# COURSE STRUCTURE (R20)

## I - SEMESTER

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| 8    | 20AE51      | Engineering Fluid Mechanics Lab       | 0   | 0  | 3  | 1.5 | 15  | 35   | 50   |
| 9    | 20AE52      | Strength of Materials Lab             | 0   | 0  | 3  | 1.5 | 15  | 35   | 50   |
| 10   | 20AES1      | Advanced AutoCAD                      | 1   | 0  | 2  | 2   | --  | 50   | 50   |
| Total                       |             |                                      | 14   | 4  | 11 | 21.5| 225 | 575  | 800  |

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| 7    | 20AE54      | Thermal Engineering Lab              | 0   | 0  | 3  | 1.5 | 15  | 35   | 50   |
| 8    | 20AE55      | MATLAB applications in Engineering Lab | 0   | 0  | 3  | 1.5 | 15  | 35   | 50   |
| 9    | 20ITS1      | Problem Solving Using Python         | 1   | 0  | 2  | 2   | --  | 50   | 50   |
| Total                       |             |                                      | 15   | 1  | 11 | 21.5| 195 | 505  | 700  |

| Honors/Minor Courses               |             |                                      |       |    |    |     |     |       |
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<td>20EC85</td>
<td>Systems and Signal Processing</td>
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<td>20EC86</td>
<td>Cellular Technology</td>
<td>AI&amp;DS, ASE, CE, CSE, CSE(AI&amp;ML), EEE, IT &amp; ME</td>
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## OPEN ELECTIVES

<table>
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<tr>
<th>Course Code</th>
<th>Course Name</th>
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<tbody>
<tr>
<td>20EE81</td>
<td>Linear Control Systems</td>
<td>AI&amp;DS, ASE, CE, CSE, CSE(AI&amp;ML), ECE, IT &amp; ME</td>
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<td>20EE82</td>
<td>Basics of Electrical Measurements</td>
<td>AI&amp;DS, ASE, CE, CSE, CSE(AI&amp;ML), ECE, IT &amp; ME</td>
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<td>Utilization of Electrical Energy</td>
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<td>20EE84</td>
<td>Electric Vehicles</td>
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<td>OOP through JAVA</td>
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<td>20IT82</td>
<td>Web Technologies using PHP</td>
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<td>20IT83</td>
<td>Mobile Application Development</td>
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<td>20IT84</td>
<td>Cyber Security &amp; Digital Forensics</td>
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<td>20ME81</td>
<td>Renewable Energy Sources</td>
<td>AI&amp;DS, CE, CSE, CSE(AI&amp;ML), ECE, EEE &amp; IT</td>
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<td>20ME82</td>
<td>Robotics in Automation</td>
<td>AI&amp;DS, CE, CSE, CSE(AI&amp;ML), ECE, EEE &amp; IT</td>
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<td>20ME83</td>
<td>Operations Research Techniques</td>
<td>AI&amp;DS, CE, CSE, CSE(AI&amp;ML), ECE, EEE &amp; IT</td>
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<td>20ME84</td>
<td>Elements of Automobile Engineering</td>
<td>AI&amp;DS, CE, CSE, CSE(AI&amp;ML), ECE, EEE &amp; IT</td>
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</table>
Pre-requisites: Nil

Course Educational Objectives: To improve English language proficiency of the students in various aspects like vocabulary, grammar, communication skills, listening skills, reading & writing skills.

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

CO1 : Write sentences and paragraphs using proper grammatical structures and word forms (Remember – L1)
CO2 : Comprehend the given text by employing suitable strategies for skimming and scanning and draw inferences (Understand – L2)
CO3 : Write summaries of reading texts using correct tense forms & appropriate structures (Remember – L1)
CO4 : Write Formal Letters, Memos & E-Mails (Apply – L3)
CO5 : Edit the sentences/short texts by identifying basic errors of grammar/vocabulary/syntax (Understand – L2)

Unit - I
Exploration - ‘A Proposal to Girdle the Earth – Nellie Bly’; Reading: Skimming for main idea; Scanning for specific information; Grammar & Vocabulary: Content Words; Function Words; Word Forms: verbs, nouns, adjectives and adverbs; Nouns: Countable and Uncountable, Singular and Plural forms; Wh - Questions; Word Order in Sentences; Writing: Paragraph Analysis; Paragraph Writing; Punctuation and Capital Letters

Unit – II
On Campus- ‘The District School as it Was by One Who Went to it – Warren Burton’; Reading: Identifying Sequence of Ideas; Grammar & Vocabulary: Cohesive Devices: Linkers/Signposts/Transition signals, Synonyms, Meanings of Words/Phrases in the context; Writing: Memo Drafting.

Unit – III
Working Together- ‘The Future of Work’
Reading: Making basic inferences; Strategies to use text clues for comprehension; Summarizing; Grammar & Vocabulary: Verbs: Tenses; Reporting Verbs for Academic Purpose; Writing: Rephrasing what is read; Avoiding redundancies and repetitions; Abstract Writing/Summarizing.

Unit – IV
‘A.P.J. Abdul Kalam’; Grammar & Vocabulary: Direct & Indirect Speech; Articles and their Omission; Writing: E-Mail Drafting.

Unit – V
‘C.V.Raman’; Grammar & Vocabulary: Subject-Verb Agreement; Prepositions; Writing: Formal Letter Writing.
Text Books:

Reference Books:
Pre-requisites : Nil

Course Educational Objective: The objective of this course is to introduce the first order and higher order differential equations, functions of several variables. The students also learn solving of first order partial differential equations.

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

CO1: Apply first order and first-degree differential equations to find orthogonal trajectories (Apply – L3)
CO2: Distinguish between the structure and methodology of solving higher order differential equations with constant coefficients (Understand – L2)
CO3: Apply various Numerical methods to solve initial value problem (Apply – L3)
CO4: Generate the infinite series for continuous functions and investigate the functional dependence (Understand – L2)
CO5: Solve partial differential equations using Lagrange’s method (Apply – L3)

UNIT – I
Differential Equations of First Order and First Degree
Differential equations of first order and first degree – Exact and Non Exact differential Equations, Applications of differential equations – Orthogonal Trajectories.

UNIT – II
Linear Differential Equations of Higher Order
Homogeneous and Non Homogeneous Linear differential equations of second and higher order with constant coefficients with R.H.S. functions $e^{ax}$, $\sin (ax+b)$, $\cos (ax+b)$, $x^m$, $e^{ax}V(x)$, $xV(x)$, Method of variation of parameters.

UNIT – III
Numerical solution of Ordinary Differential Equations
Euler’s Method - Runge- Kutta Methods.

UNIT – IV
Functions of several variables
Generalized Mean Value Theorem (without proof), Maclaurin’s series, Functions of several variables, Jacobians (Cartesian and polar coordinates), Functional dependence. Maxima and Minima of function with two variables.

UNIT – V
Partial Differential Equations
Text Books:

Reference Books:
Pre-requisites: Nil

Course Educational Objectives: It enables the students to understand the fundamental concepts of chemistry and to provide them with the knowledge of industrial problems and finding the solutions. It helps to strengthen the basic concepts of water, fuel technologies, electrochemistry, corrosion and advanced materials used in technologies.

Course Outcomes: At the end of the course, students will be able to,

CO1: Identify the troubles due to hardness of water and its maintenance in industrial applications. (Understand - L2)

CO2: Understand the issues related to conventional fuels, biofuels and photo-voltaic cells in energy production. (Understand - L2)

CO3: Apply Nernst Equation for calculating electrode cell potentials and compare batteries for different applications. (Apply - L3)

CO4: Apply principles of corrosion for design and effective maintenance of various equipment. (Apply - L3)

CO5: Analyse the suitability of engineering materials like polymers, lubricants, nano materials and composites in technological applications. (Understand – L2)

UNIT – I
Water Technology
Sources of water and quality: Hardness of Water - Temporary and permanent hardness, units and their inter relation, problems on hardness and disadvantages of hard water in industries. Boiler troubles - Reasons, disadvantages and methods of prevention for Scale and sludge formation, caustic embrittlement, boiler corrosion and carry over (priming and foaming), W.H.O standards of potable water; Water softening: Ion- Exchange Process, merits and demerits; Desalination of brackish water - Electro dialysis and reverse osmosis; Treatment of industrial waste water.

UNIT – II
Fuel Technology
Classification of fuels (solid, liquid and gaseous fuels, merits and demerits) and characteristics of a good fuel; Calorific value -Definition, gross and net calorific values (definition only). Solid fuels - Coal – origin, proximate analysis of coal and significance; Liquid Fuels - Petroleum-origin, types of crude oil and refining of petroleum. Cracking - moving bed catalytic cracking and synthetic petrol – Fischer Tropsch’s process; Gaseous fuels - Natural gas composition and C.N.G - advantages. Bio fuels - Characteristics of bio fuels, sources of bio mass and advantages - Production of biodiesel from rape seed oil; Photo-voltaic Cell - Design, working, schematic diagram, advantages and disadvantages.

UNIT – III
Electro Chemistry & Batteries
Types of Electrodes - Calomel Electrode, Glass Electrode, Calculation of EMF of Cell, Applications of Nernst Equation, Applications of Electro chemical Series Batteries - Lead-acid Battery, Lithium ion Battery, H2– O2 Fuel Cell, Mg-Cu reserve battery.
UNIT – IV
Science of Corrosion
Dry Corrosion (Direct Chemical corrosion) - Types of dry corrosion-oxidative corrosion, Pilling Bed worth rule, corrosion by other gases and liquid metal corrosion; Wet Corrosion (Electro Chemical corrosion) - Mechanism- oxygen absorption, hydrogen evolution, types of wet corrosion, Galvanic Corrosion, Concentration Cell Corrosion, passivity and Galvanic series; Factors Influencing Corrosion -Nature of metal (purity, position in galvanic series, relative area of cathode & anode, nature of surface film) and nature of environment (temperature, humidity, atmospheric pollution and nature of ions in the medium); Control of Corrosion -Cathodic Protection - Sacrificial anode and impressed current methods, electro plating and metal cladding.

UNIT – V
Chemistry of Engineering Materials
Polymers - Differences between thermoplasts and thermosets, Types of polymerization with examples, Preparation properties and engineering applications of PVC, Teflon, BUNA-S and Polyurethane; Lubricants -Characteristics of a good lubricant and properties of lubricants (viscosity, flash and fire points, cloud and pour points, aniline point) and applications; Nano Materials -Introduction, definition, extraordinary changes observed at nano size of materials and reasons, types of nano-materials, Gas-Phase Synthesis of nanomaterials, Applications; Composites - Advantageous characteristics of Composites, Constituents, Fibre reinforced composites (GFRP, CFRP), Reasons for failure of composites.

TEXT BOOKS

REFERENCE BOOKS
Pre-requisites: Mathematics

Course Educational Objective:

To recognize the Bureau of Indian Standards of Engineering Drawing and develop an ability to get familiarized with orthographic projections and isometric views of solid objects.

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

CO1: Identify the geometrical objects considering BIS standards. (Remember-L1)
CO2: Comprehend the basics of orthographic projections and deduce orthographic projectionsof a point and a line at different orientations. (Understand-L2)
CO3: Represent graphically the geometrical planes at different positions and orientations. (Understand-L2)
CO4: Analyze and draw solid objects at different positions and orientations. (Apply- L3)
CO5: Visualize isometric and orthographic views of geometrical objects and convert one form to another. (Understand-L2)

UNIT – I
INTRODUCTION TO ENGINEERING DRAWING:
Engineering Curves: Conic Sections- Ellipse, Parabola, Hyperbola and Rectangular Hyperbola-General method and other methods; Cycloid, Epi-Cycloid and Hypo-Cycloid; Involutes.

UNIT – II
ORTHOGRAPHIC PROJECTIONS:

UNIT – III
PROJECTIONS OF PLANES: Introduction,Planes parallel to one of the reference planes-Inclined to one reference plane and perpendicular to other-Oblique planes.

UNIT – IV
PROJECTIONS OF SOLIDS: Introduction,RegularPolyhedral, Solids of Revolution, Projection of solids in simple position - Axis inclined to one of the reference planes and parallel to the other-Axis inclined to both Principle Planes.

UNIT – V
ISOMETRIC VIEWS: Introduction-theory of isometric projection, isometric views, isometric axes, scale, lines and planes-Isometric view of prism, pyramid, cylinder and cone-non isometric lines-methods to generate an isometric drawing.
TRANSFORMATION OF PROJECTIONS: Conversion of Orthographic Projections to Isometric Views of composite objects, Conversion of Isometric Views to Orthographic Projections.
TEXT BOOKS:

BOS APPROVED REFERENCE BOOKS:
2 R.K.Dhawan, Engineering Drawing, S.Chand Company LTD.
3 Venugopal, Engineering Drawing and Graphics, New Age publishers
5 N.S.Parthasarathy, Vela Murali, Engineering Drawing, Oxford Higher Education
PRE-REQUISITES: Physics, Mathematics

COURSE EDUCATIONAL OBJECTIVE:
The main objective of this course is to develop the ability to predict the behavior of rigid solid bodies under the action of external forces in real world scenario.

COURSE OUTCOMES: At the end of the course, the student will be able to
CO1: Apply free body diagram concepts to analyze rigid bodies in static conditions. (Apply-L3)
CO2: Apply the equilibrium Equations of rigid bodies associated with frictional forces. (Apply-L3)
CO3: Identify the location of centroid / centre of gravity and evaluate the moment of inertia of plane sections/solids. (Apply-L3)
CO4: Understand the behavior of moving bodies in rectilinear motion using kinematic equations or motion curves. (Understand-L2)
CO5: Examine the behavior of moving bodies using dynamic equilibrium conditions. (Apply-L3)

UNIT-I
SYSTEM OF FORCES: Introduction, Basic terminology in Mechanics, laws of Mechanics, characteristics of force, system of forces-types, Resolution and Composition of forces, Resultant of coplanar concurrent force system, Resultant of coplanar non-concurrent force system-moment of a force and couple.
EQUILIBRIUM OF SYSTEM OF FORCES: Free Body Diagram, Lami’s theorem, Equilibrium of a rigid body subjected to coplanar concurrent forces and non-concurrent forces, Equilibrium of connected bodies.

UNIT-II
FRICITION: Introduction, Frictional force, laws of Coulomb friction, angle of friction, limiting friction and angle of repose, problems on blocks resting on horizontal and inclined planes.

