MARINE ENGINEERING

SCHEME AND SYLLABI : (with effect from 2022-23)B.Tech & B.Tech. + M.Tech

I Year - I Semester

Course Code	Category	Course Title	Hours per week L	T	Internal Marks	External Marks	Total Marks	Credits
NM1101	BS	Mathematics – I	4	0	30	70	100	3
NM 1102	BS	Physics	4	0	30	70	100	3
NM 1103	ES	Engineering Graphics	2	3	30	70	100	3
NM 1104	ES	Basic Ship Theory	4	0	30	70	100	3
NM 1105	ES	Introduction to Naval Architecture	4	0	30	70	100	3
NM 1106	ES	Workshop	0	3	50	50	100	1.5
NM 1107	BS	Physics Lab	0	3	50	50	100	1.5
NM 1108	ES	Ship Welding Lab	0	3	50	50	100	1.5
		Total Credits						19.5

B.Tech I Year - II Semester

NM1201	BS	Mathematics – II	4	0	30	70	100	3
NM1202	BS	Green Chemistry	4	0	30	70	100	3
NM1203	HSS	English	4	0	30	70	100	3
NM1204	ES	Computer programming and Numerical Methods	4	0	30	70	100	3
NM1205	ES	Industry 4.0	4	0	30	70	100	3
NM1206	HSS	English Language Lab	0	3	50	50	100	1.5
NM1207	BS	Green Chemistry Lab	0	3	50	50	100	1.5
NM1208	ES	Computer programming and Numerical Methods Lab	0	3	50	50	100	1.5
		Total Credits						19.5

B. Tech (Naval Architecture and Marine Engineering)

B. Tech - II Year- I Semester

NM 2101	BS	Python Programming	4	0	30	70	100	3
NM 2102	PC	Engineering Mechanics – I (Statics)	4	0	30	70	100	3
NM 2103	PC	Mechanics of Materials - I	4	0	30	70	100	3
NM 2104	PC	Basic Thermodynamics	4	0	30	70	100	3
NM 2105	HSS	Managerial Economics	4	0	30	70	100	3
NM 2106	PC	Computer Aided Ship Design Lab	0	3	50	50	100	1.5
NM 2107	PC	Mechanics of Materials Lab	0	3	50	50	100	1.5
NM 2108	PC	Ship Drawing - I	0	3	50	50	100	1.5
NM 2109	SC	Python Lab	1	2	50	50	100	2
NM 2110	MC	Professional Ethics & Universal Human Values	0	0	0	100	100	0
NM 2111	MC	NSS/NCC	0	2	-	-	-	0
		Total Credits						21.5

B. Tech -II Year- II Semester

NM 2201	ES	Electrical Technology	4	0	30	70	100	3
NM 2202	BS/PC	Eng. Mechanics – II (Dynamics)	4	0	30	70	100	3
NM 2203	PC	Mechanics of Materials - II	4	0	30	70	100	3
NM 2204	PC	Engineering Thermodynamics	4	0	30	70	100	3
NM 2205	PC	Material Science	4	0	30	70	100	3
NM 2206	PC	Electrical Tech Lab	0	3	50	50	100	1.5
NM 2207	PC	Auto CAD Lab	0	3	50	50	100	1.5
NM 2208	SC	Intellectual Property Rights	1	2	50	50	100	2
NM 2209	MC	Environmental Science	0	0	0	100	100	0
		Total Credits						20

Internship I

NM 1101 - MATHEMATICS - I

Periods/week :4 Sessional. : 30 Exam: 70 Credits: 3

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.

SYLLABUS

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. Higher Engineering Mathematics by Dr. M.K.Venkataraman.

NM 1102- PHYSICS

Periods/week :4 Sessional. : 30 Exam: 70 Credits: 3

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:

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.

