### MARINE ENGINEERING

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

#### I Year - I Semester

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Category</th>
<th>Course Title</th>
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| Total Credits | 19.5 |
### B.Tech | Year - II Semester

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<tbody>
<tr>
<td>NM1201</td>
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<td>NM1202</td>
<td>BS Green Chemistry</td>
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<td>NM1203</td>
<td>HSS English</td>
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<tr>
<td>NM1204</td>
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<td>NM1205</td>
<td>ES Industry 4.0</td>
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<td>NM1206</td>
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| Total Credits | 19.5 |

### B. Tech (Naval Architecture and Marine Engineering)

#### B. Tech - II Year - I Semester

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<td>NM 2102</td>
<td>PC Engineering Mechanics – I (Statics)</td>
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<td>NM 2103</td>
<td>PC Mechanics of Materials - I</td>
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<td>NM 2104</td>
<td>PC Basic Thermodynamics</td>
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<td>NM 2105</td>
<td>HSS Managerial Economics</td>
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<td>NM 2106</td>
<td>PC Computer Aided Ship Design Lab</td>
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<td>NM 2107</td>
<td>PC Mechanics of Materials Lab</td>
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<td>PC Ship Drawing - I</td>
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| Total Credits | 19.5 |

#### B. Tech -II Year - II Semester

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<td>PC Mechanics of Materials - II</td>
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<td>NM 2204</td>
<td>PC Engineering Thermodynamics</td>
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<td>NM 2205</td>
<td>PC Material Science</td>
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<td>NM 2206</td>
<td>PC Electrical Tech Lab</td>
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<td>NM 2207</td>
<td>PC Auto CAD Lab</td>
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<td>NM 2208</td>
<td>SC Intellectual Property Rights</td>
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<td>NM 2209</td>
<td>M C Environmental Science</td>
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| Total Credits | 20    |

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

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.
CO2. 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 planes and parallel 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:

Reference:

**NM 1104 Basic Ship Theory**

**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.


Trim and effects of changes in draught. Free board, Different types of free board, ships types based on free board, ILLC requirements, freeboard calculations.

Subdivision of ships: Causes and types flooding, volume and surface permeability due to bilging of side compartments. Added weight and buoyancy, methods of calculation, subdivision load lines, margin line, floodable length, permissible length, floodable length curves.

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

**Text Book:**
Introduction to Basic Ship Theory- Butterworth Heinemann Publications

**NM 1105 INTRODUCTION TO NAVAL ARCHITECTURE**

**SYLLABUS**


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**

**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.
Instruments

The relative edge and the means to imply it in a practical manner by performing various related interpret

Course

Lab 4/e Vikas.

Stair

and

Elbow

Half

repairs.

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:


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.
3. Study the Intensity Variation of the Magnetic Field along axis of Current Carrying Circular Coil.
5. Determination of Refractive Index of Ordinary ray m---, and Extraordinary m--- ray.
10. Lees Method - Coefficient of thermal Conductivity of a Bad Conductor.
12. Meldle’s Apparatus – Frequency of electrically maintained Tuning Fork.
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.


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:

* 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 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.

SY LLABUS

Matrix Algebra, Ordinary Differential Equations and Laplace Transforms

(Linear Algebra)


(b) 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.

(c) Ordinary Differential Equations of First Order and its Applications


(d) 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.

(e) Laplace Transforms


TEXT BOOK:

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

REFERENCE BOOKS:

tional publishing house Pvt. Ltd.

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


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


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
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:

Suggested Readings

**NM 1204-Computer programming and Numerical Methods**

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 points, 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


Text Book:
2. Introduction to Numerical Methods, SS Sastry, Prentice Hall

Reference Books:
3. The C –Programming Language B.W. Kernghan, Dennis M. Ritchie, PHI.

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 - 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

Credits: 1.5

Lab Periods/week : 3 Sessional : 50 Exam: 50
Course Outcomes:
* 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:

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:
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 find 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

Course Objectives
1. To develop skills on procedural oriented and object oriented programming in Python
2. To understand and apply different data wrangling techniques using Python.
3. To perform data analysis using python libraries like NumPy, Pandas and exploratory data analysis using Matplotlib

Course Outcomes
At the end of the course, a student should be able to:
1. acquire programming knowledge on Basics of Python
2. acquire programming knowledge on Text and File Handling
3. develop Python programs to Mean, Median, Mode, Correlation
4. acquire programming knowledge on NumPy, Pandas Library
5. acquire programming knowledge on Graph Visualizations in Python and Data Analysis using Python