UNIT - III
CENTROID AND AREA MOMENT OF INERTIA: Introduction, centroid, axis of symmetry, centroid of simple figures from first principles, centroid of simple composite sections, area moment of inertia, polar moment of inertia, theorems of moment of inertia, moment of inertia of rectangle, circle, semi circle, I and T cross sections.
CENTRE OF GRAVITY AND MASS MOMENT OF INERTIA: Centre of gravity, centre of gravity of solid cylinder, right circular cone, hemi sphere, mass moment of inertia, radius of gyration, mass moment of inertia of uniform rod, rectangular plate, circular plate and solid cylinder only.

UNIT –IV
KINEMATICS: Introduction, general principles in dynamics, types of motion, rectilinear motion, motion curves, motion with uniform velocity, motion with uniform acceleration, motion with varying acceleration, angular motion, relationship between linear and angular motions.

UNIT – V
KINETICS: Introduction, Newton’s second law of motion-inertia force, D-Alembert’s principle, bodies in rectilinear translation, fixed axis rotation of rigid bodies.
TEXT BOOKS

REFERENCES
Pre-requisites: Nil

Course Educational Objectives: This course enables the students to analyze water samples and perform different types of volumetric titrations. It provides them with an overview of preparation of polymers and properties of fuels.

Course Outcomes: At the end of the course, the students will be able to
CO1: Assess quality of water based on the procedures given. (Understand - L2)
CO2: Distinguish different types of titrations in volumetric analysis after performing the experiments listed in the syllabus. (Understand - L2)
CO3: Acquire practical knowledge related to preparation of polymers. (Understand - L2)
CO4: Exhibit skills in performing experiments based on theoretical fundamentals. (Understand - L2)

List of Experiments
(Any of the 10 experiments are required to be conducted)

Model Experiment
1) Determination of amount of Na₂CO₃ using standard HCl solution.

Water Analysis
2) Determination of alkalinity of water sample.
3) Determination of total Hardness of water by EDTA method.
4) Determination of permanent hardness of water by EDTA method.

Preparation of Polymers
5) Nylon Fibers
6) Bakelite

Redox Titrations
7) Estimation of Mohr’s salt by using potassium permanganate.
8) Estimation of Mohr’s salt by using potassium dichromate.
9) Determination of Copper(II) using standard hypo solution.

Demonstration Experiments
10) Determination of pH of the given sample solution/ soil using pH meter.
11) Determination of Turbidity of the given sample water.

Estimations
12) Determination of ferrous content in the given sample of iron ore against potassium dichromate using potassium ferricyanide as external indicator.
13) Determination of Iron(III) by colorimetric method.

Fuels
14) Determination of flash and fire points of a given fuel/lubricant.

REFERENCES
Lab manual
PRE-REQUISITES: Engineering Mechanics, Applied Chemistry

COURSE EDUCATIONAL OBJECTIVE:

The main objective of this course is to demonstrate the concepts of engineering mechanics and fuels through experiments.

COURSE OUTCOMES:

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

CO1: Verify the basic laws of Mechanics in static environment. (Apply-L3)
CO2: Evaluate the forces in the mechanical systems. (Apply-L3)
CO3: Estimate various properties of fuel like Viscosity Flash and Fire point. (Apply-L3)
CO4: Determine calorific-value of fuels. (Apply-L3)

LIST OF EXPERIMENTS:

At least 10 experiments are to be conducted

1. Verification of polygon law of forces using Universal-Table apparatus.
2. Verification of Lami’s Theorem.
4. Determination of coefficient of friction between the two materials using Tilting-plane method.
5. Estimate Time period of oscillations of a simple and compound pendulum.
6. Verification of Newton ‘s second law.
10. Determination of viscosity of given oil using Englers Viscometer.
11. Determination of Flash and Fire point of given oil using ABELS Apparatus.

REFERENCES:

Lab-Manual
PRE-REQUISITES: Physics and Mathematics

COURSE EDUCATIONAL OBJECTIVE:
The objective of this course is to get familiarized with various trades used in Engineering Workshop and learn the safety precautions to be followed in the workshops while working with the different tools.

COURSE OUTCOMES: After completion of the course students will be able to:

CO1: Develop different prototypes in the carpentry section. (Understand-L2)
CO2: Fabricate various basic prototypes in fitting trade. (Understand-L2)
CO3: Demonstrate various operations related to plumbing, tin smithy and blacksmithy. (Understand-L2)
CO4: Perform various basic house wiring techniques. (Apply-L3)

(Conduct at least 4 Trades with 2 exercises from each Trade and demonstrate about 2 Trades)

Trade –1: CARPENTRY SHOP
Introduction to various types of wood such as Teak, Sal, Oak, Beach, Neam, Wallnut Mango, Shisham, Deodar, Babul. Demonstration, function and use of carpentry hand-tools and their safety precautions. Introduction to various types of wooden joints, their relative advantages and uses.
Job I - Marking, sawing, plaining and chiselling operations.
Job II - Preparation of half lap-joint
Job III – Preparation of Mortise and Tenon Joint

Trade –2: FITTING SHOP
Introduction to fitting shop tools, common materials used in fitting shop, description, demonstration, care, use of tools and safety precautions.
Job I-Making a L-Fit from a rectangular piece of MildSteel (MS).
Job II-Making a T-Fit from a rectangular piece of MS.
Job III-Making a V-Fit from a rectangular piece of MS
Job IV-Making a Half round fit from a rectangular piece of MS.

Trade -3: TIN- SMITHY SHOP
Introduction to tin-smithy, specification and use of hand tools, accessories and the safety precautions.
Job I - Preparation of a rectangular tray.
Job II- Preparation of an open scoop/ funnel.
Job III - Preparation of a Single Seam Joint and Double Seam Joint.
Job IV - Preparation of a Corner Seam Joint.
Trade –4: PLUMBING SHOP
Introduction to plumbing –demonstration, use of hand tools, accessories and safety precautions.
Job I – preparation of pipelayout.
Job II – Pipe threading.

Trade -5: BLACK SMITHY
Introduction–demonstration of tools, equipment and safety precautions.
Job I – Preparation of S–Hook.
Job II – Preparation of Chisel

Trade -6: HOUSE WIRING
Demonstration and identification of common electrical materials such as wires, cables, switches, fuses, PVCConduits. Study of electrical safety measures and demonstration about use of protective devices such as fuses, and relays including earthling.
Job I – One lamp controlled by one one-way switch.
Job II – Two lamps in series and parallel connection with one-way switch.
Job III - Florescent lamp and calling bell circuit.
Job IV - One lamp connection with two 2- way switches (stair case connection).
Job V -- House wiring circuit.

REFERENCES
1. LBRCE Workshop LabManual.
II SEM
Pre-requisites: Nil

**Course Educational Objective:** To improve English language proficiency of the students in various aspects like vocabulary, grammar, communication skills, listening skills, reading & writing skills.

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

- **CO1:** Produce a coherent paragraph interpreting a figure/graph/chart/table *(Understand – L2)*
- **CO2:** Comprehend the given texts thoroughly by guessing the meanings of the words contextually *(Understand – L2)*
- **CO3:** Use language appropriately for describing/comparing/contrastings/giving directions & suggestions *(Remember – L1)*
- **CO4:** Write formal/informal dialogues with an understanding of verbal/non-verbal features of communication. *(Understand – L2)*
- **CO5:** Write well structured essays; Reports & Résumé *(Apply – L3)*

**UNIT - I**

*Fabric of Change* - ‘H.G. Wells and the Uncertainties of Progress – Peter J. Bowler’; Reading: Studying the use of Graphic elements in texts; Grammar & Vocabulary: Quantifying Expressions; Adjectives and adverbs; Comparing and Contrasting; Degrees of Comparison; Writing: Information Transfer

**UNIT - II**

*Tools for Life* - ‘Leaves from the Mental Portfolio of a Eurasian – Sui Sin Far’; Reading: Global Comprehension; Detailed Comprehension; Grammar & Vocabulary: Active & Passive Voice; Idioms & Phrases; Writing: Structured Essays using suitable claims and evidences

**UNIT - III**

‘Homi Jahangir Bhabha’;
Grammar & Vocabulary: Words often confused; Common Errors; Writing: Incident & Investigation Reports

**UNIT - IV**

‘Jagadish Chandra Bose’; Grammar & Vocabulary: Use of Antonyms; Correction of Sentences; Writing: Dialogue Writing

**UNIT - V**

‘Prafulla Chandra Ray’; Grammar & Vocabulary: Analogy; Sentence Completion; Writing: Writing a Résumé
TEXT BOOKS:

REFERENCE BOOKS:
Pre-requisites: Nil

Course Educational Objective: In this course, students learn Matrix Algebra and introduced with transformation techniques such as Laplace Transforms and Z – Transforms.

Course Outcomes: At the end of the course, the student will be able to
CO1: Investigate the consistency of the system of equations and solve them (Apply – L3)
CO2: Determine the eigen vectors and inverse, powers of a matrix using Cayley – Hamilton Theorem (Apply - L3)
CO3: Use the concepts of Laplace Transforms to various forms of functions (Understand – L2)
CO4: Solve ordinary differential equations by using Laplace Transforms (Apply – L3)
CO5: Apply Z - Transforms to solve difference equations (Apply – L3)

UNIT – I
System of Linear Equations

UNIT – II
Eigen Values and Eigen Vectors

UNIT – III
Laplace Transforms
Laplace transforms of standard functions –Linear Property - Shifting Theorems, Change of Scale Property
Multiplication and Division by‘t’ – Transforms of derivatives and integrals – Unit step function – Dirac’s delta function.

UNIT – IV
Inverse Laplace Transforms
Inverse Laplace transforms– Linear Property - Shifting Properties - Convolution theorem, Applications of Laplace transforms to ordinary differential equations.

UNIT – V
Z-Transforms
TEXT BOOKS:

REFERENCE BOOKS:
Pre-requisites: Nil

Course Educational Objectives: It enables the students to understand the fundamental concepts of elastic behaviour of materials, lasers, optical fibers, acoustics, ultrasonics, magnetic, dielectric, superconducting and nano materials.

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

CO1: Analyse the different mechanical properties of materials (Understand – L2).
CO2: Apply the lasers and optical fibres in different fields (Apply - L3).
CO3: Summarize the properties of sound waves (Understand – L2).
CO4: Classify the different types of magnetic and dielectric materials (Understand - L2).
CO5: Identify the properties of superconducting and nano materials (Understand – L2).

UNIT – I
Elasticity
Stress, Strain, Hooke’s Law, Elastic behavior of a material, Factors affecting elasticity, Classification of elastic modulus, relation between Young’s, bulk and rigidity modulus, bending of beam – bending moment of a beam and Cantilever (qualitative treatment).

UNIT – II
Lasers and Optical fibers
Optical Fibers: Optical Fiber principle, Structure of optical fiber, numerical aperture and acceptance angle, types of optical fibers - applications.

UNIT – III
Acoustics & Ultrasonics

UNIT – IV
Magnetic & Dielectric materials
Magnetic parameters, Classification of magnetic materials-Diamagnetic, paramagnetic and ferromagnetic materials, Hysteresis loop, soft and hard magnetic materials, Applications of Ferro magnetic materials.
Dielectric polarization - Electronic and ionic polarization, orientation polarization (Qualitative), Local field, ClaussiusMosotti equation, Applications of dielectric materials.

UNIT – V
Superconducting and nanomaterials
Introduction- Meissner effect, Type I and Type II super conductors, Josephson Effect, Applications of super conductors.
Nanomaterials: Introduction, classification, properties, different methods of preparation and applications.
TEXT BOOKS

REFERENCE BOOKS
Pre-requisite: NIL

COURSE EDUCATIONAL OBJECTIVE: The Objective of the course is to make learn the basic elements of C programming, control structures, derived data data types, Modular programming, user defined structures, basics of files and its I/O operations.

COURSE OUTCOMES (COs): At the end of this course, the student will be able to

CO1: Familiar with syntax and semantics of the basic programming language constructs. (Understand - L2)

CO2: Construct derived data types like arrays in solving problem. (Apply - L3)

CO3: Decompose a problem into modules and reconstruct it using various ways of user-defined functions. (Apply - L3)

CO4: Use user-defined data types like structures and unions and its applications to solve problems. (Apply - L3)

CO5: Discuss various file I/O operations and its application. (Understand - L2)

UNIT – I
Introduction to Problem solving through C-Programming: Problem Specification, Algorithm / pseudo code, flowchart, examples.

C-Programming: Structure of C program, identifiers, basic data types and sizes, Constants, variables, Input-output statements, A sample c program, operators, expressions, type conversions, conditional expressions, precedence of operators and order of evaluation.

Control statements: if, if else, else if ladder and switch statements, while, do-while and for statements, break, continue, goto and labels.

UNIT – II
Arrays- concept, declaration, definition, accessing elements, storing elements, two dimensional and multi-dimensional arrays.

Character Arrays: declaration, initialization, reading, writing strings, string handling functions, Pre-processor Directives and macros.

Applications of Arrays: Linear search, Binary search, Bubble Sort.

UNIT – III
Pointers- concepts, declaring & initialization of pointer variables, pointer expressions, pointer arithmetic, pointers and arrays, pointers and character arrays, pointers to pointers.

Functions: basics, category of functions, parameter passing techniques, recursive functions-comparison with Iteration, Functions with arrays, Standard library functions, dynamic memory management functions, command line arguments.

Storage classes - auto, register, static and extern,

UNIT – IV
Derived types- structures- declaration, definition and initialization of structures, accessing structures, nested structures, arrays of structures, structures and functions, pointers to structures, self-referential structures, unions, typedef .
UNIT – V
Files – concept of a file, text files and binary files, streams, standard I/O, Formatted I/O, file I/O operations, error handling.

TEXT BOOKS:

REFERENCE BOOKS:
Prerequisites: Nil

Course Educational Objectives: To learn the components of airplane and different types of flight vehicles, the basic aspects of aerodynamics and airfoils, the elements of propulsive systems, function of structural components in wing and fundamental aspects of flight vehicle in space.

Course Outcomes: At the end of the semester, the student will be able to
CO1: Describe functions of various external and internal components of an airplane (Remember - L1)
CO2: Classify the various forces and moments acting on an airfoil (Understand - L2)
CO3: Differentiate the working principles of various aircraft engines systems (Understand - L2)
CO4: Formulate the basic aspects of space flight (Apply - L3)

UNIT - I
BASIC ASPECTS: History-Early Planes, Components of Airplane and Their Functions, Types of Flight Vehicles, Classifications, Standard Atmosphere, Altitude, Hydrostatic Equation, Geopotential and Geometric Altitudes

UNIT - II

UNIT - III

UNIT - IV

UNIT - V

TEXT BOOK

REFERENCES
Pre-requisites: Nil

Course Educational Objectives

• To enable the student to understand the importance of constitution.
• To understand the structure of Executive, Legislature and Judiciary.
• To understand Philosophy of fundamental rights and duties.
• To understand the autonomous nature of constitution bodies like Supreme Court and High Court Controller and Auditor General of India and Election Commission of India.
• To understand the Central and State relation, financial and administrative.

Course Outcomes: At the end of the course, the student shall be able to

CO1: Understand history and philosophy of constitution with reference to Preamble, Fundamental Rights and Duties (Understand – L2).

CO2: Understand the concept of Unitary and Federal Government along with the role of President, Prime Minister and Judicial System (Understand – L2).

CO3: Understand the structure of the state government, Secretariat, Governor and Chief Minister and their functions (Understand – L2).

CO4: Learn local administration viz. Panchayat, Block, Municipality and Corporation (Understand – L2).

CO5: Learn about Election Commission and the process and about SC, ST, OBC and women (Understand – L2).

UNIT – I:

UNIT – II:
Union Government and its Administration Structure of the Indian Union: Federalism – Centre – State relationship, President: Role, Power and Position. Prime Minister (PM) and Council of Ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha. The Supreme Court and High Court: Powers and Functions.
UNIT – III:
State Government and its Administration Governor – Role and Position – Chief Minister (CM) and Council of Ministers. State Secretariat: Organization, Structure and Functions.

UNIT – IV:
A Local Administration -- Role and Importance, Municipalities – Mayor and Role of Elected Representative, Panchayati Raj: Functions of Panchayati Raj Institution, Zilla Panchayat, Elected Officials and their roles, Village level – Role of Elected and Appointed officials.

UNIT – V:

Reference Books
3. J.A. Siwach, Dynamics of Indian Government and Politics.

E-Resources:
1. nptel.ac.in/courses/109104074/8.
2. nptel.ac.in/courses/109104045.
3. nptel.ac.in/courses/101104065.

* * *
Pre-requisites: Nil

Course Educational Objective: To improve the proficiency of students in English with an emphasis on better communication in formal and informal situations; Develop speaking skills required for expressing their knowledge and abilities and to face interviews with confidence.

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

- **CO1:** Introduce oneself and others using appropriate language and details (Understand – L2)
- **CO2:** Comprehend short talks and speak clearly on a specific topic using error free English (Understand – L2)
- **CO3:** Report effectively after participating in informal discussions ethically (Remember – L1)
- **CO4:** Interpret data aptly, ethically & make oral presentations (Apply – L3)

Syllabus: Professional Communication Skills Lab (PCS) shall have two parts:

- **Computer Assisted Language Learning (CALL) Lab** for 60 students with 60 systems, LAN facility and English language software for self-study by learners.
- **Interactive Communication Skills (ICS) Lab** with movable chairs and audio-visual aids with a P.A System, a T.V., a digital stereo – audio & video system and camcorder etc.

Exercise – I

**CALL Lab: Understand** - Sentence structure

**ICS Lab: Practice** - Listening: Identifying the topic, the context and specific information
Speaker: Introducing oneself and others

Exercise – II

**CALL Lab: Understand** - Framing questions

**ICS Lab: Practice** - Listening: Answering a series of questions about main idea and supporting ideas after listening to audio text
Speaker: Discussing in pairs/small groups on specific topics; Delivering short structured talks using suitable cohesive devices (JAM)

Exercise – III

**CALL Lab: Understand** - Comprehension practice – Strategies for Effective Communication

**ICS Lab: Practice** - Listening: Listening for global comprehension and summarizing
Speaker: Discussing specific topics in pairs/small groups, reporting what is discussed
Exercise – IV

**CALL Lab: Understand** - Features of Good Conversation – Strategies for Effective Communication.

**ICS Lab: Practice** - Listening: Making predictions while listening to conversations/transactional dialogues with/without video
Speaking: Role – plays – formal & informal – asking for and giving information / directions / instructions / suggestions

Exercise – V

**CALL Lab: Understand** - Features of Good Presentation, Methodology of Group Discussion

**ICS Lab: Practice** - Introduction to Group Discussions

Listening: Answering questions, identifying key terms and understanding concepts
Speaking: Formal Oral & Poster presentations on topics from academic contexts without the use of PPT

**Lab Manual:**


**Suggested Software:**

1. Digital Mentor: Globarena, Hyderabad, 2005
4. Dorling Kindersley Series of Grammar, Punctuation, Composition, USA, 2001
Pre - requisites: Nil

Course Educational Objectives: This course enables the students to acquire theoretical ideas, analytical techniques, and graphical analysis, by completing a host of experiments with the procedures and observational skills for appropriate use of simple and complex apparatus.

Course Outcomes: At the end of the course, the student will be able to,
CO1: Analyze the wave characteristics of light (Understand – L2).
CO2: Determine the wavelength of laser source and width of slit (Apply - L3).
CO3: Estimate the magnetic field using Stewart’s and Gee’s apparatus and the rigidity modulus of material using Torsional Pendulum (Understand - L2).
CO4: Identify the phenomena of resonance in strings (Understand – L2).
CO5: Improve report writing skills and individual team work with ethical values (Understand – L2)

List of Experiments
(Any of the 10 experiments are required to be conducted)

General experiments:
1. Determine the frequency of AC supply by using Sonometer.
2. Verification of Laws of vibrations in stretched strings -Sonometer.
3. Determine the frequency of a tuning fork by using Melde’ s arrangement.
4. Study the magnetic field along the axis of a current carrying circular coil using Stewart’s & Gee’s apparatus and to verify Biot - Savart’s law.
5. Determine the rigidity modulus of a given material using Torsional pendulum.
6. Determination of Young’s modulus by the method of single Cantilever oscillations.
7. Measurement of magnetic susceptibility by Gouy’s method.
9. Determination of dielectric constant by charging and discharging method.

Optics lab experiments:
12. Determine the width of a single slit by forming diffraction pattern.
13. Determine the acceptance angle and numerical aperture of a fiber.
14. Measure the bending losses in the optical fiber cable at different wavelengths.
Pre-requisite : NIL

Course Educational Objective: The objective of the course is to learn the basic elements of C Programming Structures like Data Types, Expressions, Control Statements, and Various I/O Functions and to solve simple mathematical problems using control structures. Design and implementation of various software components, which solve real world problems.

Course Outcomes (CO): At the end of this course, the student will be able to:

CO1: Apply control structures of C in solving computational problems.(Apply - L3)
CO2: Implement derived data types & use modular programming in problem solving(Apply- L3)
CO3: Implement user defined data types and perform file operations.(Apply- L3)
CO 4: Improve individual / teamwork skills, communication & report writing skills with ethical values.

# of modules at most 10 can be taught and all the modules should be in line with theory.

Module 1: Introduction to Raptor Tool.
Module 2: Problem solving using Raptor Tool
Module 3: Exercise Programs on Basics of C-Program.
Module 4: Exercise Programs on Control Structures.
Module 5: Exercise Programs on Loops & nesting of Loops.
Module 6: Exercise Programs on Arrays & Strings.
Module 7: Exercise Programs on Pointers.
Module 8: Exercise Programs on Functions.
Module 9: Exercise Programs on user defined data types.
Module 10: Exercise Programs on Files.
PRE-REQUISITES: Engineering Graphics, Mathematics

Course Educational Objective: The course aims to teach developing and drawing of engineering objects using AutoCAD. The student will be taught the fundamentals of AutoCAD and then asked to develop the projections of objects related to straight lines, planes, solids, orthographic and isometric views, development of surfaces using principles of engineering drawing.

Course Outcomes: At the end of the course, the student will be able to-
CO1: Draw simple objects using functional tools in AutoCAD. (Understand-L2)
CO2: Develop and draw the positions and views of points, lines, planes and solids using AutoCAD. (Understand-L2)
CO3: Develop and draw the orthographic and isometric projections of simple objects using Auto-CAD. (Understand-L2)
CO4: Develop and draw the projections of the solids by developing the surfaces using AutoCAD. (Understand-L2)

BASIC AUTOCAD COMMANDS
1. Basic drawing commands (line, circle, arc, ellipse, polygon, and rectangle).
2. Edit commands (copy, move, erase, zoom).
3. Array commands (polar array, rectangular array, P-edit, divide, pline, offset).
4. Hatching & line commands (hatching with different angles & different types of lines).
5. Mirror & trim commands (mirror an object, trim, extend a line, chamfer &fillet, explode).
6. Dimensioning & text commands (linear, angular, radius, diameter & text).

PROJECTION OF POINTS, LINES AND PLANES
2. Projection of lines parallel to both reference planes.
3. Projection of lines parallel to one reference plane & inclined to other reference plane.

PROJECTION OF SOLIDS
1. Projection of solids in simple position and transfer of points.
2. Projection of solids with axes inclined to one reference plane & parallel to other.
3. Sections of solids: Simple sections

ORTHOGRAPHIC PROJECTIONS
1. Conversion of plane figures to orthographic views.
2. Conversion of circular figures to orthographic views.
3. Conversion of combination of plane figures and circular figures to orthographic views.
ISOMETRIC PROJECTIONS
1. Conversion of plane figures to isometric views.
2. Conversion of circular figures to isometric views.
3. Conversion of combination of plane figures and circular figures to isometric views.

DEVELOPMENT OF SURFACES
1. Parallel-line development (prism, cylinder) for objects in simple position.
2. Radial-line development (cone, pyramid) for objects in simple position.

TEXTBOOK

REFERENCE
III SEM
Pre-requisites: None

Course Educational Objective: The main objective of this course is to enable the students learn Numerical Techniques for solving the equations and apply interpolation techniques. They will also learn about the Fourier analysis of single valued functions, Multiple Integrals in different coordinate systems and Vector differentiation.

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

CO1: Estimate the best fit polynomial for the given tabulated data using Interpolation.(Understand – L2)
CO2: Apply numerical techniques in solving of equations and evaluation of integrals. (Apply – L3)
CO3: Discriminate among Cartesian, Polar and Spherical coordinates in multiple integrals and their respective applications to areas and volumes. (Apply – L3)
CO4: Generate the single valued functions in the form of Fourier series and obtain Fourier series representation of periodic function. (Apply – L3)
CO5: Evaluate the directional derivative, divergence and angular velocity of a vector function. (Apply – L3)

UNIT – I
Interpolation and Finite Differences

UNIT – II
Numerical Solution of Equations and Numerical Integration
Solutions of Algebraic and Transcendental Equations – Regula Falsi method and Newton Raphson Method in one variable.
Numerical Integration

UNIT – III
Multiple Integrals
Multiple integrals - double and triple integrals (Cartesian, polar, spherical coordinates) – Changing the order of Integration.

UNIT IV
Fourier series
Determination of Fourier coefficients – Fourier series – even and odd functions – Fourier series in an arbitrary interval– Half-range sine and cosine series

UNIT – V
Vector Differentiation
Vector Differentiation: Gradient- Directional Derivatives -Divergence – Solenoidal fields- Curl – Irrotational fields-potential surfaces - Laplacian and second order operators
TEXT BOOKS


REFERENCES

**Prerequisite:** Physics

**Course Educational Objective:** This course enables student to illustrate the basics of applied electricity and electronics.

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

- CO1: Apply network reduction techniques to simplify electrical circuits. *(Apply-L3)*
- CO2: Illustrate the working principle of DC machines and transformers. *(Understand-L2)*
- CO3: Understand V-I characteristics of semiconductor devices. *(Understand-L2)*
- CO4: Illustrate the configuration of Transistors and their applications. *(Understand-L2)*

**UNIT – I: Electrical Circuit Fundamentals**
Basic definitions, Types of elements-active and passive, Ohm’s Law, Kirchhoff’s Laws-Network reduction techniques- series, parallel, star to delta, delta to star transformations, source transformation (for resistive networks), mesh analysis, nodal analysis (Basic problems).

**UNIT – II: DC Network Theorems and AC Fundamentals**
Theorems-Superposition, Thevenin’s, Norton’s and Maximum Power Transfer (Basic problems in DC excitation only)
Peak, R.M.S, average, instantaneous values, form factor and peak factor– periodic waveforms – Phase and Phase difference –concepts of reactance, impedance, susceptance and admittance, real, reactive and apparent powers, Power Factor- resonance-bandwidth-quality factor.

**UNIT – III: DC Machine Fundamentals and Single-Phase Transformers**
DC generator principle, constructional details, emf equation, types of generators (Theory only).
DC motor principle, Back emf, types of motor (Theory only).
Construction and Principle of operation of single-phase transformers-Emf equation

**UNIT–IV: P-N Junction Diode and Zener Diode**
**P-N Junction Diode:** Operation and V-I characteristics of PN junction diode, Rectifiers-Half Wave Rectifier, Full Wave Rectifier-Bridge type, Zener Diode-Voltage Regulator.

**UNIT – V: Transistors**
Construction, Principle of Operation, Symbol, CB, CE configurations, JFET, MOSFET and application of transistor as an amplifier (Theory only).

**TEXT BOOKS:**

**REFERENCE:**
Prerequisites: Nil

Course Educational Objectives: To demonstrate the properties of fluids and behavior of fluids under static conditions, differential relations for fluid flows, features of flow through pipes and to understand the working of Hydraulic turbines and Hydraulic pumps.

Course Outcomes: At the end of the course, the student will be able to
CO1: Analyze the forces acting on objects submerged in fluids under static conditions (Analyze-L4)
CO2: Apply differential relations to characterize the behavior of fluid flow (Apply-L3)
CO3: Apply the conservation laws to solve elementary fluid flow problems (Apply-L3)
CO4: Analyze the simple pipe network for fluid transportation (Apply-L3)
CO5: Analyze the performance of various hydraulic turbines and pumps (Analyze-L4)

UNIT - I
INTRODUCTION: Fluids and Continuum, Classification of Fluids, Properties of Fluid – Pressure, Temperature, Density, Specific Weight, Specific Gravity, Viscosity-Newton’s Law of Viscosity, Compressibility, Surface Tension, Capillarity, Vapour Pressure,
Fluid Statics: Pressure Acting at a Point in a Static Fluid-Pascal’s Law, Basic Equation of Fluid Statics-Hydrostatic Pressure Distribution, Hydrostatic Forces on Submerged Plane Surfaces, Manometers, Buoyancy and Stability, Hydostatic pressure distribution in earth’s atmosphere

UNIT - II
ANALYSIS OF FLUID FLOW: Eulerian and Lagrangian Approaches, Velocity Field, Flow Patterns- Pathline, Streamline, Streakline, Timeline, Stream Tube.

