic/pharmacodynamic considerations

Introduction to pharmacometrics: Introduction to Bayesian Theory, adaptive method or dosing with feedback, analysis of population pharmacokinetic data. 12 Hours

Unit 3: Non linear mixed effects modeling: The structural or base model, modeling random effects, modeling covariate relationships, mixture model, estimation methods, model building techniques, covariate screening methods. Testing the model assumptions, precision of the parameter estimates and confidence intervals, model misspecification and violation of the model assumptions. Model validation, simulation of dosing regimens and dosing recommendations, Pharmacometrics software. 12 Hours

Unit 4: Altered pharmacokinetics: Drug dosing in the elderly, drug dosing in the paediatrics, drug dosing in the obese patients, drug dosing in the pregnancy and lactation, drug dosing in the renal failure and extracorporeal removal of drugs, drug dosing in the in hepatic failure. 12 Hours

Unit 5: Therapeutic Drug Monitoring (TDM): Introduction, individualization of drug dosage regimen (variability – genetic, age, weight, disease and interacting drugs), indications for TDM. Protocol for TDM, pharmacokinetic/pharmacodynamic correlation in drug therapy. TDM of drugs used in the following conditions:

Cardiovascular disease: Digoxin, lidocaine, amiodarone; Seizure disorders: Phenytoin, carbamazepine, sodium valproate; Psychiatric conditions: Lithium, fluoxetine, amitriptyline; Organ transplantations: Cyclosporine; Cytotoxic agents: Methotrexate, 5-fluoro uracil, cisplatin; Antibiotics: Vancomycin, gentamicin, meropenem. 12 Hours

REFERENCES

1. Applied Biopharmaceutics and Pharmacokinetics - Leon Shargel & Andrew B C Yu.
2. Pharmacokinetic - Pharmacodynamic Modeling and Simulation - Peter L Bonate. Springer Publications.
3. Applied Pharmacokinetics & Pharmacodynamics: Principles of Therapeutic Drug Monitoring - Michael E Burton, Leslie M Shaw, Jerome J Schentag & William E Evans. Lippincott Williams & Wilkins.
4. Handbook of Analytical Therapeutic Drug Monitoring and Toxicology - Steven How-Yan Wong & Irving Sunshine. CRC Press.
5. Clinical Pharmacokinetics - Soraya Dhillon & Andrzej Kostrzewski. 1st ed. Pharmaceutical Press, London.
6. Concepts in Clinical Pharmacokinetics - Joseph T Dipiro, William J Spruill, William E Wade, Robert A Blouin & Jane M Pruemer. American Society of Health-System Pharmacists, USA.
7. Clinical Pharmacokinetics & Pharmacodynamics - Malcolm Rowland & Tozer. 4th ed. Lippincott Publications.
8. Applied Pharmacokinetics & Pharmacodynamics: Principle of Therapeutic Drug Monitoring – M.E. Burton, L.M. Shaw, J.J. Schentag & W.E. Evans. American Society of Health System Pharmacists, USA.
9. Basic Clinical Pharmacokinetics - Michael E. Winter. Lippincott Williams & Wilkins, USA.
10. Biopharmaceutics and Clinical Pharmacokinetics - Milo Gibaldi. 3rd ed. Pharma Book Syndicate.
11. Clinical Pharmacokinetics - Dhillon and Kostrzewski. Pharmaceutical Press, London.
12. Clinical Pharmacokinetics - John E Murphy. 5th ed. American Society of Health System Pharmacists, USA.
13. Relevant review articles from recent medical and pharmaceutical literature

PHARMACOEPIDEMOLOGY & PHARMACOECONOMICS (MPP 204T)

Unit 1: Introduction to pharmacoepidemiology: Definition, scope, need, aims & applications; Outcome measures, drug use measures, monetary units, number of prescriptions, units of drug dispensed, defined daily doses, prescribed daily doses, diagnosis and therapy surveys, prevalence, incidence rate, monetary units, number of prescriptions, unit of drugs dispensed, defined daily doses and prescribed daily doses, medications adherence measurements. Concept of risk: Measurement of risk, attributable risk and relative risk, time - risk relationship and Odds' ratio. 12 Hours

Unit 2: Pharmacoepidemiological methods: Qualitative models: Drug utilization review;

Quantitative models: Case reports, case series, cross sectional studies, cohort and case control studies, calculation of Odds' ratio, meta analysis models, drug effects study in populations: spontaneous reporting, prescription event monitoring, post marketing surveillance, record linkage systems, applications of pharmacoepidemiology. 12 Hours

Unit 3: Introduction to pharmacoeconomics: Definition, history of pharmacoeconomics, need of pharmacoeconomic studies in Indian healthcare system. Cost categorization and resources for cost estimation: Direct costs. indirect costs. intangible costs.

Outcomes and measurements of pharmacoeconomics: Types of outcomes, clinical outcome, economic outcomes, humanistic outcomes; quality adjusted life years, disability adjusted life years incremental cost effective ratio, average cost effective ratio. person time, willingness to pay, time trade off and discounting. 12 Hours

Unit 4: Pharmacoeconomic evaluations: Definition, steps involved, applications, advantages and disadvantages of the following pharmacoeconomic models: Cost Minimization Analysis (CMA), Cost Benefit Analysis (CBA), Cost Effective Analysis (CEA), Cost Utility Analysis (CUA), Cost of Illness (COI), Cost Consequences Analysis (COA). 12 Hours

Unit 5: Definition, steps involved, applications, advantages and disadvantages of the following: Health related quality of life (HRQOL): Definition, need for measurement of HRQOL, common HRQOL measures. Definition, steps involved, applications of the following:

Decision analysis and decision tree, sensitivity analysis, Markov modeling, software used in pharmacoeconomic analysis, applications of pharmacoeconomics. 12 Hours

REFERENCES

1. Essentials of Pharmacoeconomics – K.L. Rascati. Woulters Kluwer Lippincott Williams & Wilkins, Philadelphia.
2. Health economics: Fundamentals and Flow of Funds - Thomas E Getzen. John Wiley & Sons, USA.
3. Decision Modelling for Health Economic Evaluation - Andrew Briggs, Karl Claxton & Mark Sculpher. Oxford University Press, London.
4. Methods for the Economic Evaluation of Health Care Programmes - Michael Drummond, Mark Sculpher, George Torrence, Bernie O'Brien & Greg Stoddart. Oxford University Press, London.
5. Understanding Health Outcomes and Pharmacoeconomics - George E Mackinnon III.
6. Pharmacoeconomics and outcomes: Applications for patient care – D.W. Grauer & Thomas S Jane. American College of Clinical Pharmacy.

7. Pharmacoeconomics – Tom Walley, Allan Haycox & Angela Boland. Elsevier Publications.

8. Pharmacoeconomics – E. Nowakowska. University of Medical Sciences, Poznan.

9. Relevant review articles from recent medical and pharmaceutical literature

PHARMACY PRACTICE PRACTICAL - III (MPP 205P)

1. Causality assessment of adverse drug reactions (three)
2. Detection and management of medication errors (three)
3. Rational use of medicines in special population (three)
4. Presentation of clinical cases of various disease conditions adopting pharmaceutical care plan model (eight)
5. Calculation of bioavailability and bioequivalence from the given data (two)
6. Interpretation of therapeutic drug monitoring reports of a given patient (three)
7. Calculation of various pharmacoeconomic outcome analysis for the given data (two)

Third Semester

RESEARCH METHODOLOGY & BIOSTATISTICS (MRM 301T)

(Note: Common Paper for all specializations)

Unit 1: General research methodology: Research, objective, requirements, practical difficulties, review of literature, study design, types of studies, strategies to eliminate errors/bias, controls, randomization, crossover design, placebo, blinding techniques. 12 Hours

Unit 2: Biostatistics: Definition, application, sample size, importance of sample size, factors influencing sample size, dropouts, statistical tests of significance, type of significance tests, parametric tests (students "t" test, ANOVA, Correlation coefficient, regression), non- parametric tests (Wilcoxon rank tests, analysis of variance, correlation, Chi-square test), null hypothesis, P values, degree of freedom, interpretation of P values. **12 Hours**

Unit 3: Medical Research: History, values in medical ethics, autonomy, beneficence, non- maleficence, double effect, conflicts between autonomy and beneficence/non-maleficence, euthanasia, informed consent, confidentiality, criticisms of orthodox medical ethics, importance of communication, control resolution, guidelines, ethics committees, cultural concerns, truth telling, online business practices, conflicts of interest, referral, vendor relationships, treatment of family members, sexual relationships, fatality. **12 Hours**

Unit 4: CPCSEA guidelines for laboratory animal facility: Goals, veterinary care, quarantine, surveillance, diagnosis, treatment and control of disease, personal hygiene, location of animal facilities to laboratories, anesthesia, euthanasia, physical facilities, environment, animal husbandry, record keeping, SOPs, personnel and training, transport of lab animals. **12 Hours**

Unit 5: Declaration of Helsinki: History, introduction, basic principles for all medical research, and additional principles for medical research combined with medical care. **12 Hours**

REFERENCES

1. Pharmaceutical Statistics: Practical and Clinical Applications - Stanford Bolton & Charles Bon. 5th ed. CRC Press.
2. Biostatistics: A Foundation for Analysis in the Health Sciences - Wayne W Daniel. 10th ed. John Wiley & Sons.
3. Introduction to Research in the Health Sciences - Stephen Polgar & Shane Thomas. 7th ed. Elsevier.
4. www.cpcsea.nic.in
5. www.wma.net