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 – Coher-

ence - 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

Periods/week :5 Sessional. : 30 Exam: 70 Credits: 3

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 Mc-Graw Hill

NM 1104 Basic Ship Theory

Periods/week : 4 Sessional. : 30 Exam: 70 Credits: 3

SYLLABUS

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, flood able length curves.

Launching: Launching arrangement, end launching, side launching, launching calculations, docking and grounding.

Text Book:

Introduction to Basic Ship Theory- Butterworth Heinemann Publications

NM 1105 INTRODUCTION TO NAVAL ARCHITECTURE

Periods/week :4 Sessional. : 30 Exam: 70 Credits: 3

SYLLABUS

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.

Text Book:

Introduction to Naval Architecture by Eric Tupper- Butterworth Heinemann Publications

NM 1106- WORKSHOP

Lab Periods/week : 3 Sessional. : 50 Exam: 50 Credits: 1.5

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

* 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:

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.

NM 1107-PHYSICS LAB

Lab Periods/week : 3 Sessional. : 50 Exam: 50 Credits: 1.5

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 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.

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.

B.Tech I Year - II Semester

NM 1201- MATHEMATICS-II

Periods/week :4 Sessional. : 30 Exam: 70 Credits: 3

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.

SYLLABUS

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.

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.

NM 1202 – Green Chemistry

Periods/week :4 Sessional. : 30 Exam: 70 Credits: 3

Course Objectives

* To know the sources of water, impurities and treatment methods of water.

* To know the types of batteries, their uses and batteries for Electrical Vehicles.

* To know about fuel cells, its working, different types and their applications.

* To know about the corrosion, types and methods to reduce corrosion.

* To identify the goals of Green Chemistry and application of Green Chemistry.

Course Outcomes

The student is able

* To know the Treatment methods of water and different water softening methods.

* To understand the construction of different types of batteries.

* To understand different types of Fuel Cells.

* To differentiate the types of corrosion and its eradication.

* To understand the concept of Green Chemistry and its importance.

SYLLABUS

Water Technology : 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.

Batteries : Primary batteries: The chemistry - Types: Zinc-carbon (Leclanche type), zinc alkaline (Duracell), zinc/air batteries; Lithium primary cells – liquid cathode, solid cathode and lithium-ferrous sulphide cells. Secondary batteries: Lead acid and VRLA (valve regulated (sealed) lead acid), nickel-cadmium, nickel-zinc, nickel-metal hydride batteries, lithium ion batteries, ultrathin lithium polymer cells. Advanced Batteries for electric vehicles, requirements of the battery – sodium-beta and redox batteries.

Fuel Cells : Fuel Cells: Description, working principle, anodic, cathodic and cell reactions, fabrication of electrodes and other components, applications, advantages, disadvantages and environmental aspects of the following types of fuel cells: Proton Exchange Membrane Fuel Cells, alkaline fuel cells, phosphoric acid, solid oxide, molten carbonate, direct methanol fuel cells-Membranes and Fuels

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.

Green Chemistry and Technology : Introduction and significance of green chemistry, Goals of green chemistry, 12 principles of green chemistry, toxicity of chemicals, material safety data sheet (MSDS), concept of zero pollution technologies, atom economy, functional toxicity vs non-functional toxicity, functional group approaches to green chemistry, Elimination of toxic functional group, optimization of frameworks for the design of greener synthetic pathways, Applications of green chemistry - Green solvents, green fuels and propellants, biocatalysis.

Text Book

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.

3. Hand Book of Green Chemistry and Technology; by James Clarke and Duncan Macquarrie; Blakwell Publishing

NM 1203 – ENGLISH

Periods/week :4 Sessional. : 30 Exam: 70 Credits: 3

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: Principals 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

Text Book:

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 Heasly. 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-Computer programming and Numerical Methods

Periods/week :4 Sessional. : 30 Exam: 70 Credits: 3

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 pointes, 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 Industry 4.0

SYLLABUS

Unit-1: Introduction to Industry 4.0 : Introduction, Idea of Industry 4.0, Various Industrial Revolutions, Origin concept of Industry 4.0,Industry 4.0 Production system, How is India preparing for Industry 4.0, Comparison of Industry 4.0 Factory and Today's Factory.

Unit - 2: Trends in Industry 4.0 : Introduction, Main Concepts and Components of Industry 4.0, State of Art Technologies, Proposed Framework for Industry 4.0, Trends of Industrial Big Data and Smart Business Transformation.

Unit - 3: Roadmap for Industry 4.0 : Introduction, Proposed Framework for Technology Roadmap: Strategy Phase, Development Phase, Smart Manufacturing, Types of Smart Devices, Smart Logistics, Smart Cities, Predictive Analytics.

Unit - 4: Advances in the Era of Industry 4.0 : Introduction, Recent Technological Components of Robots- Advanced Sensor Technologies, Internet of Things, Industrial Robotic Applications- Manufacturing, Maintenance and Assembly, loT- Industrial loT.

Unit - 5: The Role of Industry 4.0 and Future Aspects : Introduction, Challenges & Future of Works and Skills for Workers in the Industry 4.0 Era, Strategies for competing in an Industry 4.0 world.

(MATERIAL IS READILY AVAILABLE ON INTERNET)

NM 1206- ENGLISH LANGUAGE LAB

Lab Periods/week : 3 Sessional. : 50 Exam: 50 Credits: 1.5

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.

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.

NM 1207- GREEN CHEMISTRY LAB

Lab Periods/week : 3 Sessional. : 50 Exam: 50 Credits: 1.5

Course Objectives:

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

* To prepare ion exchange/ zeolite column for removal of hardness

* To develop the skill of green synthesis through the preparation of a polymer/ drug

Course Outcomes

* The students are able to determine the amount of various chemical species in solutions by titrations quantitatively with accuracy

* The students are able to develop novel materials to be used as zeolite and prepare columns for removal of hardness of water

* The students develop skills to synthesise 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 Chromium (VI) by Mohr's Salt Solution

4. Determination of Hardness of Water sample by EDTA method

5. Ion exchange/ Zeolite column for removal of hardness of water

6. Green Synthesis of Polymer/ drug

Text Books:

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

2. Experiments in Applied Chemistry (For Engineering Students) – Sirita Rattan – S. K. Kataria & Sons, New Delhi **NM1208- NM Computer programming and numerical Methods Lab**

Lab Periods/week : 3 Sessional. : 50 Exam: 50 Credits: 1.5

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.

B. Tech (Naval Architecture and Marine Engineering)

B. Tech - II Year- I Semester

NM 2101 PYTHON PROGRAMMING

Periods/week : 4 Sessional. : 30 Exam: 70 Credits: 3

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 Procedular 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 Vothilong, 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 3,3rdEdition, David Beazley, Brian K. Jones, Oreilly

NM 2102 ENGINEERING MECHANICS-I (STATICS)

Periods/week : 4 Sessional. : 30 Exam: 70 Credits: 3

Course Educational Objectives

* The objectives of the course are

* To teach the student how to determine the resultant force and moment for a given force system.

* 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.

* To Teach the student how to determine the centroid and second moment of area

* 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:

* Determine the resultant force and moment for a given force system.

* Analyze planar and spatial systems to determine the forces in members of trusses, frames and problems related to friction.

* Determine the centroid and second moment of area

* Learn the method of Virtual Work for the solution of Engg Mechanic problems

SYLLABUS

General Principles : Fundamental concepts, Units of Measurement, SI Units

LO-1:

* To provide an introduction to the basic quantities and idealizations of mechanics.

* To give a statement of Newton's Laws of Motion and Gravitation.

* To present a general guide for solving problems.

Force Vectors. Vector Operations, vector addition of forces, Coplanar forces, Cartesian vectors, Position vectors, Force vector directed along a line, dot product

LO-2:

* To show how to add forces and resolve them into components using the Parallelogram Law.