UNIT - III
DIMENSIONAL ANALYSIS AND SIMILARITY: Introduction, Principle of Dimensional Homogeneity, Buckingham’s Pi Theorem, Dimensionless Groups, Similarity.

UNIT IV
PERFORMANCE OF HYDRAULIC TURBINES: Geometric Similarity, Unit and Specific Quantities, Characteristic Curves, Governing of Turbines, Cavitation, Surge Tank, Water Hammer.
UNIT V

TEXT BOOK

REFERENCES
Prerequisites: Nil

Course Educational Objectives: To learn the basic concepts of energy conversions, laws of thermodynamics, concept of entropy, the properties of different gas mixtures and pure substances and basic aspects of ideal thermal cycles.

Course Outcomes: At the end of the course, the student will be able to
CO1: Describe the thermodynamic properties of various systems (Understand-L2)
CO2: Apply the laws of thermodynamics to analyze various thermal systems. (Apply-L3)
CO3: Analyze the entropy change of various processes. (Apply-L3)
CO4: Analyze the properties of different gas mixtures and pure substances. (Analyze-L4)
CO5: Analyze ideal gas power cycles and refrigeration cycle to estimate various performance parameters (Analyze-L4)

UNIT - I

UNIT - II

UNIT - III

UNIT – IV

UNIT - V
REFRIGERATION CYCLES: Reversed Carnot Cycle, Bell-Coleman Cycle, Simple Vapour Compression Cycle.

TEXT BOOK

REFERENCES
Prerequisites: Engineering Mechanics

Course Educational Objectives: To learn the basic concepts of stress, strain and relations based on linear elasticity, shear force and bending moment diagrams on beams, theory of simple bending and torsion.

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

CO1: Analyze the stress and strain behaviour in different types of members under various load conditions (Analyse-L4)

CO2: Evaluate stress, shear force, bending moment, deflection for beams and torsion for circular shafts under different loading conditions (Apply-L3)

CO3: Evaluate shear stress distributions over different cross sections (Apply-L3)

CO4: Apply the failure theories on structural members (Apply-L3)

CO5: Analyze internal stresses due to internal pressures in thin and thick cylindrical shells. (Apply-L3)

UNIT - I
SIMPLE STRESSES AND STRAINS: Stresses and Strains Due to Axial Force, Hooke’s Law, Factor of Safety, Stepped Bars – Uniformly Varying Sections - Stresses in Composite Bars Due toAxial Force and Temperature - Strain Energy Due to Axial Force, Stresses Due to Sudden Loads and Impact. Lateral Strain: Poisson’s Ratio - Change in Volume – Shear Stress - Shear Strain - Relationship Between Elastic Constants

UNIT - II
SHEAR FORCE AND BENDING MOMENT: Relationship Between Loading - Shear Force and Bending Moment - Shear Force and Bending Moment Diagrams for Cantilever, Simply Supported and Overhanging Beams Subjected to Concentrated Loads and Uniformly Distributed Loads Only - Maximum Bending Moment and Point of Contra Flexure.

UNIT - III

TORSION: Theory of Torsion and Assumptions - Derivation of the Torsion Equation, Polar Modulus, Power Transmitted by a Shaft, Stresses in Solid and Hollow Circular Shafts

UNIT – IV
SHEAR STRESSES: Introduction, Derivation of Shear Stress Distribution Formula – Shear Stress Distribution Across Various Beam Cross Sections Like Rectangular, Circular, Triangular, I and T Sections.

PRINCIPAL STRESSES: State of Stress at a Point-Principal Plane-Principal Stresses- Normal, Tangential and Resultant Stresses On Inclined Planes-Member Subjected to Direct Stress in One Plane, Two Mutually Perpendicular Planes- Two Mutually Perpendicular Planes with Simple Shear. Failure Theories: Maximum Stress Theory – Maximum Strain Theory – Maximum Shear Stress Theory –Distortion Energy Theory – Maximum Strain Energy Theory
UNIT – V

DEFLECTION OF BEAMS: Introduction to Deflection, Deflection and Slope of Beams Subjected to Point Load And Uniformly Distributed Load- Differential Equation of Elastic Line - Deflection of Statically Determinate Beams-Simply Supported Beam, Cantilever Beam, Overhang Beam with Point Load And Uniformly Distributed Load - Macaulay’s Method for Prismatic Members - Area Moment Method for Stepped Beams with Concentrated Loads.

Thin, Thick Shells: Introduction- Thin Cylindrical Vessel Subjected to Internal Pressure-Stresses Due to Internal Pressure- Hoop and Longitudinal Stresses -Efficiency of Joint- Stresses in a Thick Cylindrical Shell-Lame’s Equations.

TEXT BOOK

REFERENCES
Pre-requisites: Nil

Course Objectives:
In this course the student will learn about

- Environmental issues like over population, human health etc related to local, regional and global levels.
- The necessity of resources, their exploitation and sustainable management.
- The interactions of human and ecosystems and their role in the food web in the natural world.
- The global biodiversity, threats to biodiversity and its conservation.
- Environmental problems like pollution, disasters and possible solutions.
- The importance of environmental decision making in organizations through audits.

Course Outcomes:
After the completion of this course, the students will able to

CO1: Identify environmental problems arising due to engineering and technological activities that help to be the part of sustainable solutions. (Remember - L1)

CO2: Evaluate local, regional and global environmental issues related to resources and their sustainable management. (Understand – L2)

CO3: Realize the importance of ecosystem and biodiversity for maintaining ecological balance. (Understand – L2)

CO4: Acknowledge and prevent the problems related to pollution of air, water and soil. (Apply – L3)

CO5: Identify the significance of implementing environmental laws and abatement devices for environmental management. (Understand – L2)

Unit I
Nature and scope of Environmental Problems
- Introduction to Environmental Science
- Population explosion, variations among nations
- Resettlement and Rehabilitation - Issues and possible solutions
- Environmental hazards – causes and solutions. Biological hazards – AIDS, Malaria, Chemical hazards- BPA, PCB, Phthalates, Mercury, Nuclear hazards- Risk and evaluation of hazards.
- Role of Information Technology in environmental management and human health

Unit II
Natural Resources and Conservation

Introduction and classification of Natural Resources
- Forest resources: Use and over-exploitation, deforestation, Timber extraction, mining, dams and their effects on forests and tribal people
- Water resources: Use and over-utilization of surface and ground water, conflicts over water, interlinking of rivers, dams-benefits and problems, Rain water harvesting
- Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources
- Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, soil salinity
• Energy resources: Growing energy needs renewable, non-renewable and alternate energy resources

Unit III
Ecology and Biodiversity

• Structure and functions of an Ecosystem, Food chains and Food webs, Ecological succession, Ecological pyramids, Biogeochemical cycles
• Biodiversity, Values of biodiversity, Bio geographical classification of India. Endangered and endemic species of India, Threats to biodiversity; Man and wild life conflicts, Conservation of biodiversity: In-situ and Ex-situ conservation methods

Unit IV
Environmental Pollution
Introduction to Environmental Pollution Causes, effects and control measures of:
Air pollution, Water pollution, Noise pollution, Solid Waste Management – Sources, Classification, effects and control measures of Municipal solid waste, Biomedical waste & Hazardous and e-waste, Disaster Management.

Unit V
Environmental Management
• Sustainable development and unsustainability
• Climate disruption, Green house effect, Ozone layer depletion and Acid rain. Stockholm Conference
• Environmental Impact Assessment (EIA)
• Green building
• Environmental Law- Air, Water, Wild life, Forest, and Environmental protection act

Text Books:

Reference Books:
Pre-requisites: Nil

Course Educational Objective: This lab course enables the student to demonstrate the knowledge of electrical and electronic equipment and analysis of electric circuits. It also deals with plotting characteristics of basic semiconductor devices.

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

CO1: Examine electrical circuits using network theorems. (Apply-L3)
CO2: Analyze VI characteristics of semiconductor devices. (Understand-L2)
CO3: Analyze electrical circuits. (Understand-L2)
CO4: Design Resonance circuits. (Apply-L3)

List of Experiments
(Any of the 10 experiments are required to be conducted)

1. V-I relations of passive elements (R, L, C).
2. Verification of Kirchhoff’s Laws (KCL and KVL.).
3. Measurement of active power, reactive power and power factor of AC circuits.
4. Calculation of Resonant frequency, Bandwidth and Quality factor of resonant circuits.
5. Verification of Superposition theorem.
6. Verification of Thevenin’s and Norton’s theorems.
7. Verification of Maximum power transfer theorem.
8. Plot the V-I characteristics of a p-n junction diode.
9. Plot the V-I characteristics of Zener diode.
10. Plot the V-I characteristics of BJT.
11. Calculation of ripple factor and regulation of Full Wave Rectifier with and without filters.
12. Plot the V-I characteristics of MOSFET.
PRE-REQUISITES: Engineering Mechanics Lab

COURSE EDUCATIONAL OBJECTIVE:
In this course student will learn about the insights of calculating the discharge in various flow measuring devices, performance parameters of hydraulic machines.

COURSE OUTCOMES: After completion of the course students are able to:
CO1: Apply the principles Fluid mechanics in discharge measuring devices used in pipes channels and tanks (Apply-L3)
CO2: Analyze the performance of various hydraulic machines (Analyze-L4)

LIST OF EXPERIMENTS
At least 10 Experiments are required to be conducted
1. Verification of Bernoulli’s Theorem
2. Calibration of Venturi meter
4. Determination of friction factor for a given pipe line
5. Determination of loss of head due to sudden contraction in a pipeline
6. Determine Co-Efficient of Impact of jets on Vanes.
7. Performance Test on Pelton Wheel.
8. Performance Test on Kaplan Turbine.
10. Performance Test on Reciprocating Pump.
13. Flow Visualization study using Water Flow Channel

REFERENCE: Lab Manual
Prerequisites: Engineering Mechanics and Strength of Materials

**Course Educational Objectives:** To learn the methods to predict the response of a structure under loading and its susceptibility to various failure modes

**Course Outcomes:** At the end of the semester, the student will be able to
CO1: Analyze the various materials under different equilibrium loading conditions. (Analyze-L4)
CO2: Perform tests and analyze materials subjected to tension, torsion, bending, and buckling (Apply-L3)

Any of the ten experiments are required to be conducted

1. Tension test on mild steel rod.
2. Deflection test on Simply supported beam.
3. Deflection test on Cantilever beam.
4. Deflection test on overhang beams.
5. Compression test on helical spring.
6. Torsion test on mild steel rod.
7. Impact test on metal specimen
   i) Izod ii) Charpy.
8. Brinell hardness test on metals.
9. Rockwell Hardness test on metals.
10. Shear test on metals.
B.Tech. (III Sem.)

PRE-REQUISITES: Engineering Graphics, Working knowledge of Microsoft Windows, Basic knowledge AutoCAD & CAD drawing

Course Educational Objective: The course aims to teach developing and drawing of engineering objects using AutoCAD. The student will be taught the advanced features of AutoCAD related to Manipulating Objects and Data, Blocks and Attributes, Layer Management, Layouts, Plotting, Template Drawing Creation.

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

CO1: Draw objects using functional tools in AutoCAD. (Understand-L2)
CO2: Create blocks and attributes using AutoCAD. (Apply-L3)
CO3: Develop Layout Viewports and Dimensioning in Layouts using Auto-CAD. (Apply-L3)
CO4: Draw Template Drawing Using Drawing Templates using AutoCAD. (Understand-L2)

Drawing Objects Multilines, Donuts, Construction Geometry, Point Objects, Revision Clouds, Wipeouts, Boundaries, Regions

Manipulating Objects and Data Using Quick Select, Purging Objects, Exploding Objects, Dividing and Measuring Objects, Geometry Calculator

Dimensioning-Center Marks, Ordinate Dimensions, Geometric Dimensioning and Tolerances, Dimension Styles and Overrides Reusable Content Using Design Center, Creating Custom Tool Palettes, Managing and Sharing Tool Palettes, Using External References

Blocks and Attributes Blocks, Attributes, Edit and Extract Attributes, Dynamic Blocks, working with Dynamic Blocks, Creating Dynamic Block Definitions, Dynamic Block Authoring Tools, Additional Visibility Options


TEXTBOOK


REFERENCE

IV SEM
Pre-requisite(s) : None

Course Educational Objective: The objective of this course is to provide students with the foundations and applications of probabilistic and statistical methods mainly used in varied applications in engineering and science.

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

CO1: Understand various probabilistic situations using the various laws of probability and random variables (Understand - L2)

CO2: Apply probability distributions like Binomial, Poisson, Normal and Exponential distributions in solving engineering problems (Apply - L3)

CO3: Calculate the standard error of sampling distribution and confidence intervals for parameters like mean and proportion based on the sample data. (Apply - L3)

CO4: Analyze the data scientifically with the appropriate statistical methodologies to apply the suitable test of hypothesis (Analyze - L4)

CO5: Construct the regression lines to predict the dependent variables and calculate the Correlation Coefficient for a bivariate statistical data. (Apply – L3)

Unit-1:
Probability and Random variables
Probability, Sample space and events, Additive Rule, Conditional probability, Multiplicative rule, Baye’s theorem.

Unit-2:
Probability Distributions
Binomial distribution, Poisson distribution, Poisson approximation to Binomial distribution, Exponential distribution, Normal distribution, Normal approximation to Binomial distribution.

Unit-3:
Sampling distribution & Estimation
Population, sample, parameter, statistic, sampling distribution, Standard error, Types of sampling, Sampling distribution of means and sampling distribution of variance, Parameter estimations – point estimation and interval estimation for mean and proportions.

Unit-4:
Tests of Hypothesis
Hypothesis, Null and Alternate Hypothesis, Type I and Type II errors, level of significance.
Z-test for means and proportions, t-test for single mean, difference of means, paired t-test, F-test for equality of population variances, $\chi^2$ - test for goodness of fit and independence of attributes.
Unit-5:  
Correlation & Regression  
Karl Pearson’s coefficient of correlation, linear Regression, Regression lines, Regression coefficients, Spearman’s Rank correlation coefficient, Spearman’s Rank correlation for repeated ranks.