SYLLABUS
1. Introduction to Python: Rapid Introduction to Procedural Programming, Data Types: Identifiers and Keywords, Integral Types, Floating Point Types
2. Strings: Strings, Comparing Strings, Slicing and Striding Strings, String Operators and Methods, String formatting with str. format
3. Collections Data Types: Tuples, Lists, Sets, dictionaries, Iterating and copying collections
4. Python Control Structures, Functions and OOP: Control Structures and Functions: Conditional Branching, Looping, Exception Handling, Custom Functions
5. Python Library Modules: random, math, time, os, shutil, sys, glob, re, statistics, creating a custom module
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
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
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
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

**NM 2102 ENGINEERING MECHANICS-I (STATICS)**

**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:

References:

**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**


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:

NM 2104: BASIC THERMODYNAMICS
Periods/week: 4 Sessional: 30 Exam: 70 Credits: 3

Course Objectives:
* 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

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 Clausius statement and their equivalence, Corollaries- PMM 1 & PMM 2 - Reversibility and irreversibility- Causes of irreversibility- Carnot cycle- Heat engines and heat pumps- Carnot efficiency- Clausius theorem- Clausius inequality- Concept of entropy

LO-3:
Analyze basic thermodynamic cycles.

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:
2. Thermodynamics (SI Version) by William Z Black & James G Hartley

References:
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:

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
Elasticity of demand - 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

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:

Reference Books:
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 software

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- Brinells, 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.
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 arrays and dataframes
4. introduce students to data visualization in Python through creation of line plots, histograms, scatter plots, box plots and others
5. implementation of basic machine learning tasks in Python including pre-processing data, dimensionality reduction of data using PCA, clustering, classification and cross-validation.

Course Outcomes
After completion of the course the student should be able to:
1. implement searching, sorting and handle text and files using Python data structures such as lists and dictionaries
2. calculate statistical measures using Python such as measures of central tendency, correlation
3. use Python data related libraries such as Numpy and Pandas and create data visualizations
4. implement basic machine learning tasks pre-processing data, compressing data, clustering, classification and cross-validation.

SYLLABUS
1. Python Programs on lists & Dictionaries
2. Python Programs on Searching and sorting
3. Python Programs on Text Handling
4. Python Programs on File Handling
5. Python Programs for calculating Mean, Mode, Median, Variance, Standard Deviation
6. Python Programs for Karl Pearson Coefficient of Correlation, Rank Correlation
7. Python Programs on NumPy Arrays, Linear algebra with NumPy
8. Python Programs for creation and manipulation of DataFrames using Pandas Library
9. Write a Python program for the following.
   Simple Line Plots,
   Adjusting the Plot Line Colors and Styles, Axes Limits, Labeling Plots,
   * Simple Scatter Plots,
   * Histograms,
   * Customizing Plot Legends,
   * Choosing Elements for the Legend,
   * Boxplot
   * Multiple Legends,
   * Customizing Colorbars,
   * Multiple Subplots,
   * Text and Annotation,
   * Customizing Ticks
10. Python Programs for Data preprocessing: Handling missing values, handling categorical data, bringing features to same scale, selecting meaningful features
11. Python Program for Compressing data via dimensionality reduction: PCA
12. Python Programs for Data Clustering
13. Python Programs for Classification
14. Python Programs for Model Evaluation: K-fold cross validation

Reference Books
2. Chris Albon, “Machine Learning with Python Cookbook-practical solutions from preprocessing to Deep learning”, O’REILLY Publisher, 2018
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

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


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, Magnetome 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


LO-2: Understand the basics of magnetic circuits and identify the relationship between current and magnetic fields with application to determination of inductance


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


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


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


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


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


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


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


Kinetics of a Particle: Impulse and Momentum


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


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


Planar Kinetics of a Rigid Body: Work and Energy


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


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

Text Book:

References:

**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.

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.
3. Strength of materials by L.B.Shah and Dr.R.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 combustion 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


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 combustion 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.


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

Text Books:

References:
1. I.C. Engines by V. Ganesan.

**NM 2205 : MATERIAL SCIENCE**

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**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**


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


LO-3: To give information about phase diagrams.


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

Text Books:
1. Materials Science and Engineering, by V.Raghavan.

References:

**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.
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.
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
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

**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 IP
- 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-1: 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

LO-5: Explain patent right and its scope
Trademark: Types of trademarks, Trademark and Brand, Trademark Registration, Trademark Infringement
Copyright: Copyrights and related rights, Copyright registration, Copyright infringement, Section 52 of Indian Copyright Act

Industrial Design: What is Industrial design, Design registration, Design infringement
Trade Secret: What are Trade Secrets, How trade secrets are maintained in trade and business

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

Reference Books
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


LO-1: 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.


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


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:


Reference Books:


