## I - SEMESTER

### COURSE STRUCTURE (R20)

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## II - SEMESTER

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<td>6</td>
<td>20ME36</td>
<td>Industrial/Economics and Management</td>
<td>3</td>
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</tr>
</tbody>
</table>

| **Laboratory Courses** |             |                                                  | L | T | P | CIE | SEE | Total |
| 7    | 20PI02      | Industrial/Research Internship                   | 3 | - | - | 3   | 70  | 100   |
| 8    | 20HS03      | Skill Advanced Course                            | 2 | - | - | 2   | 50  | 50    |
|      |             |                                                 | 23|   |   | 180 | 520 | 700   |

| **TOTAL** |             |                                                  | L | T | P | CIE | SEE | Total |
| 18        |             |                                                  | 18|   |   | 180 | 520 | 700   |

| **Laboratory Courses** |             |                                                  | L | T | P | CIE | SEE | Total |
| 1    | 20PI02      | Industrial/Research Internship                   | 3 | - | - | 3   | 70  | 100   |
| 8    | 20PI03      | Skill Advanced Course                            | 2 | - | - | 2   | 50  | 50    |
|      |             |                                                 | 23|   |   | 180 | 520 | 700   |
|      |             |                                                 |    |   |   | 180 | 520 | 700   |

### VIII - SEMESTER

<table>
<thead>
<tr>
<th>S.No</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Contact hours/week</th>
<th>Credits</th>
<th>Scheme of Valuation</th>
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<td></td>
<td>L</td>
<td>T</td>
<td>P</td>
</tr>
</tbody>
</table>

| **Laboratory Courses** |             |                                                  | L | T | P | CIE | SEE | Total |
| 1    | 20PI03      | Project Work | 0 | 0 | 24 | 12  | 60  | 140  | 200   |

| **Laboratory Courses** |             |                                                  | L | T | P | CIE | SEE | Total |
| 1    | 20PI03      | Project Work | 0 | 0 | 24 | 12  | 60  | 140  | 200   |
## OPEN ELECTIVES

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Offered to the branches</th>
</tr>
</thead>
<tbody>
<tr>
<td>20AD81</td>
<td>Introduction to Artificial Intelligence</td>
<td>ASE, CE, ECE, EEE, &amp; ME</td>
</tr>
<tr>
<td>20AD82</td>
<td>Introduction to Data Science</td>
<td>ASE, CE, ECE, EEE, &amp; ME</td>
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<tr>
<td>20AD83</td>
<td>Introduction to Machine Learning</td>
<td>ASE, CE, ECE, EEE, &amp; ME</td>
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<tr>
<td>20AD84</td>
<td>Fundamentals of Deep Learning</td>
<td>ASE, CE, ECE, EEE, &amp; ME</td>
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<tr>
<td>20AE81</td>
<td>Principles of Flight</td>
<td>AI&amp;DS, CE, CSE, CSE(AI&amp;ML), ECE, EEE, IT &amp; ME</td>
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<tr>
<td>20AE82</td>
<td>Space Science</td>
<td>AI&amp;DS, CE, CSE, CSE(AI&amp;ML), ECE, EEE, IT &amp; ME</td>
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<tr>
<td>20AE83</td>
<td>Aircraft Systems</td>
<td>AI&amp;DS, CE, CSE, CSE(AI&amp;ML), ECE, EEE, IT &amp; ME</td>
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<tr>
<td>20AE84</td>
<td>Air Transportation Systems</td>
<td>AI&amp;DS, CE, CSE, CSE(AI&amp;ML), ECE, EEE, IT &amp; ME</td>
</tr>
<tr>
<td>20CE81</td>
<td>Basics of Civil Engineering</td>
<td>AI&amp;DS, ASE, CSE, CSE(AI&amp;ML), ECE, EEE, IT &amp; ME</td>
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<tr>
<td>20CE82</td>
<td>Disaster Management</td>
<td>AI&amp;DS, ASE, CSE, CSE(AI&amp;ML), ECE, EEE, IT &amp; ME</td>
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<td>20CE83</td>
<td>Fundamentals of Geospatial Technologies</td>
<td>AI&amp;DS, ASE, CSE, CSE(AI&amp;ML), ECE, EEE, IT &amp; ME</td>
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<td>20CE84</td>
<td>Environmental Sanitation</td>
<td>AI&amp;DS, ASE, CSE, CSE(AI&amp;ML), ECE, EEE, IT &amp; ME</td>
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<tr>
<td>20CS81</td>
<td>Unix and Shell Programming</td>
<td>ASE, CE, ECE, EEE, &amp; ME</td>
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<tr>
<td>20CS82</td>
<td>Introduction to Algorithm Techniques</td>
<td>ASE, CE, ECE, EEE, &amp; ME</td>
</tr>
<tr>
<td>20CS83</td>
<td>Principles of Computer Architecture</td>
<td>ASE, CE, ECE, EEE, &amp; ME</td>
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<tr>
<td>20CS84</td>
<td>PHP Programming</td>
<td>ASE, CE, ECE, EEE, &amp; ME</td>
</tr>
<tr>
<td>20CS85</td>
<td>Object Oriented Software Engineering</td>
<td>ASE, CE, ECE, EEE, &amp; ME</td>
</tr>
<tr>
<td>20EC81</td>
<td>Satellite Technology</td>
<td>AI&amp;DS, ASE, CE, CSE, CSE(AI&amp;ML), EEE, IT &amp; ME</td>
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<tr>
<td>20EC82</td>
<td>Elements of Communication Systems</td>
<td>AI&amp;DS, ASE, CE, CSE, CSE(AI&amp;ML), EEE, IT &amp; ME</td>
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<tr>
<td>20EC83</td>
<td>Microprocessors and Interfacing</td>
<td>AI&amp;DS, ASE, CE, CSE, CSE(AI&amp;ML), EEE, IT &amp; ME</td>
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<tr>
<td>20EC84</td>
<td>Analog and Digital Communications</td>
<td>AI&amp;DS, ASE, CE, CSE, CSE(AI&amp;ML), EEE, IT &amp; ME</td>
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<tr>
<td>20EC85</td>
<td>Systems and Signal Processing</td>
<td>AI&amp;DS, ASE, CE, CSE, CSE(AI&amp;ML), EEE, IT &amp; ME</td>
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<tr>
<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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</table>
## OPEN ELECTIVES