TEXT BOOKS


REFERENCES

Pre-requisites: Nil

Course Educational Objectives: The objectives of this course are to acquire knowledge on structure of metals and alloys, understand the concept of alloys and equilibrium diagrams and to learn primary manufacturing processes, working of basic machines and various operations to be performed and also about conventional and unconventional machining processes.

Course Outcomes: At the end of the semester, the student will be able to

CO1: Estimate the properties of the metals and alloys based on structures. (Understand-L2)
CO2: Classify, construct and analyze equilibrium diagrams, various ferrous, non-ferrous metals and alloys. (Understand-L2)
CO3: Acquire knowledge of the basic aspects of casting process. (Understand-L2)
CO4: Know the various basic concepts of welding process, metal forming process and sheet metal operations in the manufacturing of products. (Understand-L2)
CO5: Know different conventional and unconventional machining processes while manufacturing a product. (Understand-L2)

UNIT – I

UNIT – II
STEEL: Classification of steels, structure, properties and applications of plain carbon steel, low carbon steel, medium carbon steel and high carbon steel.
CAST IRONS: structure, properties and applications of white cast iron, malleable cast iron, grey cast iron, spheroidal graphite cast iron.
NON-FERROUS METALS AND ALLOYS: structure, properties and applications of copper and its alloys, Aluminium and its alloys.

UNIT – III

UNIT - IV
METAL FORMING PROCESSES: Types of Rolling Mills and Products; Principles of Forging - Types of Forging-Smith Forging, Drop Forging.

UNIT - V
MACHINING PROCESSES: Tool Geometry; Cutting Tool & Tool Wear; Cutting Materials; Cutting Fluids; Introduction and Working Principle of Lathe and Operations
INTRODUCTION TO UNCONVENTIONAL MACHINING PROCESSES: Classification of Unconventional Machining Processes. Abrasive Jet Machining, Ultrasonic Machining, Laser Beam Machining

TEXT BOOK

REFERENCES
Pre-requisites: Engineering Fluid Mechanics

Course Educational Objective: To learn the theoretical methods to solve the potential flow problems, potential flow theory to solve for airfoil characteristics, the finite wing theory and properties of viscous flows and boundary layer development over flat plate.

Course Outcomes: At the end of the semester, the student will be able to
CO1: Apply Laplace equation for obtaining 2D and axisymmetric solutions. (Apply-L3)
CO2: Apply conformal transformation to from aerodynamic shapes. (Apply-L3)
CO3: Apply potential flow theory to solve for airfoil characteristics. (Apply-L3)
CO4: Apply the Prandtl’s lifting line theory to predict finite wing properties. (Apply-L3)
CO5: Analyze the effect of boundary layer on flow over objects. (Analyze-L4)

UNIT - I

UNIT - II
CONFORMAL TRANSFORMATION: Introduction, Basic Principles, Methods for Performing Transformation, Kutta-Joukowski Transformation, Transformation of Circle to Straight Line, Transformation of Circle to Ellipse, Transformation of Circle to Symmetrical Aerofoil, Transformation of Circle to Cambered Aerofoil

UNIT - III

UNIT - IV

UNIT - V
BOUNDARY LAYER: Introduction, Boundary Layer Development, Boundary Layer Thickness, Displacement Thickness, Momentum Thickness, Energy Thickness, Types of Boundary Layer, Momentum Integral Estimates- Karman Analysis of the Flat Plate, Boundary Layer Equations-2D Flow, Boundary Layer Growth on a Flat Plate-Blasius Solution, Boundary Layer with Pressure Gradient

TEXT BOOK

REFERENCES
Pre-requisites: Engineering Mechanics and Strength of Materials

Course Educational Objectives: To learn the basic aspects of elasticity, characteristics of statically determinate and indeterminate structures, energy methods and theorem applicable to beams and trusses, behavior of columns under loading conditions

Course Outcomes: At the end of the semester, the student will be able to
CO1: Solve problems related to elastic members by applying stress-strain relations (Apply-L3)
CO2: Analyze the behavior of beams, frames and trusses under various loading conditions (Analyze-L4)
CO3: Analyze the statically indeterminate structures under various loading conditions (Analyze-L4)
CO4: Evaluate the strain energy stored in the structural members (Apply-L3)
CO5: Analyze the buckling of columns and compressive member under various loading conditions (Analyze-L4)

UNIT - I
BASIC ELASTICITY: Concept of Principal Planes-Principal Stresses-Determination of Normal and Tangential Stresses-Mohr’s Circle. Basic Elasticity Stresses and Strains, Equations of Equilibrium, Plane Stress and Plane Strain Problems, Compatibility Equations, Stress - Strain Relations, Airy’s Stress Function.

UNIT - II

UNIT - III

UNIT - IV
ENERGY METHODS: Strain Energy Due to Axial Loading, Strain Energy Due to Bending– Strain Energy Stored by A Beam Subjected to Uniform Bending Moment- Work Done by A Force On a Member-Law’s of Reciprocal Deflections- Castigliano’s First Theorem- Castigliano’s Second Theorem -Maxwell's Reciprocal Theorem, Unit Load Method - Application to Beams and Trusses.

UNIT – V
TEXT BOOKS

REFERENCES
B.Tech. (IV Sem.)  20HS01 – UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY

Pre-requisites: Nil

Course Educational Objective: 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.

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

CO1: Apply the value inputs in life and profession (Apply – L3)
CO2: Distinguish between values and skills, happiness and accumulation of physical facilities, the self, and the Body (Understand – L2)
CO3: Understand the role of a human being in ensuring harmony in society (Understand – L2)
CO4: Understand the role of a human being in ensuring harmony in the nature and existence. (Understand – L2)
CO3: Distinguish between ethical and unethical practices (Apply – L3)

UNIT-I: Need, Basic Guidelines, Content and Process for Value Education

‘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, Understanding Happiness and Prosperity

UNIT-II: Understanding Harmony in the Human Being - Harmony in Myself!

Understanding human being as a co-existence of the sentient ‘I’ and the material ‘Body’; Understanding the needs of Self (‘I’) and ‘Body’ - happiness and physical facility; Understanding the Body as an instrument of ‘I’ (I being the doer, seer and enjoyer);

Understanding the characteristics and activities of ‘I’ and harmony in ‘I’; Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail


Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship;

Understanding the harmony in the society: Resolution, Prosperity, fearlessness and co-existence as comprehensive Human Goals; Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family, Gratitude as a universal value in relationships.
UNIT-IV: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

Understanding the harmony in the Nature; Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self regulation in nature; Understanding Existence as Coexistence of mutually interacting units in all-pervasive space; Holistic perception of harmony at all levels of existence.

UNIT-V: 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, Strategy for transition from the present state to Universal Human Order

TEXT BOOKS

Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

REFERENCES

3. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
Pre-requisites: Engineering workshop

Course Educational Objectives:
The objectives of the course are to provide hands-on laboratory experience to acquire basic knowledge in the area of casting, welding and its equipment, lathe machine and special machine operations.

COURSE OUTCOMES: After completion of the course students are able to:
CO1: Design and develop a product using casting (Apply-L3)
CO2: Fabricate machine components with suitable welding, lathe and other machining operations (Understand-L2)
CO3: Manufacture plastic components using various plastic processing techniques (Understand-L2)

I. METAL CASTING LAB
1. Pattern Design and making - for one casting drawing.
2. Moulding, Melting and Casting - 1 Exercise

II. WELDING LAB
1. ARC Welding Lap & Butt Joint - 2 Exercises
2. Spot Welding - 2 Exercises

III PROCESSING OF PLASTICS
1. Injection Moulding
2. Blow Moulding

IV MACHINE TOOLS LAB
1. Lathe Operations
2. Special Machines: Drilling, Shaping, Milling Grinding (Surface Grinding).
3. Preparation of Single Point Cutting Tool
Prerequisite: Thermal Engineering

Course Objectives: The main objective of this course is to familiarize the principles and its evaluation of various performance parameters of mechanical systems and its impact on global environment.

Course Outcomes: After the completion of the course, students should be able to
CO1: Estimate various fuel characteristics through experimental testing (Apply-L3)
CO2: Analyze the performance characteristics of Internal Combustion Engines (Analyze-L4)
CO3: Evaluate the performance parameters of refrigeration and air conditioning systems (Apply-L3)

LIST OF EXPERIMENTS (Any 10 experiments):
1. I.C. Engines Valve & Port Timing Diagrams
2. Performance Test on Variable Compression Ratio single cylinder 4-Stroke petrol Engine By using Eddy Current Dynamometer
3. Test on single cylinder 4-Stroke Diesel Engine by using Mechanical Dynamometer
6. Evaluation of engine friction power by conducting Morse test on Multi cylinder 4-Stroke Petrol Engine.
7. Heat Balance of 4 stroke single cylinder diesel engine
8. Performance Test on Reciprocating Air – Compressor.
9. Determination of COP of Vapour Compression Refrigeration Unit.
10. Performance Test on Air Conditioning Unit.
11. Demonstration of automobile working components.
13. Solar parabolic concentrator apparatus

References:
Thermal engineering lab manuals.
Pre-requisites: Engineering Mechanics and Numerical Methods

Course Educational Objectives: This course is designed to use the basic in-built commands and to write the MATLAB code to solve ordinary differential equation, integration and make the user-friendly environment using graphical user interface.

Course Outcomes: At the end of the course, the student will be able to
CO1: Apply the basic MATLAB operations in basic engineering problems (Apply-L3)
CO2: Solve the system of linear algebraic equation using matrix operation (Apply-L3)
CO3: Apply the graphical user interface to write the code as more user friendly (Apply-L3)

LIST OF EXPERIMENTS

Part – I: Introduction to MATLAB

1. Basic matrix operations
2. Solving ordinary differential equations
3. Solving double integration problems
4. Plotting of simple 2D and 3D graphs
5. Introduction to graphical user interface – addition and subtraction

Part – II: Application of MATLAB

6. Solving of system of linear algebraic equation using matrix
7. Solving of ordinary differential equation using Runge-Kutta method a numerical approach
8. Solving of integration using Simpson’s 1/3 rule a numerical approach
10. Develop the graphical user interface to identify the area moment of inertia of simple section – trapezoidal and triangle
11. Identification of shear force and bending moment diagram of cantilever beam with point load
12. Identification of pathline traced by a particle in fluid domain.
Pre-requisite : Programming languages like C Language.

Course Educational Objective:

The Objective of Python course is to lead the students from the basics of writing and running Python scripts in problem solving and also to design and implement the modules and understands the working of classes and objects in python.

Course Outcomes (COs): At the end of the course, the student shall be able to

CO 1: Identify various programming constructs available in Python and apply them in solving computational problems. (Apply - L3)

CO 2: Demonstrate data structures available in Python and apply them in solving computational problems. (Apply - L3)

CO 3: Implement modular programming, string manipulations and Python Libraries (Apply - L3)

CO 4: Improve individual / teamwork skills, communication & report writing skills with ethical values.

Introduction: Language basics and example problems

Implement Python Script for checking the given year is leap year or not.
Implement Python Script for finding biggest number among 3 numbers.
Implement Python Script for displaying reversal of a number.
Implement Python Script to check given number is Armstrong or not.
Implement Python Script to print sum of N natural numbers.
Implement Python Script to check given number is palindrome or not.
Implement Python Script to print factorial of a number.
Implement Python Script to print all prime numbers within the given range.

Module 1: Exercise Programs on Lists.
Write a Python script to display elements of list in reverse order.
Write a Python script to find the minimum and maximum elements without using built-in operations in the lists.
Write a Python script to remove duplicates from a list.
Write a Python script to append a list to the second list.
Write a Python script to count the number of strings in a list where the string length is 2 or more.
Module 2: Exercise Programs on Tuples.
Write a Python script to create a tuple with different data types.
Write a Python script to find the repeated items of a tuple.
Write a Python script to replace last value of tuples in a list.
Sample list: [(10, 20, 40), (40, 50, 60), (70, 80, 90)]
Expected Output: [(10, 20, 100), (40, 50, 100), (70, 80, 100)]
Write a Python script to sort a tuple by its float element.
Sample data: [('item1', '12.20'), ('item2', '15.10'), ('item3', '24.5')]
Expected Output: [('item3', '24.5'), ('item2', '15.10'), ('item1', '12.20')]

Module 3: Exercise Programs on Sets.
Write a Python script to add member(s) in a set.
Write a Python script to perform Union, Intersection, difference and symmetric difference of given two sets.
Write a Python script to test whether every element in S is in T and every element in T is in S.

Module 4: Exercise Programs on Dictionaries
Write a Python script to sort (ascending and descending) a dictionary by value.
Write a Python script to check whether a given key already exists or not in a dictionary.
Write a Python script to concatenate following dictionaries to create a new one.
Sample Dictionary: dic1={1:10, 2:20} dic2={3:30, 4:40} dic3={5:50,6:60}
Expected Result: {1: 10, 2: 20, 3: 30, 4: 40, 5: 50, 6: 60}
Write a Python script to print a dictionary where the keys are numbers between 1 and 15 (both included) and the values are square of keys.
Write a Python program to map two lists into a dictionary.

Module 5: Exercise Programs on functions and recursion.
a) Define a function max_of_three() that takes three numbers as arguments and returns the largest of them.
b) Write a program which makes use of function to display all such numbers which are divisible by 7 but are not a multiple of 5, between given range X and Y.
c) Define functions to find mean, median, mode for the given numbers in a list.
d) Define a function which generates Fibonacci series up to n numbers.
e) Implement a python script for factorial of number by using recursion.
f) Implement a python script to find GCD of given two numbers using recursion.
Module 6: Exercise programs on Strings
a) Implement Python Script to perform various operations on string using string libraries.
b) Implement Python Script to check given string is palindrome or not.
c) Implement python script to accept line of text and find the number of characters, number of vowels and number of blank spaces in it.
d) Implement python script that takes a list of words and returns the length of the longest one.

Module 7: Exercise programs on Regular Expressions
a) Write a Python script to check that a string contains only a certain set of characters (in this case a-z, A-Z and 0-9).
b) Write a Python script to check whether password is valid or not.
   Conditions for a valid password are:
   Should have at least one number.
   Should have at least one uppercase and one lowercase character.
   Should have at least one special symbol.
   Should be between 6 to 20 characters long.