* To express force and position in Cartesian vector form and explain

* To introduce the dot product in order to determine the angle between two vectors or the projection of one vector onto another Equilibrium of a Particle Condition for the equilibrium of a particle, coplanar force system, Three-dimensional force systems

LO-3

* To introduce the concept of the free-body diagram for a particle.

* To show how to solve particle equilibrium problems using the equations of equilibrium.

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

LO-4:

* To provide a method for finding the moment of a force about a specified axis.

* To define the moment of a couple. 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

LO-6:

* To introduce the concept of the Equilibrium of a Rigid body.

* To show how to solve Rigid body equilibrium problems using the equations of equilibrium. Structural Analysis Simple Trusses, method of joints, zero force members, method of sections, space trusses, frames and machines

LO-7:

* To solve problems on Simple Trusses

* To show how to solve problems on Frames and machines

Friction Characteristics of dry friction, problems involving dry friction, wedges, screws, flat belts

LO-8

* To introduce the concept of friction and to solve problems in dry friction.

Center of Gravity and Centroid Centre of gravity, centre of mass, centroid, composite bodies, pappus Guldinus theorem, distributed loading resultants.

LO-9:

* To introduce the concept of Centroid, Center of gravity and center of mass.

Moments of Inertia MI, parallel axis theorem, MI of area by integration, MI of composite areas, product of inertia, Mass MI

LO-10:

* To Derive MI of various composite areas and composite bodies.

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

LO-11

* To introduce the concept of Principal of Virtual Work

Text Book:

R C Hibbeler, "Engineering Mechanics – Statics and Dynamics- 14th Edition," Pearso

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

Periods/week : 4 Sessional. : 30 Exam: 70 Credits: 3

Course Objectives:

* To provide the student with an understanding of Stress and Strain, thermal stresses, Mohr's circle for the solution of stress in 2-D

* To teach the student regarding the structural elements like trusses and frames and their analyses

* Teach the student to Draw the BM and SFD

* To determine the deflection in beams subjected to various loadings

* 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

* Calculate the state of stress including thermal stresses.

* Design structural elements like trusses and frames and beams

* Determine the state of stress in beams and the deflection of beams.

* Design shafts and springs

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.

LO-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

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.

Lo-2:

Calculate and represent the stress diagrams in bars and simple structures

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.

LO-3:

Solve problems relating to pure and non-uniform bending of beams and other simple structures

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.

LO-4:

Understand the concept of buckling and be able to solve the problems related to isolated bars

Text Books:

Engineering mechanics of solids by E.P.Popov,second edition ,PHI.

References:

1. Mechanics of solids by R.C.Hibbler.
2. Analysis of structures by Vazirani and Ratwani Vol 1,1993 edition.

NM 2104 : BASIC THERMODYNAMICS

Periods/week : 4 Sessional. : 30 Exam: 70 Credits: 3

Course Objectives:

* The objectives of the course is to teach the student Fundamental concepts of continuum, system, control volume, thermodynamic properties, thermodynamic equilibrium, work and heat.

* The various laws of thermodynamics so that he can analyze systems like boilers,heat pumps, refrigerators, heat engines, compressors and nozzles.

* Evaluate the performance of vapour power cycles.

Course Outcomes:

At the end of the course, the student will be able to:

* Understand the concepts of continuum, system, control volume, thermodynamic properties, thermodynamic equilibrium, work and heat.

* Apply the laws of thermodynamics to analyze boilers, heat pumps, refrigerators, heat engines, compressors and nozzles.

* Evaluate the performance of vapor power cycles.

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

LO-1:

To explain fundamental thermodynamic properties

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.

LO-2:

Derive and discuss the first and second laws 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

LO-3:

Analyse basic thermodynamic cycles.

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.

LO-4:

To improve the knowledge on various 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

LO-5:

To Explain velocity diagrams in turbines.

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 : MANAGERIAL ECONOMICS

Periods/week : 4 Sessional. : 30 Exam: 70 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 Micro Economics.

LO-1:

To know the basic fundamentals of 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.

LO-2:

To know about Managerial Economics

Demand and Utility Analysis:

Demand - Definition, Meaning, Nature and types of demand, Demand function, Law of demand - Assumptions and limitations. Exceptional demand curve.

LO-3:

To understand the concept of Demand

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.

LO-4:

To obtained the knowledge on 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.

LO-5 :

To know the concept of Utility Analysis

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.

LO-6:

To know the Theory of Production and Cost analysis.

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.

LO-7:

To know the concept of Pricing and Business Cycles.

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 2106 : COMPUTER AIDED SHIP DESIGN LAB

Lab Periods/week : 3 Sessional. : 50 Exam: 50 Credits: 1.5

Course Objectives

* The objectives of the course are to provide training and provide hands on experience to the students on CAD software

Course Outcomes

* At the end of the course, the student will be in a position to model a ship using the softare

SYLLABUS

CASD 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. Drawing a flange.

4. Drawing a Bushing assembly.

5. Dimensioning the drawing and adding text.

6. Setting the layers and application of the layers.

7. Isometric and orthographic projections.

8. Viewing in Three dimensions.

9. Removal of hidden lines - Shading and rendering

NM 2107 – MECHANICS OF MATERIALS LAB

Periods/week : 3 Ses. : 50 Exam : 50

Examination Practical: 3hrs. , Credits: 1.5

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 Hounsefield Tensometer.

3. Determination of compression strength of wood.

4. Determination of hardness using different hardness testing machines- Brinnels, 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 Hounsefield tensometer.

12. Sieve Analysis and determination of fineness number.

NM 2108 : SHIP DRAWING – I

Lab Periods/week : 3 Sessional. : 50 Exam: 50 Credits: 1.5

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 2109 : PHYTON LAB

Lab Periods/week : 3 Sessional. : 50 Exam: 50 Credits: 2

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 arras and dataframes

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, Additson 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 Person and Luiz Felipe Martins, Mastering Python Data Analysis, Packt Publishing Ltd

7. Sebastian Raschka& Vahid Mirjalili, "Python Machine Learning', Packt Publisher, 2017

NM2110 : PROFESSIONAL ETHICS AND UNIVERSAL HUMAN VALUES

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.

LO-1: To know about Need, Basic Guidelines, Content and Process for Value Education

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.

LO-2: To provide knowledge on Understanding Harmony in the Human Being

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.

LO-3: To Understanding Harmony in the Family and Society, Harmony in Human and Human Relationship 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.

LO-4: To Understanding Harmony in the Nature and Existence - Whole existence as Coexistence 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.

LO-5: To know the Concept of Law and Law of Torts 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.

LO-6: To Provide basic Implications of the above Holistic Understanding of Harmony on Professional Ethics

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 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. FSchumacher. “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.

NM 2111 NSS/NCC

B. Tech -II Year- II Semester

NM 2201 ELECTRICAL TECHNOLOGY

Periods/week : 4 Sessional. : 30 Exam: 70 Credits: 3

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 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

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).

LO-1: Understand the fundamentals of e.m.f, potential difference, current, resistance and energy conversions from one form to another

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).

LO-2: Understand the basics of magnetic circuits and Identify the relationship between current and magnetic fields with application to determination of 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. (Chapter-10, 11, Pages 208-238).

LO-3: Apply the concept of electromagnetism to understand Generator operation and interpret the relationship between charge and electric fields with its application.

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).

LO-4: Analyze D. C. circuits, interpret relationship between voltage, current and power, examine concept of resonance, and analyze balanced three phase circuits.

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).

LO-5: Apply the concept of electromagnetism to understand Transformer operation and interpret the relationship between charge and electric fields with its application

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).

LO-6: Analyze and solve D. C. networks by applying various laws and theorems.

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.

LO-7: Solve problems on principles of measurement.

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)

Periods/week : 4 Sessional. : 30 Exam: 70 Credits: 3

Course Objectives:

The objectives of the course are

* To introduce the concepts of position, displacement, velocity, and acceleration

* To analyze the accelerated motion of a particle using the equation of motion with different coordinate systems.

* To develop the principle of work and energy

* To study the conservation of linear momentum for particles.

* To introduce the concept of angular impulse and momentum.

* To discuss applications of these equations to bodies undergoing translation, rotation about a fixed axis, and general plane motion.

* To show how the conservation of energy can be used to solve rigid–body planar kinetic problems.

* 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

* Understand the concepts of position, displacement, velocity, and acceleration

* Analyze the accelerated motion of a particle

* 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

* Write the equations on motion for a plane body in translation, rotation about a fixed axis, and general plane motion.

* Use various techniques to solve kinetic problems in Plane motion.

SYLLABUS

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.

LO-1: Ability to form the relation between displacement, velocity and acceleration

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.

LO-2: Ability to form the equilibrium equations under dynamic forces, to calculate the unknowns of the equations, to determine the motion of the body

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.

LO-3: To know the knowledge of Impulse and Momentum

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.

LO-4: To provide the basic knowledge on Instantaneous center.

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.

LO-5: To Solve problems on principle of work and enegy

Planar Kinetics of a Rigid Body: Impulse and Momentum Linear and Angular Momentum. Principle of Impulse and Momentum. Conservation of Momentum. Eccentric Impact.

Lo-6: To provide the knowledge on kinetics of a rigid Body.

Text Book:

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 2203: MECHANICS OF MATERIALS – II

Periods/week : 4 Sessional. : 30 Exam: 70 Credits: 3

Course objectives:

* To provide basic knowledge in mechanics of materials so that the students can solve real engineering problems and design engineering systems.

* 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:

* 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.

* 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.

* Solve problems relating to torsional deformation of bars and other simple tri-dimensional structures.

* Understand the concept of buckling and be able to solve the problems related to isolated bars.

SYLLABUS

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.

LO-I: To solve problems on Fixed beams and Continuous Beams and Analyze a statistically indeterminate structure.

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.

LO-2: To calculate Euler's formulae for the end conditions of the column

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.

LO-3: To Analysis the stresses due to curved bars of various geometric sections.

Thick cylinders Subjected to internal and external pressure cylinders. Theories of failure: Application to design of shafts.

LO-4: To Calculate Pressure in cylinders.

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

Periods/week : 4 Sessional. : 30 Exam: 70 Credits: 3

Course objectives:

* 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.

* 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.

* To provide the students with some knowledge and analysis skills associated with the principles and techniques of the design of energy conversion systems.

* To develop the student's ability to communicate effectively the knowledge of thermodynamics and energy conversion systems

Course Outcomes

* 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.

* 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.

* 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.

* Students will demonstrate an ability to determine engineering design quantities and estimate their effects on the basic performance characteristics of the energy conversion systems.

* 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.

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, Sterling, Ericson and Atkinson cycles and their analysis. Valve timing and port timing diagrams Various Efficiencies. Basic principles of carburetion and fuel injection.

LO-1: To Understand the various engine components

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

LO-2: To 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 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

LO-3: To Understand the fuel supply and the ignition systems.

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.

LO-4: Understand the turbo charging, supercharging and new engine technology Refrigeration& Air Conditioning: Bell Colemen cycle, Vapor compression cycle. Vapor absorption system, Principles of psychrometry –psychometric Chart and terminology, air conditioning systems.

LO-5: To provide basic knowledge on Refrigeration and Air Conditioning.

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, byC.P.Arora and Domokundwar.