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Offered to the branches</th>
</tr>
</thead>
<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>
</tr>
<tr>
<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>
</tr>
<tr>
<td>20EE83</td>
<td>Utilization of Electrical Energy</td>
<td>AI&amp;DS, ASE, CE, CSE, CSE(AI&amp;ML), ECE, IT &amp; ME</td>
</tr>
<tr>
<td>20EE84</td>
<td>Electric Vehicles</td>
<td>AI&amp;DS, ASE, CE, CSE, CSE(AI&amp;ML), ECE, IT &amp; ME</td>
</tr>
<tr>
<td>20IT81</td>
<td>OOP through JAVA</td>
<td>ASE, CE, ECE, EEE, &amp; ME</td>
</tr>
<tr>
<td>20IT82</td>
<td>Web Technologies using PHP</td>
<td>ASE, CE, ECE, EEE, &amp; ME</td>
</tr>
<tr>
<td>20IT83</td>
<td>Mobile Application Development</td>
<td>ASE, CE, ECE, EEE, &amp; ME</td>
</tr>
<tr>
<td>20IT84</td>
<td>Cyber Security &amp; Digital Forensics</td>
<td>ASE, CE, ECE, EEE, &amp; ME</td>
</tr>
<tr>
<td>20ME81</td>
<td>Renewable Energy Sources</td>
<td>AI&amp;DS, CE, CSE, CSE(AI&amp;ML), ECE, EEE &amp; IT</td>
</tr>
<tr>
<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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<tr>
<td>20ME83</td>
<td>Operations Research Techniques</td>
<td>AI&amp;DS, CE, CSE, CSE(AI&amp;ML), ECE, EEE &amp; IT</td>
</tr>
<tr>
<td>20ME84</td>
<td>Elements of Automobile Engineering</td>
<td>AI&amp;DS, CE, CSE, CSE(AI&amp;ML), ECE, EEE &amp; IT</td>
</tr>
</tbody>
</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 this 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

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
Formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary
functions. Solution of first order and first degree linear partial differential equation – Lagrange’s
method.

Text Books:
   2012.
   2010

Reference Books:
   New Delhi, 2011.
   Delhi, 2011.
   Wiley & sons, New Delhi, 2011.
   Private Limited, New Delhi, 2012.
Pre-requisites: Nil

Course Educational Objective: 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, student 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:
Pre-requisites : Nil

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 projections of 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, Regular Polyhedral, 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
**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:**
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. (Apply-L3)

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 : 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: Nil

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 Mild Steel Flat (MS).
Job II-Making a T-Fit from a rectangular piece of MS Flat.
Job III-Making a V-Fit from a rectangular piece of MS Flat
Job IV-Making a Half round fit from a rectangular piece of MS flat.

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 using GI sheet.
Job II - Preparation of an open scoop/ funnel using GI sheet.
Job III - Preparation of a Single Seam Joint and Double Seam Joint using GI sheet.
Job IV - Preparation of a Corner Seam Joint using GI sheet.
Trade –4: PLUMBING SHOP
   Introduction to plumbing – demonstration, use of hand tools, accessories and safety precautions.
   Job I – preparation of pipe layout.
   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, PVC Conduits. 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-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 Lab Manual.
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/contrasting/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, ClausiusMosotti 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
B.Tech. (II Sem.)  20CS01 - PROGRAMMING FOR PROBLEM SOLVING USING C

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 types, Modular programming, user defined structures, basics of files and its I/O operations.

Course Outcomes: 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, go to 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.

Textbook:

Reference books:
PRE-REQUISITES: Physics, Mathematics

COURSE EDUCATIONAL OBJECTIVE:

The main objective of this course is to develop the ability to predict the behaviour 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, hemisphere, 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
### Course 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

Upon successful completion of the course, the students will 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 – District’s Administration Head – Role and Importance, Municipalities – Mayor and Role of Elected Representative – Chief Executive Officer (CEO) of Municipal Corporation Panchayati Raj: Functions Panchayati Raj Institution (PRI), Zilla Panchayat, Elected Officials and their roles, CEO Zilla Panchayat: Block level organizational Hierarchy – (Different Departments), Village level – Role of Elected and Appointed officials – Importance of grass root democracy.

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
Speaking: 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
Speaking: 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
Speaking: 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. (Apply - L3)

# 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 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 : 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.(Understanding-L2)

CO2: Apply numerical techniques in solving of equations and evaluation of integrals. (Applying-L3)

CO3: Discriminate among Cartesian, Polar and Spherical coordinates in multiple integrals and their respective applications to areas and volumes.(Applying-L3)

CO4: Generate the single valued functions in the form of Fourier series and obtain Fourier series representation of periodic function.(Applying-L3)

CO5: Evaluate the directional derivative, divergence and angular velocity of a vector function.(Applying-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:


Reference:


Pre Requisites: Engineering Physics and Mathematics

Course Educational Objective: To understand the fundamental concepts of fluid mechanics, various flow measuring devices, boundary layer separation and performance characteristics of hydraulic machines.

Course Outcomes:
After completion of the course the students are able to
CO1: Understand the fundamentals of fluid mechanics and dimensional analysis and similarity concepts. (Understanding-L2)
CO2: Comprehend the kinematics and dynamics of fluid flows. (Understanding - L2)
CO3: Analyze boundary layer flow and friction losses in pipes. (Analyzing-L4)
CO4: Apply impulse momentum concept to impact of jet problems. (Applying-L3)
CO5: Evaluate the performance parameters of hydraulic turbines and pumps. (Applying-L3)

UNIT-I

DIMENSIONAL ANALYSIS AND SIMILARITY: Introduction, Principle of dimensional homogeneity, Rayleigh’s method, Buckingham’s Pi theorem method.

UNIT-II


UNIT-III
BOUNDARY LAYER FLOW: Laminar and Turbulent Boundary Layer, Boundary Layer Thickness, Displacement Thickness, Energy Thickness, Momentum Thickness, Boundary Layer Separation.

IMPACT OF JETS: Hydro dynamic forces of Jets on Stationary and moving flat, Inclined, Curved vanes, Jet striking centrally and a tip for Symmetrically and Un-symmetrically vanes, Velocity diagrams, work done and efficiency, Flow over radial vanes.
UNIT-IV

HYDRAULIC TURBINES: Classification of Turbines, Pelton Wheel, work done and efficiencies of Pelton Wheel, Working proportions of Pelton Wheel, Francis Turbine, work done and Efficiencies of Francis Turbine, Working proportions of Francis Turbine, Kaplan Turbine, work done, heads and efficiencies.


UNIT-V

CENTRIFUGAL PUMPS: Working of Centrifugal Pumps, Types of Centrifugal Pumps, Work done by The Impeller –Losses and Efficiencies, Specific Speed, Pumps in Series and Parallel.

RECIPROCATING PUMPS: Main components and working of a Reciprocating Pumps, Types of Reciprocating Pumps, work done by Reciprocating Pump, Percentage of Slip and Negative slip of pump.

TEXTBOOKS


REFERENCES

Pre-requisites: Engineering Physics

Course Educational Objective:
To provide an intuitive understanding of thermodynamics to emphasize on physics of thermodynamic systems and this covers the heat and work interactions. It also provides insights on laws of thermodynamics and its applications, properties of pure substances, ideal gases and different thermodynamic cycles.

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

CO1: Classify the various thermodynamic systems, properties and processes with examples and temperature scale of a system. [Remembering-L1]

CO2: Differentiate open and closed system and built up the heat and work transfer relations of thermal systems. [Understanding-L2]

CO3: Apply the laws of thermodynamics to find the thermodynamic properties and parameters of various thermal systems. [Applying-L3]

CO4: Understand the properties of pure substance and gases to compute the non reactive mixture parameters. [Understanding-L2]

CO5: Analyse the performance parameters of various thermodynamic cycles. [Analyzing-L4]

UNIT – I
Basic Concepts and Zeroth Law of Thermodynamics
Basic Concepts: Introduction, Classification of thermodynamic systems, Macroscopic and Microscopic view point, Control mass, Control volume, Properties of system, State, Change of state, Path, Process - reversible and irreversible processes, Quasi static process, Equilibrium, Path and Point Functions, Specific Heat, Internal Energy, Enthalpy.


UNIT – II
First Law of Thermodynamics
First Law Analysis of Closed Systems: Introduction, First law for a closed system undergoing change of state and cycle, Representation of Thermodynamic processes on P-V planes, Different forms of stored energy, Forms of energy, Mechanical and Non mechanical forms of Work transfer, pdV work and other types of work transfer.

UNIT – III

Second Law of Thermodynamics


UNIT – IV

Properties of Pure Substances and Gases

Properties of Pure Substance: Introduction, Phases of pure substance, p-v, p-T, T-s and h-s diagrams for pure substance, p-v-T Surface, Properties of steam, quality or dryness fraction, phase change processes, Mollier diagram for a pure substance.


UNIT – V

Thermodynamic Cycles


TEXT BOOKS


REFERENCES

### Prerequisite Subject:
Engineering Physics, Engineering Chemistry

### Course Educational Objectives:
The objective of this course is to acquire knowledge on the structure, properties and applications of metals and alloys and also understand the effect of mechanical working and heat treatment on materials.

### Course Outcomes:
After completion of the course students will be able to:
1. Comprehend the structure of materials, alloys and correlated the material properties with structure. *(Remembering-L1)*
2. Illustrate the procedure of drawing the equilibrium diagrams and apply the principle of equilibrium diagrams in evaluating the materials properties. *(Understanding-L2)*
3. Recall the properties, applications of ferrous, non ferrous and composite materials. *(Remembering-L1)*
4. Apply the principle of mechanical working on metals and heat treatment on materials. *(Applying-L3)*
5. Identify the types of composite materials and the manufacturing processes of fiber reinforced composites. *(Understanding-L2)*

#### UNIT – I
**STRUCTURE OF METALS:** Crystal structures-Body cantered cubic, Face cantered cubic, closed packed hexagonal, crystallographic planes. Mechanism of crystallization of metals, grain and grain boundaries, Effect of grain boundaries on the properties of metal / alloys – Determination of grain size.

**CONSTITUTION OF ALLOYS:** Necessity of alloying, Solid solutions-Interstitial Solid Solution and Substitution Solid Solution, Hume Rothery’s rules.

#### UNIT – II

#### UNIT – III
**FERROUS METALS AND ALLOYS:** Study of Iron-Iron carbide equilibrium diagram

**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 - IV
MECHANICAL WORKING: Hot working, Cold working, Strain hardening, Recovery, Recrystallisation and Grain growth. Comparison of properties of cold and hot worked parts.

UNIT – V
COMPOSITE MATERIALS: Classification of composites, various methods of component manufacture of fiber reinforced composites-Hand layup process, Filament winding process, SMC processes, Continuous pultrusion processes, Resin transfer moulding.
TYPES OF COMPOSITES: Introduction to metal ceramic mixtures, Metal – Matrix composites and C – C composites and applications

TEXT BOOKS:

REFERENCES:
2. William and callister, Materials Science and engineering, Wiley India private Ltd., 2011.
Pre-requisites : Engineering Mechanics

Course Educational Objective:
The objective of the course is to identify nature of the stress and compute the deformations in mechanical members due to various loads.

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

CO1 : Compute the stresses and deformations of a member subjected to various types of loading. (Applying-L3)

CO2 : Construct the shear force and bending moment diagrams along the length of beam. (Applying-L3)

CO3 : Comprehend the variation of bending and shear stresses across the cross section of the beams. (Understanding-L2)

CO4 : Analyze the structural members subjected to biaxial stresses. (Analyzing-L4)

CO5 : Formulate the equations for stresses and deformations due to various loads. (Applying-L3)

UNIT - I
SIMPLE STRESSES AND STRAINS: Stress and strain due to axial force, Hooke's law, Strains, Poisson’s ratio, Stepped bars - Stresses in composite bars due to axial force - 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 beams subjected to concentrated loads and uniformly distributed loads only - Maximum bending moment and Point of contra flexure.

UNIT – III
STRESSES IN BEAMS: Theory of simple bending - Assumptions - Derivation of flexure equation - Section modulus - Normal stresses due to flexure applications.

SHEAR STRESSES: Derivation of formula – Shear stress distribution across beam cross sections like Rectangular, Circular sections only.

UNIT - IV
ANALYSIS OF COMBINED STRESSES: State of plane stress at a point in stressed body, Normal and Tangential stresses on inclined planes - Principal stresses and their planes - Plane of maximum shear.

UNIT - V

THIN AND THICK CYLINDRICAL SHELLS: Hoop stress and longitudinal stress- Thin and Thick cylinders –Lame’s equations.
TEXT BOOKS

REFERENCES
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. *(Remembering-L1)*

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

CO3: Realize the importance of ecosystem and biodiversity for maintaining ecological balance. *(Understanding-L2)*

CO4: Acknowledge and prevent the problems related to pollution of air, water and soil. *(Applying-L3)*

CO5: Identify the significance of implementing environmental laws and abatement devices for environmental management. *(Understanding-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: Engineering Mechanics

COURSE EDUCATIONAL OBJECTIVE:
Determine the discharge of various flow measuring devices, estimation of friction factor and performance parameters of hydraulic machines.

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

CO1: Identify the need and use of various flow measuring devices. (Understanding-L2)

CO2: Apply the Bernoulli’s equation for energy balance of fluid flow system. (Applying - L3)

CO3: Determine the friction losses of fluid flow through different pipes. (Applying-L3)

CO4: Evaluate the performance characteristics of hydraulic pumps, turbines and impact of jets. (Applying-L3)

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 pipe line.
6. Impact of jets on Vanes.
7. Performance Test on Pelton Wheel.
8. Performance Test on Kaplan Turbine.
10. Performance Test on Multi Stage Centrifugal Pump.
11. Performance Test on Reciprocating Pump.
12. Turbine flow meter.
13. Reynolds experiment.

REFERENCES: Lab Manuals
Prerequisite Subjects: Mechanics of solids, Metallurgy and Material science

COURSE EDUCATIONAL OBJECTIVES:
The main objective of the course is to determine various mechanical properties of materials by testing under different load conditions and observe the microstructure of various materials and perform heat treatment of materials.

COURSE OUTCOMES:
After completion of the course students are able to:
CO1: Evaluate the mechanical properties of materials by conducting various tests. (Applying-L3)
CO2: Estimate the behaviour of various materials under different loading. (Understanding-L2)
CO3: Identify the material by observing the microstructure. (Remembering-L1)
CO4: Perform the hardness test and heat treatment of steels. (Applying-L3)

PART-A: MECHANICS OF SOLIDS
LIST OF EXPERIMENTS
Any 6 Experiments are required to be conducted
1. Compression test on helical spring.
2. Tension test on mild steel rod.
3. Double shear test on metals.
4. Torsion test on mild steel rod.
5. Impact test on metal specimen.
   (a) Izod Impact Test (b) Charpy Impact Test
6. Hardness test on metals. (a) Rockwell Hardness Test (b) Brinell Hardness Test
7. Deflection test on beams. (a) Cantilever Beam (b) Simply Supported Beam
8. Compression test on brittle materials.