Module 8 : Exercise programs on Matplotlib Library
a) Write a Python program to draw a line with suitable label in the x axis, y axis and a title.
b) Write a Python program to plot two or more lines with legends, different widths and colors.
c) Write a Python program to create multiple plots.
d) Write a Python programming to display a bar chart using different color for each bar.
e) Write a Python programming to create a pie chart with a title.
f) Write a Python program to draw a scatter plot with empty circles taking a random distribution in X and Y and plotted against each other.
V SEM
Pre-requisites: Elements of Aerospace Engineering

Course Educational Objectives: To learn the conventional and modern control systems and working principle of different types of hydraulic and pneumatic systems, engine systems, auxiliary systems, and flight and navigation instruments used in an aircraft.

Course Outcomes: At the end of the semester, the student will be able
CO1: To identify the various types of controls in the airplane design (Understand-L2)
CO2: To understand the performance of hydraulic and pneumatic systems in the aircraft operation (Understand-L2)
CO3: To analyze the performance of various engine systems of an aircraft (Analyze-L4)
CO4: To employ necessary auxiliary systems in the operation of an aircraft (Apply-L3)
CO5: To employ various instruments necessary of the aircraft operation (Apply-L3)

UNIT - I

UNIT - II

UNIT - III
ENGINE SYSTEMS: Fuel Systems for Piston and Jet Engines, Components of Multi Engines. Lubricating Systems for Piston and Jet Engines - Starting and Ignition Systems, Typical Examples for Piston and Jet Engines.

UNIT - IV

UNIT - V

TEXT BOOKS

REFERENCES
Pre-requisites: Engineering Fluid Mechanics, Engineering Thermodynamics, Aerodynamics

Course Educational Objectives: To learn the basic concepts of compressible fluid flows, steady one-dimensional flow properties discharging from a reservoir, the supersonic flow properties, the basic formulation for flow with friction and heat transfer and the theoretical aspects of compressible flow over wings

Course Outcomes: At the end of the semester, the student will be able

- **CO1**: To apply the of compressible fluid flow equations to solve flow problems (Apply-L3)
- **CO2**: To apply the steady one-dimensional flow principles in designing the nozzles and diffusers (Apply-L3)
- **CO3**: To analyze the supersonic flow behaviour over objects (Analyze-L4)
- **CO4**: To analyze fluid flow through ducts by considering friction and heat transfer affects (Analyze-L4)
- **CO5**: To apply compressible flow theory to analyze flow over wings (Apply-L3)

**UNIT - I**
**BASICS OF COMPRESSIBLE FLOW**: Introduction, Compressibility, Basic Equations of Compressible Flow- Energy Equation, Isentropic Flow Relations, Stagnation Properties, Speed of Sound, Mach Number, Mach Cone, Wave Propagation

**UNIT - II**
**STEADY ONE-DIMENSIONAL FLOW**: Introduction, Fundamental Equations, Discharge from A Reservoir, Critical Values, Stream Tube Area-Velocity Relation, Types of Nozzles, Applications of Nozzles, Area-Mach Number Relation, Isentropic Flow Through Nozzles, Diffusers, Dynamics Head Measurement in Compressible Flow, Compressibility Correction to Dynamics Pressure, Pressure Coefficient

**UNIT - III**

**UNIT - IV**

**UNIT - V**
TEXT BOOK

REFERENCES
Pre-requisites: Aircraft Structures – I

Course Educational Objectives: The objective of the course is to enable the students to apply standard methods to calculate the stress and displacement of thin walled symmetrical and unsymmetrical components located in fuselage, wing and landing gear are subjected to static loads.

Course Outcomes: At the end of the semester, the student will be able
CO1: To analyze the behavior of beam structures subjected to different loading conditions (Analyze-L4)
CO2: To determine location of shear centre for open and closed sections (Apply-L3)
CO3: To analyze the shear flow distribution for open and closed sections (Analyze-L3)
CO4: To analyze the behavior of thin plates subjected to bending and buckling loads (Analyze-L4)
CO5: To apply the principles of bending and shear flow over aircraft components (Apply-L3)

UNIT - I
BENDING STRESS: Introduction - Principal Axis and Neutral Axis Methods, Bending Stresses - Beams of Symmetric Sections with Symmetric and Skew Loads - Beams of Unsymmetrical Sections with Symmetric and Skew Loads.

UNIT - II
SHEAR FLOW IN OPEN SECTIONS: Thin Walled Beams, Concept of Shear Flow - Shear Centre, Shear Flow in Open-Section – Symmetrical - Unsymmetrical, Thin Wall Bending – Effective - Ineffective.

UNIT - III

UNIT - IV
BUCKLING OF THIN PLATES: Introduction to Inelastic buckling of plates, Determination of critical load for a flat plate, Local instability, Instability of stiffened panels, Failure stress in plates and stiffened panels.

UNIT - V
STRESS ANALYSIS IN WING AND FUSELAGE: Study of Wing Spars and Box Beams, Shear Resistant Web Beams, Tension Field Web Beams (Wagner's) – Procedures to Find Shear and Bending Moment Distribution for Cantilever Beam.

TEXT BOOKS

REFERENCES
Pre-requisites: Aerodynamics

Course Educational Objectives: The course is intended to understand the aerodynamic aspects of wind generators, automobiles, buildings, bird, importance in recent industries.

Course Outcomes: At the end of the semester, the student will be able
CO1: To analyze the aerodynamics effects on wind turbines, buildings and its ventilation (Analyze-L4)
CO2: To analyze the effects of aerodynamics in automobiles (Analyze-L4)
CO3: To analyze the effects of wind and flow induced vibrations over objects (Analyze-L4)
CO4: To apply the effects of aerodynamics in flapping wing vehicles (Analyze-L4)

UNIT I
WIND ENERGY AND WIND TURBINES: Types of Winds, Causes of Variation of Winds, Atmospheric Boundary Layer, Effect of Terrain On Gradient Height. Horizontal Axis and Vertical Axis Machines, Power Coefficient, Betz Coefficient by Momentum Theory.

UNIT II
GROUND VEHICLE AERODYNAMICS: Sources of Drag in Ground Vehicles, Power Requirement and Drag Coefficients of Automobiles, Aerodynamics of Passenger Cars, Race Cars, Motorcycles, Trains

UNIT III

UNIT IV
FLOW INDUCED VIBRATIONS: Effect of Reynolds Number On Wake Formation of Bluff Shapes, Vortex Induced Vibrations, Buffeting, Vortex Shedding, Galloping and Flutter.

UNIT V

REFERENCES
Pre-requisites: Numerical Methods, Strength of Materials

Course Educational Objectives: To understand the concepts such as discretization, natural coordinates, stiffness matrix etc, the analysis of trusses and beams, the concepts of axisymmetric solids subjected to axisymmetric loading and the importance of isoparametric elements, the Eigen value and Eigen vectors for dynamic problems.

Course Outcomes: At the end of the semester, the student will be able
CO1: To identify mathematical model for solution of common engineering problems (Understand-L2)
CO2: To analyze structural behavior of Plane Truss Elements (Analyze-L3)
CO3: To determine the design quantities (deformation, strain, stress) for engineering structures under different loading conditions (Apply-L3)
CO4: To formulate new solutions for the existing problems using FEM approaches (Apply-L3)
CO5: To estimate natural frequencies of bar and beam structures (Apply-L3)

UNIT - I
INTRODUCTION TO FINITE ELEMENT METHODS: Stress and Equilibrium, Strain – Displacement relations, Stress – strain relations, Potential Energy and Equilibrium.
ONE DIMENSIONAL PROBLEMS

UNIT - II

UNIT - III
ANALYSIS OF BEAMS: Hermite shape functions, Element stiffness matrix, Load vector, Boundary conditions. 2-D Problems using Constant Strain Triangles (CST) – Shape functions, Stiffness matrix, Strain-Displacement matrix, Force terms.

UNIT - IV
FINITE ELEMENT MODELING OF AXISYMMETRIC SOLIDS: Axisymmetric solids subjected to axisymmetric loading with triangular elements, Two dimensional four noded isoparametric elements, problems on isoperimetric formulation of four nodes quadrilateral element, Numerical Integration-Gauss quadrature.

UNIT - V
REFERENCES

Course Educational Objectives: To study the basic terminologies, the integration methods and subsystems to construct the UAVs and MAVs and the flight performance parameters of UAVs and MAVs.

Course Outcomes (COs): At the end of the semester, the student will be able
CO1: To understand the basic needs to design UAV and MAV (Understand-L2)
CO2: To acquire the knowledge and importance of payload integration with UAV airframe (Understand-L2)
CO3: To understand the advanced concepts of UAV and MAV system design to the engineers (Understand-L2)
CO4: To analyze the Performance of UAVs and MAVs subsystems for stable fly (Analysis-L4)

UNIT I
INTRODUCTION TO UAV AND MAV: Historical Background of UAV and MAV - Classifications Based on Range and Endurance –Basic Terminologies -Models and Prototypes - Preliminary, Conceptual and Detailed Design Stages.

UNIT II

UNIT III

UNIT IV
PAYLOADS AND COMMUNICATIONS: Non-dispensable Payloads, Dispensable Payloads, Communication Media Radio Communication, Mid-air Collision (MAC) Avoidance, Communications Data Rate, Bandwidth Usage Antenna Types

UNIT V
ASSEMBLY: Introduction, Assembling the UAV Empennage, Wiring and Servo Motors - Problems in Wiring Installation, Wings, RC- Control Techniques

References
Course Educational Objectives: To learn the basic experiments in wind tunnel, open jet facility and basic flow visualization techniques

Course Outcomes: At the end of the semester, the student will be able to
CO1: To analyze the flow characteristics over aerodynamic bodies (Analyze-L4)
CO2: To analyze nozzle flow characteristics (Analyze-L4)

Any of the 10 Experiments are required to be conducted

1. Determination of lift and drag for the symmetrical aerofoil.
2. Determination of lift and drag for the cambered aerofoil.
3. Determination of center of pressure and aerodynamics center for symmetrical and cambered airfoil
4. Generation of potential flow pattern over objects using Hele-Shaw Apparatus.
5. Visualization of flow field around a flat plate using open channel.
6. Pressure Distribution over a smooth circular cylinder.
7. Pressure Distribution over a symmetrical aerofoil.
8. Pressure Distribution over a cambered aerofoil.
10. Yaw effect on Pitot probe and Pitot-Static probe in incompressible and compressible flows
11. Flow thorough Convergent Nozzle
12. Flow through Convergent- Divergent Nozzle
14. Flow visualization of submerged water jet
Course Educational Objectives: To understand various principles and theorems involved in the theory of aircraft structures, vibrations and experimental analysis by doing simple and advanced experiments.

Course Outcomes: At the end of the semester, the student will be able to:

CO1: To analyze the behavior of beam subjected to different loading conditions (Analyze-L4)
CO2: To analyze deflection of various structural members based on different theories (Analyze-L4)
CO3: To analyze the performance of governors and gyroscope (Analyze-L4)

Any of the 10 Experiments are required to be conducted:
1. Verification of Maxwell’s Reciprocal Theorem.
2. Verification of Castigliano’s Theorem.
3. Verification of Superposition Theorem.
4. Non Destructive Test- Dye Penetration Test and Magnetic Particle Detection.
5. Determination of Beam Deflection (C, Z, L and T-Sections).
6. Compression Test of Columns.
7. Wagner Beam-Tension Field Beam.
8. Determination of Shear Center of Open Section (C, Z and T-Sections).
11. Unsymmetrical Bending of a Cantilever Beam (C, Z, L and T-Sections)
12. Composite Laminate preparation and testing.
13. Shear Failure of Bolted and Riveted Joints.
Pre-requisites: Engineering Graphics, Working knowledge of Microsoft Windows, Basic knowledge CAD drawing

Course Educational Objective: The course Describes the functional capabilities and general usage of: Part Design, Generative Shape Design, Assembly Design. The student will be taught the advanced features like patterns, threading, Advanced Surfacing and Assembly Drafting of CATIA

Course Outcomes: At the end of the course, the student will be able
CO1: To draw, modify and constrain sketches (Apply-L3)
CO2: To model and assemble various components (Apply-L3)

Module-I
CATIA as a CAD software: - Concept of Parametric Modeling, Feature Based Modeling, User Interface, Mouse operations, Sketch Tools, View Tool bar, Profile Tool bar, Operation Tool bar, Tools, Constrain tool bar, Transformation Tool bar, User Selection Filter, Standards, Visualizations. File types and Management, drawing profiles

Module-II
Sketcher: Profile toolbar, operation (corner, chamfer, relimitations, transformations, project 3D element), constrainers, types of constraints, workbench. sketch tools, Sketch Based Features, Dress up Features, Transformation Features, Reference Elements, Measure, Thickness, Boolean Operations.

Module-III
Part Modelling: Modeling of Machined component, Material Addition and Removal (Pad, Pocket, Shaft, Groove), Sketch and Positioned Sketch, Types of Fillets, Types of Chamfer, Types of Hole. Pattern (Rectangular, Circular, User), Thread/Tap, Datum Features (Plane, Axes, Points), Simple Draft Advance Design features: - Axis System, Types of draft, Shell, Stiffener, rib slot, Multisection solid

Module-IV
Drafting: Introduction to Drafting & Detailing Theory- (types Generative – Interactive), Initial Drafting setting, Sheet Background, Views (ortho, ISO), Dimensions (Types- Generate Dimension & Create Dimension). Annotations: - GD & T, Symbols, Note, Leaders, Table, Symbols (Machining, Roughness, Welding, Custom), Dress-up Toolbar.

Module-V
Surfacing Modeling based Plastic Component: - Environment, Tool bars, Surface Creation (Extrude, Revolve, Sphere, Cylinder), Surface Modification, Surface Editing (Trim, Split, Shape Fillet, Close Surface, Thickness), Offset (All 3 types), Fill, Blend, Join, healing. Project-Combine Advanced Surfacing: - Adaptive Sweep, Sweep (ALL), Multisection Surface.

Module-VI
Assembly & Mechanism: Introduction to Assembly: - Types of assembly approach, Types of Constrains and DOF, placement of components in the Assembly, Manipulating Components, BOTTOM UP Approach- TOP DOWN Approach: - Part, Product, Component, Space Analysis, Reuse Pattern, Save management. Assembly Drafting: - Scene (Exploded View), Bill of material, Ballon creation, Graph Tree Reordering.
VI SEM
Pre-requisites: Engineering Fluid Mechanics, Engineering Thermodynamics

Course Educational Objectives: To learn the basic differential equations of heat transfer in conduction, convection, radiation, and to understand the LMTD concepts used in heat exchangers.