NM 2205 : MATERIAL SCIENCE

Periods/week : 4 Sessional. : 30 Exam: 70 Credits: 3

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.

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.

Lo-1: To describe basic definition and conception of materials and physical properties of materials. 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.

Lo-2: Analyze the Structure of materials at different levels, basic concepts of crystalline materials like unit cell, FCC, BCC, HCP, APF

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. Nonferrous 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.

LO-3: To give information about phase diagrams.

Plastic deformation: Slip, twining 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.

LO-4: To provide fundamental knowledge on powder metallurgy and composite materials.

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

Lab Periods/week : 3 Sessional. : 50 Exam: 50 Credits: 1.5

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.

Alternator regulation by Syn. Impedance method.

NM 2207 : AUTOCAD LAB

Lab Periods/week : 3 Sessional. : 50 Exam: 50 Credits: 1.5

List of Experiments:

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

4.Tracking to extrapolate a projected top view Using Modify tools to arrange an office layout

5.Drawing Precision in AutoCAD Polar and Ortho Tracking Entering Coordinates and Angles Object Snaps and Tracking

6.Making Changes in Your Drawing Move Copy Rotate Mirror Scale Using the reference option with the Scale Tool

7. Drawing Templates Using Template Files (.dwt) to Make New Drawing Exploring what Settings and Elements are saved with Templates

8. Organizing Your Drawing with Layers Layer States Properties by Layer Tools

9. Advanced Object Types Polylines Arcs Polygons Ellipses

10.Analyzing Model and Object Properties The Properties Palette Quick Select Similar Measure Geometry Tools

11. Advanced Editing Commands Trim and Extend Fillet and Chamfer Polyline Edit and Spline Offset and Explode Join

12. Inserting Blocks The Insert Block Command Inserting Blocks with Tool Palettes Dynamic Blocks Migrating Blocks and other Elements between Drawings with Design Center

13. Projects - Creating More Complex Objects

NM 2208 : INTELLECTUAL PROPERTY RIGHTS SKILL DEVELOPMENT COURSE

Lab Periods/week : 3 Sessional. : 50 Exam: 50 Credits: 2

Course Objectives:

* To introduce the students to Intellectual Property Rights (IPR) which is a key component in modern knowledge management processes

* 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

* 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

* 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

* Identify the types of intellectual property protection available for their research outcome

* conduct patent search and analyze patentability of the invention

* understand the basic structure of Patent document

* understand the registration and prosecution of different IPs

* 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

LO-I: To Illustrate research problem formulation

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

LO-2: Summarize the approaches of investigation of solutions for a research problem

Types of IPR : Major forms of IP in India and globally, Acts enacted in India related to IP

LO-3: Discover the new developments in IPR

Patent : Concept, Life of patent, Rights of Patentee, Criteria of patentability- novelty, non-obviousness, and utility, Non-patentable inventions

LO-4: Outline the process of patenting and development

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

LO-5: Explain patent right and its scope

Trademark : Types of trademarks, Trademark and Brand, Trademark Registration, Trademark Infringeme

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

LO-6: Make use of Patent information and databases

Other forms of IP : Semiconductor Integrated Circuits Layout Design, Geographical Indications, Protection of Plant Varieties & Farmers' right, Traditional knowledge

LO-7: Discover the new developments in IPR

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

LO-8: Explain the procedure for granting patent

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, 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

* 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),

LO-I: Articulate the interconnected and interdisciplinary nature of environmental studies;

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.

LO-2: Demonstrate an integrative approach to environmental issues with a focus on sustainability

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.

LO-3: Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.

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.

LO-4: Appreciate that one can apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes.

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.

LO-5: Understand and evaluate the global scale of environmental problems

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.

LO-6: communicate clearly and competently matters of environmental concern and understanding to a variety of audiences in appropriate forms and E-waste

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, 2016and its amendments 2018.
6. MoEF&CC, Govt. of India, CPCB: Plastic waste management rules, 2016.