PART-B: METALLURGY
Any 6 Experiments are required to be conducted
1. Preparation and study of the microstructure of pure metals like Iron, Cu and Al.
2. Preparation and study of the microstructure of low carbon steels, medium carbon steel and high carbon steels.
3. Study of the microstructures of gray cast iron, malleable cast iron and nodular cast iron.
4. Study of the microstructures of brass.
5. Study of the microstructures of heat treated steels.
6. Hardenability of steels by Jominy end quench test.
7. Hardness of various treated and untreated steels.

REFERENCE BOOKS
Lab Manual
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 (Two weeks)*

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.

Implement Python Script to calculate the series: \( S=1+x+x^2+x^3+\ldots\times n \)

Implement Python Script to print the following pattern:

```
* 
* *
* * *
```

**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 program to display a bar chart using different color for each bar.

e) Write a Python program 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.

********
PRE-REQUISITES: Engineering Graphics

COURSE EDUCATIONAL OBJECTIVE:
The main objective of this course is to improve the skill sets of students in drafting packages (Auto CAD/CATIA) and enable them to draw the diagrams related to mechanical engineering components/applications.

COURSE OUTCOMES: After completion of the course students will be able to:
CO1: Understand the Auto-CAD basics for 2D sketches used in industries. (Understanding - L2).
CO2: Draw the machine components using 3D modelling commands. (Applying – L3)
CO3: Edit the 3D solid Models using solid editing commands. (Understanding - L2)
CO4: Extract the Orthographic views of the models in Wire Frame, Surface & Solid Modelling. (Applying – L3)

Exercises to be conducted using Auto CAD software:

<table>
<thead>
<tr>
<th>Expt. No.</th>
<th>Type of Drawings</th>
<th>Name of the Experiment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Basic drawing Commands</td>
<td>Exercise on Basic Drawing Commands</td>
</tr>
<tr>
<td>2.</td>
<td>Modify commands</td>
<td>Exercise on Modify Commands</td>
</tr>
<tr>
<td>3.</td>
<td>Isometric Diagrams using 2D commands</td>
<td>Exercise on isometric views</td>
</tr>
<tr>
<td>4.</td>
<td>3D Modelling Commands</td>
<td>Exercise on 3D Modelling Commands-I</td>
</tr>
<tr>
<td>5.</td>
<td></td>
<td>Exercise on 3D Modelling Commands-II</td>
</tr>
<tr>
<td>6.</td>
<td></td>
<td>Exercise on 3D Modelling Commands-III</td>
</tr>
<tr>
<td>7.</td>
<td>3D Solid Editing Commands</td>
<td>Exercise on 3D Solid Editing Commands-I</td>
</tr>
<tr>
<td>8.</td>
<td></td>
<td>Exercise on 3D Solid Editing Commands-II</td>
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<tr>
<td>9.</td>
<td></td>
<td>Exercise on 3D Solid Editing Commands-III</td>
</tr>
<tr>
<td>10.</td>
<td>Wire Frame, Surface &amp; Solid Modelling</td>
<td>Perform Wire Frame, Surface &amp; Solid Modelling from 3D Models</td>
</tr>
<tr>
<td>11.</td>
<td>Drafting</td>
<td>Extraction of Ortho Graphics Views from 3D model-I</td>
</tr>
<tr>
<td>12.</td>
<td></td>
<td>Extraction of Ortho Graphics Views from 3D model-II</td>
</tr>
</tbody>
</table>

WEB REFERENCES:
1. https://www.slideshare.net/qarni888/auto-cad-introduction
2. https://www.slideshare.net/Vgroksoo7/presentation-on-auto-cad
3. https://www.autodesk.in/shortcuts/autocad
4. https://www.youtube.com/watch?v=uy2GvFwVJU4&list=PL970B66C256FA05E1
5. https://www.youtube.com/watch?v=HDTwvQ06zDI&list=PL970B66C256FA05E1&index=62
20FE09-PROBABILITY AND STATISTICS
(/common to AI&DS, CSE, IT & MECH)

R20

B.Tech (IV Sem.)

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</tbody>
</table>

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 the 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.
Random variables – Discrete and continuous Random Variables, distribution function.
Mathematical Expectation of one-dimensional Random Variable.

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


Reference Books

**COURSE EDUCATIONAL OBJECTIVE:** This course provides the analysis of vapour power cycle, principle of working, thermodynamic analysis, performance and applications of its components.

**COURSE OUTCOMES:**

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

**CO1:** Describe the working of a vapour power cycles and identify the suitable fuels for power plants. *(Understanding-L2)*

**CO2:** Identify the need of various boilers and draught systems for a thermal power plant. *(Remembering-L1)*

**CO3:** Apply thermodynamic analysis to study the characteristics of steam nozzles and steam condensers. *(Applying-L3)*

**CO4:** Evaluate the performance characteristics of an impulse and reaction turbines. *(Applying-L3)*

**CO5:** Comprehend the different compressors used in thermal systems. *(Understanding-L2)*

**UNIT – I**

**VAPOUR POWER CYCLES:** Introduction, Carnot Vapour Power Cycle, Rankine Cycle, Actual Vapour Power Cycle, Methods to improve efficiency of Rankine cycle, Reheating of steam, Regeneration-Open and Closed Feed Water Heaters. Fuels used in power plant.