Course Outcomes: At the end of the semester, the student will be able
CO1: To formulate heat conduction phenomenon through plane, cylindrical surfaces (Apply-L3)
CO2: To analyze steady state heat conduction in planes walls and cylindrical shells (Analyze-L4)
CO3: To analyse the convective heat transfer phenomenon in both external and internal flows (Analyze-L4)
CO4: To understand the thermal radiation concepts (Understand-L2)
CO5: To apply the heat transfer principles on the working of heat exchangers and electronic equipment (Apply-L3)

UNIT - I

UNIT – II

UNIT - III

UNIT - IV

UNIT - V
APPLICATIONS:

NOTE: Heat and Mass Transfer Data Book By C.P. Kothandaraman and Subramanian- New Age Publications Is To Be Allowed In Examination.

TEXT BOOK

REFERENCES
Pre-requisites: Engineering Mechanics, Aerodynamics

Course Educational Objectives: To learn the concepts of performance estimation on steady level flight at various altitudes and velocities, performance of maneuvering flight at unaccelerated and accelerated conditions, the concepts of static stability requirements during flight, the basic concepts of dynamic stability and control of an aircraft.

Course Outcomes: At the end of the semester, the student will be able
CO1. To determine thrust and power requirement conditions for steady level flight (Apply-L3)
CO2: To estimate performance parameters of flight during manoeuvring (Apply-L3)
CO3. To apply the conditions of static stability and control in the aircraft design (Apply-L3)
CO4: To understand various concepts and conditions of dynamic stability and control (Understand-L2)

UNIT - I

UNIT - II

UNIT - III

UNIT - IV
STATIC LATERAL-DIRECTIONAL STABILITY AND CONTROL: Lateral stability-Dihedral effect, criterion for lateral stability, contribution of wing, fuselage, tail, lateral control-strip theory estimation of aileron effectiveness, aileron reversal. Directional stability-yaw and sideslip, Criterion of directional stability, contribution wing, fuselage, tail, Directional control- rudder control effectiveness, rudder requirements-adverse yaw, asymmetric power condition, spin recovery, Rudder lock and Dorsal fin,

UNIT - V
DYNAMIC STABILITY AND CONTROL:
Dynamic Longitudinal Stability: Modes of Stability, Aircraft Equations of motion, Small disturbance theory, Solving the stability quartic, Routh’s discriminant, , Phugoid motion, Short period of oscillation
Lateral and Directional Dynamic Stability- Spiral Divergence, Dutch Roll, Auto Rotation and Spin
TEXT BOOKS

REFERENCES
Pre-requisites: Engineering Thermodynamics, Elements of Aerospace Engineering

Course Educational Objectives: To learn engineering concepts of jet engines, flow through subsonic and supersonic inlets of a jet engine, principle of operation of aircraft jet engines, fundamentals of combustion process.

Course Outcomes: At the end of the semester, the student will be able,
CO1: To determine the performance parameters of various jet engines (Apply-L3)
CO2: To analyze flow thorough subsonic and supersonic inlets (Analyze-L4)
CO3: To estimate the performance parameters of aircraft compressor (Apply-L3)
CO4: To identify the parameters governing the working of combustion chambers (Understand-L2)
CO5: To determine the performance parameters of turbines of jet engines (Apply-L3)

UNIT - I

UNIT - II

UNIT - III

UNIT - IV

UNIT - V

TEXT BOOK
REFERENCES
2. Mattingly. J. D, Elements of propulsion: Gas Turbines and Rockets, AIAA Educational Series
Course Educational Objectives: To learn the basic governing equations of fluid dynamics, mathematical behaviour of partial differential equations, phenomena of various discretization techniques, techniques to solve the simple incompressible and compressible flow problems

Course Outcomes: At the end of the semester, the student will be able
CO1: To formulate the governing equations of fluid dynamics (Apply-L3)
CO2: To apply the discretization techniques to governing equations of fluid dynamics (Apply-L3)
CO3: To understand various CFD techniques (Understand-L2)
CO4: To apply various CFD techniques to solve fluid dynamic problems (Apply-L3)

UNIT - I
Introduction
Computational Fluid Dynamics as a Research and Design Tool, Applications of Computational Fluid Dynamics.


UNIT – II
Basics Aspects of Discretization
Introduction, Introduction of Finite Differences, Difference Equations, Explicit and Implicit Approaches, Errors and Stability Analysis, Grid Generation

UNIT – III

UNIT – IV

UNIT – V

REFERENCES
Course Educational Objectives: To learn the fundamental equations governing the viscous fluid flow phenomenon, solutions of various viscous flow problems, basic formulations of laminar boundary layer, basic aspects of turbulent boundary layer over objects, and elementary aspects of compressible boundary layer.

Course Outcomes: At the end of the semester, the student will be able to
CO1: To formulate fundamental equations of viscous flow [Apply-L3]
CO2: To apply the viscous flow equations to solve fluid flow problems [Apply-L3]
CO3: To analyze laminar and turbulent boundary layer flow fields of objects [Analyze-L4]
CO4: To describe the properties of compressible boundary layer flow [Understand-L2]

UNIT - I

UNIT - II
SOLUTIONS OF VISCOUS FLOW EQUATIONS: Couette Flows, Hagen-Poiseuille Flow, Flow between Rotating concentric Cylinders, Combined Couette-Poiseuille Flow between Parallel Plates, Creeping Motion, Stokes Solution for an Immersed Sphere, Development of boundary layer - Estimation of boundary layer thickness-Displacement thickness, momentum and energy thickness for two-dimensional flows

UNIT - III
LAMINAR BOUNDARY LAYER: Laminar boundary layer equations, Flat Plate Integral analysis of Energy equation, flow separation - Blasius solution for flat-plate flow –Falkner-Skan Wedge flows - Boundary layer temperature profiles for constant plate temperature – Integral equation of Boundary layer - Pohlhausen method - Thermal boundary layer calculations

UNIT - IV
TURBULENT BOUNDARY LAYER: Turbulence-physical and mathematical description, Two-dimensional turbulent boundary layer equations - Velocity profiles - The law of the wall - The law of the wake - Turbulent flow in pipes and channels - Turbulent boundary layer on a flat plate - Boundary layers with pressure gradient, Eddy viscosity, Mixing length, Turbulence modeling

UNIT - V
COMPRESSIBLE BOUNDARY LAYER: Compressible boundary layer equation, Recovery factor, similarity solutions, laminar supersonic cone rule, shock-boundary layer interaction.

REFERENCES
Course Educational Objectives: To study the procedure of the formation of aerodrome and its design, various maintenance activities for airport maintenance, air traffic control, procedure and air traffic service.

Course Outcomes: At the end of the semester, the student will be able
CO1: To Acquire the concept of air traffic rules and clearance procedures for airline operation [Understand-L2]
CO2: To Analyze the various air traffic data for air traffic services [Analyze-L4]
CO3: To Analyze the influence of aerodrome design factors for service establishments [Analyze-L4]

UNIT I
BASIC CONCEPTS: Objectives of ATS - parts of ATC service - scope and provision of ATCS - VFR & IFR operations - classification of ATS air spaces - varies kinds of separation - altimeter setting procedures, establishment, designation and identification of units providing ATS - division of responsibility of control.

UNIT II
AIR TRAFFIC SERVICES: Area control service, assignment of cruising levels minimum flight altitude ATS routes and significant Points - RNAV And RNP - Vertical, lateral and longitudinal separations based on time / distance - ATC Clearances - flight plans - position report. Comparison of various ATC services.

UNIT III
FLIGHT INFORMATION: Flight Information, Alerting Services, Coordination, Emergency Procedures and Rules of the Air Radar service, basic radar terminology - identification procedures using primary / secondary radar - performance checks - use of radar in area and approach control services - assurance control and coordination between radar / non radar control

UNIT IV

UNIT V
VISUAL AIDS FOR NAVIGATION: Visual aids for navigation, wind direction indicator, landing direction indicator, location and characteristics of signal area, markings, lights, aerodrome beacon, identification beacon, simple approach lighting system and various lighting systems - VASI & PAPI, visual aids for denoting obstacles; object to be marked and lighter - emergency and other services.

REFERENCE
Course Educational Objectives: To learn the aircraft design methodologies.

Course Outcomes: At the end of the semester, the student will be able
CO1: To estimate design parameters of an aircraft system, component, or process as per the requirement [Apply- L3]
CO2: To calculate design parameters of an aircraft as per the assigned specifications [Apply-L3]

Experiments are to be performed:
1. Aircraft conceptual sketch and its gross weight estimation algorithm
2. Preliminary weight estimation
3. Trade off study on range
4. Trade off study on payload
5. Fixed sizing
6. Load or Induced Drag Estimation
7. Preliminary design of an aircraft fuselage
8. Preliminary design of load distribution on a fuselage
9. Estimate the Critical Mach number for an Airfoil
10. Static Performance: Thrust required curve
11. Static Performance: Power required curve
12. Drawing all the 3 views of a new Aircraft
Course Educational Objectives: To learn the various basic experiments related to components of jet engines and piston engines.

Course Outcomes: At the end of the semester, the student will be able
CO1: To estimate the performance parameters of various jet engine components [Apply-L3]
CO2: To characterize the wall and free jet [Apply-L3]
CO3: To prepare various solid propellant grains [Apply-L3]

Any of the 10 Experiments are required to be conducted
1. Free jet characteristics
2. Wall jet characteristics
3. Free convective heat transfer rate over an airfoil
4. Forced convective heat transfer rate over an airfoil
5. Cascade testing of compressor blade row
6. Cascade testing of turbine blade row
7. Performance characteristics of three stage axial flow compressor
8. Measurement of burning velocity of pre-mixed flame
9. Performance evaluation of thrust produced by propeller (constant pitch and variable pitch) at various speeds
10. Flow through subsonic inlet
11. Preparation of solid propellant grains
12. Study of Properties of aviation fuel
   Study of an aircraft piston engine. (Includes study of assembly of sub systems, various components, their functions and operating principles)
Course Educational Objectives: To learn modeling package (CATIA) to draw 3D parts and Assembly of various aircraft components, and finite element package (ANSYS) to analyze the behavior of simple structural elements under static loading system.

Course Outcomes: At the end of the semester, the student will be able to
CO1: To draw aircraft components 3D geometric modeling [Apply-L3]
CO2: To solve and analyze the structural components of aircraft for deformations and stresses using a numerical tool [Analyze-L4]

Any ten experiments are to be performed:
1. Design and drafting of aircraft wing structural elements
2. Design and drafting of aircraft fuselage structural elements
3. Design and drafting of landing gear
4. Design and drafting conventional aircraft parts
5. Assembly of conventional aircraft
6. Assembly of landing gear
7. Modal analysis of beam with different end conditions
8. Modal analysis of nose cone
9. Modal analysis of wing
10. Modal analysis of fuselage-Monocoque
11. Static analysis of cantilever beam.
12. Static analysis of composite laminate
13. Static analysis of bending of curved beam
14. Analysis of thermal stresses in bar
15. Eigenvalue buckling analysis of oleo strut
Course Educational Objectives:
The Soft Skills Laboratory course equips students with required behavioral, interpersonal & intrapersonal skills, communication skills, leadership skills etc. It aims at training undergraduate students on soft skills leading to enhanced self-confidence, esteem, and acceptability in professional circles.

Course Outcomes (COs): At the end of the course, student will be able

CO1: To Develop self-awareness and personality traits for professional growth (Understand – L2)
CO2: Work effectively in multi-disciplinary and heterogeneous teams through knowledge of teamwork, inter-personal relationships, conflict management and leadership quality. (Apply – L3)
CO3: Communicate through verbal/oral communication with good listening skills and empathy (Apply – L3)
CO4: Apply skills required to qualify in recruitment tests, Interviews & other professional assignments (Apply – L3)

Personality Development Skills
Role of language in Personality – How language reflects, impacts Personality – Using gender-neutral language in MNCs – being culturally-sensitive-Personality Traits - Grooming & Dress code
Activities: Group Discussion/Role play/Presentations (authentic materials: News papers, pamphlets and news clippings)

Impactful Communication
Activities: Extempore / Story Telling / Group Discussion (Case studies/Current affairs etc.)/ Elocution on Interpretation of given quotes/ Critical Appreciation and Textual Analysis/ Writing reviews on short story/videos/book/Social Media profiling/ Pronunciation Practice

Professional Skills:
Activities: SWOT analysis of the self/Goal setting-Presentation/ Writing Report/ Listening exercises/ Effective Resume-Writing and presentation/ Interview Skills: Mock interviews/ Video samples.

REFERENCES:
4. Ace of Soft skills Gopalaswamy Ramesh, Pearson Education India, 2018
5. Soft Skills for the Workplace, Goodheart-Willcox Publisher · 2020.
6. How to Win Friends and Influence People, Dale Carnegie · 2020
VII SEM
Pre-Requisites: Aerodynamics and Flight Dynamics

Course Educational Objectives: To learn the function of various parts of helicopter, rotor theories and power requirements of helicopter motion, performance of helicopter in hovering and climbing, performance of horizontal and forward flight and control.

Course Outcomes: At the end of the course, student will be able
CO1: To understand the functions of various components of helicopter [Understand-L2]
CO2: To apply momentum theory in the design of propeller [Apply-L3]
CO3: To analyze the performance of helicopter in various operating conditions [Analyze-L4]
CO4: To analyze the stability modes of helicopter [Analyze-L4]

UNIT – I

UNIT – II
MOMENTUM THEORY: Introduction, Thrust Generation - Hovering - Figure of Merit, Blade Element Theory, General Expression for $V_i$ - Local Solidity, Top Loss, Performance of ideally Twisted Constant Chord Blade, Rapid performance in Hover - Equivalent Chord.

UNIT – III

UNIT – IV
PERFORMANCE IN HORIZONTAL FLIGHT: Introduction, Flapping and lag Hinge, Steady Hover, Equilibrium in Horizontal Blade - Blade Hinge Motion, Blade Element Angle of Attack - Flapping Coefficient


UNIT – V

REFERENCES
Pre-Requisites: Thermodynamics and Elements of Heat Transfer

Course Educational Objectives: To learn the combustion process in aircraft piston engine, gas turbine combustion chamber, solid and liquid propellant rockets, and the basics of supersonic combustion.