**UNIT – II**

**BOILERS:** Introduction, Boiler systems-Function and Classification, Fire Tube Cornish, Lancashire, Cochran, Water Tube-Babcock and Wilcox, High pressure boilers-Loeffler and Benson boilers, Boiler Mountings and Accessories.

**DRAUGHT SYSTEM:** Functions, Types, Natural Draft-Height of chimney for given draught and discharge, Condition for maximum discharge, Efficiency of chimney, artificial draught-induced and forced.

**UNIT – III**

**STEAM NOZZLES:** Introduction, Types of nozzle, Flow through nozzles-thermodynamic Analysis, velocity of nozzle at exit, condition for maximum discharge, critical pressure ratio, Ideal and actual expansion in nozzle, velocity coefficient.

**STEAM CONDENSERS:** Introduction, Elements of a condenser plant, Types of Condensers-Jet condensors, Surface Condensers–working principle.

**UNIT – IV**

**STEAM TURBINES:** Introduction, Classification.

**IMPULSE TURBINES** –Mechanical details, Working principle, Velocity diagram–effect of friction–power developed, axial thrust, blade or diagram efficiency–condition for maximum efficiency. De-Laval Turbine – its features. Method store ducerotor speed-velocity compounding (Curtis Turbine), Pressure compounding (Rateau Turbine) and pressure and velocity compounding.
REACTION TURBINES: Introduction, Parson's reaction turbine, performance analysis, degree of reaction, condition for maximum efficiency.

UNIT – V

COMPRESSORS: Introduction, Classification


ROTARY COMPRESSORS: Roots blower and Vane's sealed compressor-principle of working and applications. Centrifugal and Axial flow compressors: Construction, Principle of operation and applications.

TEXT BOOKS:


REFERENCE BOOKS:

PRE-REQUISITES: Metallurgy and Material Science

COURSE EDUCATIONAL OBJECTIVE:

The main objective of this course is to understand the various manufacturing processes available for mechanical engineer and apply them in producing the components.

COURSE OUTCOMES:

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

CO1: Classify various manufacturing processes and illustrate the casting processes. [Understanding – L2]

CO2: Recall the various welding techniques and explain gas welding and arc welding. [Understanding – L2]

CO3: Illustrate resistance welding, special welding, soldering and brazing processes. [Understanding – L2]

CO4: Understand the nature of plastic deformation and identify the types of metal forming processes. [Remembering – L1]

CO5: Distinguish various types of metal forming processes. [Understanding – L2]

UNIT – I

INTRODUCTION TO MANUFACTURING: Historical perspective; Importance of manufacturing; Classification of manufacturing processes.


UNIT – II

WELDING: Classification of welding process, Principle of gas welding, Oxy- acetylene welding equipment, Process and applications, Hydrogen welding, Gas cutting process and applications.

ELECTRIC ARC WELDING: Principle, equipment, electrodes and electrode polarities, Consumable and non consumable welding process. MIG welding Sub-merged arc welding (SAW) processes and applications. Inert gas welding, Tungsten Inert Gas Welding (TIG) process and applications, Carbon arc welding.

UNIT - III

RESISTANCE WELDING: Principle and types of resistance welding and applications, Thermit welding, friction welding, explosive welding and induction welding.

SOLDERING AND BRAZING: Soldering, brazing and braze welding processes and applications, welding defects, causes and remedies. Non-destructive examination of weldments.
UNIT – IV


UNIT – V

EXTRUSION OF METALS: Basic extrusion process, its characteristics and applications. Hot extrusion and cold extrusion - Forward extrusion and backward extrusion – Impact extrusion, and Hydrostatic extrusion.

SHEET METAL OPERATIONS: Stamping, Forming and other cold working processes, Blanking and piercing – Bending and stretch forming, Embossing and coining.

TEXT BOOKS


REFERENCES:

PRE-REQUISITES: Mechanics of Solids

COURSE EDUCATIONAL OBJECTIVE:
The main objective of this course is to identify the basic components, layout and kinematics of mechanisms & familiarize the standard mechanisms used for speed and stability control under the effects of vibrations.

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

CO1. Comprehend the layout and working of various mechanisms. [Understanding-L2]
CO2. Analyze the velocity and accelerations of various kinematic links in a mechanism.[Analyzing-L4]
CO3. Analyze the gear kinematics and turning moment diagrams of engines.[Analyzing-L4]
CO4. Analyze the speed regulations in various types of governors.[Analyzing-L4]
CO5. Solve the balancing of the rotating parts and undamped, damped free vibrating mechanical systems. [Applying-L3]

UNIT – I

UNIT – II

UNIT – III
GEARS: Terminology – Law of gearing- Profile for gears- Involute action- Path of contact, Arc of contact, Contact ratio- Velocity of sliding –Interference and Undercutting.

TURNING MOMENT DIAGRAMS: Turning moment – Angular velocity and acceleration of connecting rod –Piston effort, Crank effort and torque diagrams - Fluctuation of energy - Flywheels.

UNIT – IV

UNIT – V

BASICS OF VIBRATIONS: Introduction, Types of vibrations-longitudinal, torsional and transverse vibrations, Undamped free vibrations of spring mass system using energy method, under damped free vibrations of spring mass system, logarithmic decrement.
TEXT BOOKS

REFERENCES
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. (Applying – L3)

CO2: Distinguish between values and skills, happiness and accumulation of physical facilities, the self, and the Body. (Understanding – L2)

CO3: Understand the role of a human being in ensuring harmony in society. (Understanding – L2)

CO4: Understand the role of a human being in ensuring harmony in the nature and existence. (Understanding – L2)

CO5: Distinguish between ethical and unethical practices. (Applying – 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
UNIT-III:
Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship
Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its 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 Book:

Reference Books:
Prerequisite Subject(s): Engineering Workshop, Engineering Graphics

COURSE EDUCATIONAL OBJECTIVE:
The objective of the course is to provide hands-on experience in primary production processes to design, fabricate, testing and evaluation of mechanical components of different materials using casting, welding, press working and moulding techniques.

COURSE OUTCOMES:
After completion of the course, students will be able to:
1. Choose a suitable primary production process to design an industrial component. (Understanding-L2)
2. Select a suitable production process for fabrication of designed component. (Applying-L3)
3. Choose a suitable mechanical press working operation to get the required shape of component. (Remembering-L1)
4. Manufacture a plastic component using various plastic processing techniques. (Applying-L3)

I. METAL CASTING
1. Pattern Design and making
2. Moulding sand properties testing and evaluation
3. Mould Making, Melting and Casting

II WELDING
1. ARC Welding
2. Resistance Welding
3. Special Welding Techniques
4. Brazing and Soldering

III MECHANICAL PRESS WORKING
1. Study of simple, compound, and progressive press tools.
2. Hydraulic Press - Operations

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

Ref: Production Technology Lab Manual
PRE-REQUISITES: Engineering Mechanics and Theory of Machines

COURSE EDUCATIONAL OBJECTIVE:
The main objective of this course is to demonstrate the concepts of theory of machines.

COURSE OUTCOMES:
At the end of the course, the student will be able to
CO 1. Apply the dynamics of cams, gyroscopes for any practical problems. (Applying-L3)
CO 2. Evaluate the speed regulations in governors. (Applying-L3)
CO 3. Execute the static and dynamic balancing for rotating parts of a machine. (Applying-L3)
CO 4. Analyze the vibration parameters of oscillating bodies. (Analyzing-L4)

LIST OF EXPERIMENTS:
At least 10 experiments are to be conducted
1. Study the cam jump phenomenon of various cams and followers.
2. Determination of gyroscopic couple on Motorized Gyroscope.
3. Determination of centrifugal forces and draw the characteristics curve of Watt and Porter governor.
4. Determination of centrifugal forces and draw the characteristics curve of Proell governor.
5. Determination of centrifugal forces and draw the characteristics curve of Hartnell governor.
6. Balance the given rotor system dynamically with the aid of the force polygon and the couple polygon.
7. Determination of whirling speed of rotating shaft with various boundary conditions.
8. Determination of natural frequency of the spring-mass damped and undamped systems.
9. Determination of natural frequency of torsional vibrations of a single rotor system.
10. Verification of dunkerley’s formula for transverse vibrations of beams with different end conditions.
11. Determination of damped and undamped forced vibrations of beams.
12. Determination of radius of gyration of the Bifilar suspension system.

REFERENCES:
Lab-Manual
Pre-requisites: Engineering Graphics, Engineering Drawing with AutoCAD

Course Educational Objective:
The main objectives of the course are to familiarize the basic conventions and various machine elements used in design and to understand the assembly drawings for engine parts, machine parts, valves etc.

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

CO1: Comprehend basic conventions needed for machine drawing. (Understanding-L2)

CO2: Construct the machine elements with suitable proportions used in mechanical systems. (Applying-L3)

CO3: Execute the assembly drawings of engine parts. (Analyzing-L4)

CO4: Execute the assembly drawings of machine parts. (Analyzing-L4)

UNIT- I
I. MACHINE DRAWING CONVENTIONS:
Need for drawing conventions – introduction to IS conventions

a) Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs and ribs.

b) Types of sections – selection of section planes and drawing of sections and auxiliary sectional views, Parts not usually sectioned.

c) Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centres, curved and tapered features.

d) Title boxes, their size, location and details - common abbreviations & their liberal usage

e) Types of Drawings – working drawings for machine parts.

II. DRAWING OF MACHINE ELEMENTS AND SIMPLE PARTS:
1. Sections of Solids: Introduction, Sections of Prisms, Pyramids, Cylinders and Cones
2. Selection of views, additional views for the following machine elements and parts with every drawing proportion.

a) Popular forms of screw threads, bolts, nuts, stud bolts, tap bolts and set screws.

b) Keys, cotter joints and knuckle joint.

c) Riveted joints for plates

d) Shaft coupling, spigot and socket pipe joint.

e) Journal, pivot and collar and foot step bearings.

III. ASSEMBLY DRAWINGS:
Drawings of assembled views for the part drawings of the following using conventions and easy drawing proportions.

a) Engine parts – Stuffing box, Cross head, Eccentric, Connecting rod, Piston assembly.

b) Other machine parts - Screws jack, Bench Vice, Pipe vice, Plummer block, Tailstock, Universal joint.
List of Experiments:

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Type of Drawing</th>
<th>Name of the Experiment</th>
<th>No. of Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Conventional Drawing</td>
<td>Conventional representations of various materials</td>
<td>03</td>
</tr>
<tr>
<td>2</td>
<td>Conventional Drawing</td>
<td>Conventional representations of various machine parts</td>
<td>03</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Sectional Views</td>
<td>03</td>
</tr>
<tr>
<td>4</td>
<td>Drawing of Machine elements for simple parts</td>
<td>Thread Profiles</td>
<td>03</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Bolt with Nut and Washer</td>
<td>03</td>
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<tr>
<td>6</td>
<td></td>
<td>Flanged Coupling</td>
<td>03</td>
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<tr>
<td>7</td>
<td></td>
<td>Riveted Joint</td>
<td>03</td>
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<tr>
<td>8</td>
<td>Assembly Drawing</td>
<td>Stuffing box</td>
<td>03</td>
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<tr>
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<td>Universal Joint</td>
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<td>Screw Jack</td>
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**TEXT BOOK**

**REFERENCES**
PRE-REQUISITES: Strength of Materials.

COURSE EDUCATIONAL OBJECTIVE:

The main objective of this course is to improve the modelling and analysis skills of students in ANSYS workbench and enable them to solve problems related to structures and machine members.