Course Outcomes: At the end of the semester, the student will be able

CO1: To understand the basic concepts of propulsion unit [Understand-L2]

CO2: To understand the various factors effecting the combustion process in aircraft engines-piston and jet engines [Understand-L2]

CO3: To understand the various combustion models of rocket engines [Understand-L2]

CO4: To understand the reaction and mixing process in supersonic combustion [Understand-L2]

UNIT - I

UNIT - II

UNIT - III

UNIT - IV

UNIT - V
SUPersonic COMBUSTion: Introduction to Supersonic combustion – ramjet, scramjet - need for supersonic combustion for hypersonic airbreathing propulsion, Supersonic combustion controlled by diffusion and heat convection - Analysis of reaction and mixing processes - Supersonic burning with detonation shocks.

References:

Course Educational Objectives: To Learn the basic knowledge about composite materials at micro and macro level, lamina and laminates, basic design concepts of sandwich panels, functionally graded materials and the manufacturing process of composite materials.

Course Outcomes: At the end of the semester, the student will be able
CO1: To understand stress-strain relations of orthotropic materials [Understand L2]
CO2: To analyze properties of composite lamina at micro level and macro level [Analyze-L4]
CO3: To analyze characteristics of layered composites [Analyze-L4]
CO4: To understand the nomenclature of sandwich structures [Understand-L2]
CO5: To apply techniques of fabrication processes to manufacture composites [Apply-L3]

UNIT - I

UNIT- II
METHODS OF ANALYSIS: Macro Mechanics – Stress-strain relations of orthotropic lamina with respect to on axis, off axis - Micro mechanics – Mechanics of materials approach to stiffness- determine material properties -elasticity approach to stiffness-bounding Techniques

UNIT- III
MULTI DIRECTIONAL COMPOSITES: Macro mechanical behavior of laminate, Classical Lamination Theory-stress strain variation in a laminate- Symmetric, Antisymmetric laminates, angle ply and cross ply laminates. Failure criteria for composites.

UNIT- IV
SANDWICH CONSTRUCTIONS: Basic design concepts of sandwich construction -Materials used for sandwich construction – Flexural rigidity- deflection of sandwich beams – Applications of Sandwich Structures - Failure modes of sandwich panels.

UNIT- V
FABRICATION PROCESSES: Fibres-Glass, Carbon and Boron, Laminate Composite-Open and closed mould processes, lay-up, Vacuum bagging, Pressure Bagging- Pultrusion, Resin Transfer Molding - Auto Clave-Filament Winding, Introduction to functionally graded materials

REFERENCES
Course Educational Objectives: To learn the space mission strategies and fundamental orbital mechanics, flight trajectories of rockets and missiles, and fundamentals of atmospheric re-entry issues and satellite attitude.

Course Outcomes: At the end of the semester, the student will be able
CO1: To understand the basics of launching satellites in space [Understand-L2]
CO2: To understand the orbital mechanics and it’s maneuvering [Understand-L4]
CO3: To understand the basic aspects of trajectories of rockets and missiles [Understand-L4]
CO4: To analyze the dynamics of spacecraft attitude [Analyze-L4]

UNIT - I

UNIT - II
FUNDAMENTALS OF ORBITAL MECHANICS & ORBITAL MANEUVERS:
ORBITAL MECHANICS: Two-Body Motion-Circular, Elliptic, Hyperbolic, And Parabolic Orbits-Basic Orbital Elements-Ground Trace
ORBITAL MANEUVERS: In-Plane Orbit Changes-Hohmann Transfer-Bi-Elliptical Transfer-Plane Changes- Combined Maneuvers-Propulsion for Maneuvers

UNIT - III
ASCENT FLIGHT MECHANICS OF ROCKETS AND MISSILES: Two-Dimensional Trajectories of Rockets and Missiles-Multi-Stage Rockets-Vehicle Sizing-Two Stage Multi-Stage Rockets Trade-Off Ratios-Single Stage to Orbit- Sounding Rocket-Aerospace Plane-Gravity Turn Trajectories

UNIT - IV

UNIT - V
SATELLITE ATTITUDE DYNAMICS: Torque Free Axi-Symmetric Rigid Body-Attitude Control for Spinning Spacecraft - Attitude Control for Non-Spinning, Spacecraft - The Yo-Yo Mechanism – Gravity – Gradient Satellite-Dual Spin Spacecraft-Attitude Determination

REFERENCES
Pre-requisite: Airbreathing Propulsion

Course Educational Objectives: To learn the engineering concepts of ramjet and scram jet, the basic aspects of rocket propulsion, working principle of liquid, and solid propellant rocket systems, and advance propulsion techniques.

Course Outcomes: At the end of the semester, the student will be able

CO1: To understand the working of ramjet and scram jet engines [Understand-L2]

CO2: To evaluate the preliminary parameters of rocket propulsion. [Apply-L3]

CO3: To understand the working of liquid and solid propellant rocket systems [Understand-L2]

CO4: To apply the advanced rocket propulsion techniques for a mission [Apply-L3]

UNIT - I


UNIT - II

ROCKET PROPULSION: Operating principle, Effective Exhaust Velocity, Thrust equation, Specific impulse, Rocket Propulsion Requirements, Equations of Motion for an Accelerating Rocket, Multistage Rocket

UNIT - III


UNIT - IV

SOLID PROPELLANT ROCKET: Solid propellant rockets, double base and composite propellants, Selection criteria of solid propellants, Combustion process, Propellant Burning Rate, Propellant grain and its configuration, Propellant Grain Stress and Strain, Hybrid Rockets.

UNIT - V


REFERENCES

Pre-requisites: Theory of Vibrations, Aerodynamics, Theory of Elasticity

Course Educational Objectives: To learn the phenomenon of aeroelasticity in aircraft, theories and solutions to understand the aeroelastic problems.

Course Outcomes: At the end of the semester, the student will be able

CO1: To analyze the effects of vortex induced vibration on aircraft wing [Analyze-L4]

CO2: To design the aircraft wing by considering effects of flow induced vibration [Apply-L3]

CO3: To analyze aeroelastic phenomena in aircraft wing [Analyze-L4]

CO4: To analyze aeroelastic phenomenon in various applications [Analyze-L4]

UNIT - I

UNIT - II

UNIT - III
STEADY STATE AEROELASTIC PROBLEMS: Loss and reversal of aileron control, Critical aileron reversal speed, Aileron efficiency, Semirigid theory and successive approximations, Lift distributions, Rigid and elastic wing.

UNIT - IV
FLUTTER PHENOMONON: Non-dimensional parameters, Stiffness criteria, Dynamic mass balancing, Model experiments, Dimensional similarity, Flutter analysis, Two dimensional thin airfoils in steady incompressible flow, Quasi-steady aerodynamic derivatives, Galerkin method for critical speed, Stability of distributed motion, Torsion flexure flutter, Solution of the flutter determinant, Methods of determining the critical flutter speeds, Flutter prevention and control.

UNIT - V
AEROELASTIC PROBLEMS IN CIVIL AND MECHANICAL ENGINEERING: Galloping of transmission lines and flow induced vibrations of tall slender structures and suspension bridges.

REFERENCES
Course Educational Objectives: To learn the need of experimentation and wind tunnel techniques, theory of flow visualization techniques and analogue methods, working principle of various velocity measurement instruments, working of various pressure and temperature measurement instruments, and principle data acquisition and uncertainty estimation of measured data.

Course Outcomes: At the end of the semester, the student will be able
CO1: To employ the wind tunnels for aerodynamic testing of bodies [Apply-L3]
CO2: To adopt and use a visualization technique to understand the flow field [Apply-L3]
CO3: To employ the suitable instrument to measure the velocity, temperature and pressure of fluid flow [Apply-L3]
CO4: To acquire experimental data and to estimate the uncertainty in measured values during experimentation [Apply-L3]

UNIT - I

UNIT - II

UNIT - III

UNIT - IV
PRESSURE MEASUREMENT TECHNIQUES: Introduction, Barometers, Manometers, Dial type pressure gauge, Pressure Transducers, Pitot, Static, and Pitot-Static Tube and Its characteristics, Flow direction measurement probes and Low Pressure Measurement Gauges.
TEMPERATURE MEASUREMENT: Introduction, Types of thermometers, Thermocouples, RTD, Thermistors, Pyrometers, Temperature measurement in fluid flows.

UNIT - V

REFERENCES

Course Educational Objectives: To know the properties of liquid fuels, various solid, liquid, and cryogenic propellants, and the testing procedures and facilities of propellants.

Course Outcomes: At the end of the semester, the student will be able
CO1: To understand the characteristics of aircraft fuels [Understand-L2]
CO2: To understand the characteristics of solid propellants used in rockets [Understand-L2]
CO3: To understand the characteristics of liquid propellants used in rockets [Understand-L2]
CO4: To understand the properties of cryogenic propellants [Understand-L2]
CO5: To test the propellants to estimates their characteristics [Apply-L3]

UNIT - I
LIQUID FUELS: Properties and Tests for Petroleum Products, Motor Gasoline, Aviation Gasoline, Aviation Turbine Fuels, Requirements of Aviation Fuels - Kerosene Type - High Flash Point Type, Requirements for Fuel Oils, Hydrogen Fuel

UNIT - II
SOLID PROPELLANTS: Double Base Propellants, Composite Propellants, Metallized Composite Propellants, Introduction to Different Fuels and Oxidizers of Composite Propellants, Combustion Instabilities and Their Classification, Classification of Solid Propellant Grains Shapes.

UNIT - III

UNIT –IV
CRYOGENIC PROPELLANTS: Introduction to Cryogenic Propellants, Storage and Handling, Geysering Phenomenon, Elimination of Geysering Effect in Missiles

UNIT - V

REFERENCES
Course Educational Objectives: To learn basic aspects of space and solar system, Satellite injection and its orbit perturbations, an interplanetary trajectory issues, ballistic missile trajectories and material used of spacecraft.

Course Outcomes: At the end of the semester, the student will be able
CO1: To understand the basic aspects of space [Understand-L2]
CO2: To evaluate trajectory details of ballistic missiles [Analyze-L4]
CO3: To apply N-body aspects in space exploration issues [Apply-L3]
CO4: To know the general aspects of satellite injection and orbit perturbations [Understand-L2]
CO5: To evaluate interplanetary trajectories of spacecraft [Analyze-L4]

UNIT - I

UNIT - II

UNIT - III

UNIT - IV

UNIT - V
INTERPLANETARY TRAJECTORIES: Two Dimensional Interplanetary trajectories – Hohmann trajectories, Fast Interplanetary Trajectories, Launch opportunities: Three Dimensional Interplanetary Trajectories: Launch if interplanetary Spacecraft: Trajectory about the Target Planet.

REFERENCES
Course Description:
In this course, students will learn fundamental concepts and contributions of management. This course also teaches human resources practices which play a vital role in the organisation it gives knowledge about use of improve quality of work and project management.

Course Objectives:
1. To make students understand management, its principles, contribution to management, organization, and its basic issues and types
2. To make students understand the concept of plant location and its factors and plant layout and types, method of production and work study importance
3. To understand the purpose and function of statistical quality control. And understand the material management techniques
4. To make students understand the concept of HRM and its functions
5. To make students understand PERT & CPM methods in effective project management and need of project crashing and its consequence on cost of project

Course Outcomes:
CO1: Understand management principles to practical situations based on the organization structures. (L2)
CO2: Design Effective plant Layouts by using work study methods. (L2)
CO3: Apply quality control techniques for improvement of quality and materials management. (L3)
CO4: Develop best practices of HRM in corporate Business to raise employee productivity. (L2)
CO5: Identify critical path and project completion time by using CPM and PERT techniques. (L3)

UNIT I

UNIT II
Operations Management: Plant location, Factors influencing location, Principles and types of plant layouts - Methods of production (job, batch and mass production), Work study - Basic procedure involved in method study and Work measurement

UNIT III
Statistical quality control – Concept of Quality & Quality Control-functions, Meaning of SQC - Variables and attributes - X chart, R Chart, C Chart, P Chart,(simple Problems) Acceptance sampling, Sampling plans, Deming’s contribution to quality.
Materials management – Meaning and objectives, inventory control - Need for inventory control, Purchase procedure, Store records, EOQ, ABC analysis, Stock levels
UNIT IV

**Human Resource management (HRM):** Concepts of HRM, Basic functions of HR manager: Man power planning, Recruitment, Selection, Training and development, Placement, Wage and salary administration, Promotion, Transfers Separation, performance appraisal, Job evaluation and merit rating.

UNIT V

**Project management:** Early techniques in project management - Network analysis: Programme evaluation and review technique (PERT), Critical path method (CPM), Identifying critical path, Probability of completing project within given time, Project cost analysis, project crashing (simple problems)

**Text Books:**
Dr. A.R. Aryasri, Management Science, TMH, 10th edition, 2012

**References:**
2. Stoner, Freeman, Gilbert, Management, 6th edition Pearson education, New Delhi, 2004
3. O.P. Khana, Industrial engineering and Management  L.S.Srinath, PERT & CPM
Course Educational Objective: To learn the finite element package ANSYS Fluent to analyze the incompressible and compressible flow field characteristics

Course Outcomes: At the end of the course, the student will be able
CO1: To demonstrate the various modules of Ansys Fluent [Apply-L3]
CO2: To solve and analyze the characteristics of flow over aerodynamic objects and flow through ducts [Analyze-L4]

Module – I
Introduction
Introduction to ANSYS Fluent, Basic Steps for CFD Analysis using ANSYS Fluent, Guide to a Successful Simulation Using ANSYS Fluent, Starting and Executing ANSYS Fluent

Design Modeler
Introduction, Viewing, 2D Sketching, Selection, Planes and Sketches, Geometry Representations, 3D Modeling

Module – II (Meshing)
Introduction to Meshing Mode in Fluent, Starting Fluent in Meshing Mode, Graphical User Interface, Size Functions and Scoped Sizing, Object Based Meshing - Surface, Volume, Creating Mesh, Determining Mesh Statistics and Quality

Module – III (Solver Settings and Solution)
Introduction, Solution Procedure Overview, Available Solvers, Choosing a Solver, Discretisation, Initialization, Case Check, Convergence, Solution Accuracy, Grid-Independent Solutions, Mesh Adaption,

Module – IV (Post-Processing)
Post Processing- Overview, GUI Layout, Case Comparison, Creating Locations-types, Color, Render and View, Other Graphics Objects, Generating Tables, Charts and Reports, Animation, Files

Module – V (Tutorials)
Fluid Flow and Heat Transfer in a Mixing Elbow, Flow over Cylinder, Compressible Flow over Airfoil, Flow through convergent nozzle, Flow through convergent-divergent Nozzle,