COURSE OUTCOMES:

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

CO 1: Understand the basics and fundamentals related to Finite Element Method.

(Understanding - L2)

CO 2: Apply the knowledge of ANSYS to solve the engineering problems. (Applying - L3)

CO 3: Perform the static structural analysis in 1D, 2D and 3D using ANSYS work bench.

(Applying - L3)

CO 4: Analyze the mode shapes of structures and machine elements. (Analyzing - L4)

Exercises are to be conducted using ANSYS Workbench software:

1. Introduction to Finite Element Method
2. Basics of ANSYS interface and its utilities
4. Static Analysis of a Planar Truss.
5. Static Analysis of a Cantilever Beam.
6. Static Analysis of a Simply Supported Beam with Point Load.
7. Static Analysis of a Simply Supported Beam with Uniformly Distributed Load.
8. Static Analysis of a Simply Supported Beam with Uniformly Varying Load.
10. Stress Analysis of Flat Plates and Simple Shells.

WEB REFERENCES:

1. https://www.slideshare.net/nageshsurner/introduction-to-ansys-workbench-80635115
2. https://www.youtube.com/watch?v=C8WvCQpzT2A
4. https://www.youtube.com/watch?v=6QaFX1CG-ZE
PRE-REQUISITES: Thermodynamics

COURSE EDUCATIONAL OBJECTIVE:

The objective of this course is to acquire knowledge on fundamentals of IC engine cycles and its performance analysis and the salient features of gas turbine and jet propulsion systems.

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

CO1: Describe the construction and functioning of internal combustion engines, fuel supply systems for SI and CI engines, modern automotive engines and electric vehicles. (Understanding - L2)

CO2: Comprehend the combustion characteristics of SI engines and CI engines. (Understanding - L2)

CO3: Compute the IC engine performance parameters. (Applying - L3)

CO4: Understand the construction and functioning of gas turbines. (Understanding - L2)

CO5: Apply gas turbine cycles for aircraft propulsion systems. (Applying - L3)

UNIT - I
INTRODUCTION: Basic Engine components and Nomenclature, Classification of Engines, The working principles of 2-stroke and 4-stroke SI and CI engines, Comparison of 2-Stroke and 4-Stroke Engines; CI and SI Engines, Ideal and Actual Working Cycles and their analysis, Valve timing Diagrams and Port timing diagrams.


UNIT - II
COMBUSTION IN SI ENGINE: Stages of combustion in SI engine, Normal and abnormal combustion, effect of detonation, detonation and engine variables and other factors affecting knocking and its prevention, theory of detonation in SI engines, combustion chamber requirements, types of combustion chamber, Octane number.

COMBUSTION OF CI ENGINE: Stages of combustion in CI engines, variables effecting delay period, diesel knock, methods of controlling diesel knock, CI engine combustion chamber requirements, types of combustion chambers, cold starting of CI engine, Cetane number.
UNIT - III

UNIT - IV
GAS TURBINES: Introduction to Gas Turbines, Development, Classification and Application of Gas Turbines, Ideal and Actual Cycles; Effect of Inter cooling, Reheating, Regeneration, Combined cycle,

UNIT - V

TEXT BOOKS

REFERENCE BOOKS
B.Tech. (V Sem.) 20ME11 - MACHINE TOOLS AND METROLOGY

L T P Cr. 3 - - 3

PRE-REQUISITES: Production Technology

COURSE EDUCATIONAL OBJECTIVE:

The main objective of this course is to provide an overview of machine tools and various principles of measurements.

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

CO1: Understand the concepts of metal cutting theory. (Understanding - L2)

CO2: Differentiate various machining processes. (Understanding - L2)

CO3: Comprehend the principles of finishing processes. (Understanding - L2)

CO4: Identify the instruments to measure linear, angular, and surface texture parameters (Understanding - L2)

CO5: Apply limits and fits on machine components and perform alignment tests on machine tools. (Applying - L3)

UNIT –I

METAL CUTTING THEORY: Elements of cutting process – Methods of Metal Cutting, Geometry of Single Point Cutting Tool, Chip formation, Mechanism and types of chips, Merchant’s Force Diagram, Measurement of cutting forces, Machining parameters calculations, Tool wear life and machinability.

UNIT-II


SHAPING, SLOTTING AND PLANING MACHINES: Principle of working – Principal parts – Specifications, classifications, operations performed.

UNIT-III

DRILLING MACHINES: Principle of working, specifications, types of drilling machines, various operations performed.

MILLING MACHINES: Principle of working – Specifications – Classifications of milling machines – Machining operations.

UNIT-IV METROLOGY
LINEAR AND ANGULAR MEASUREMENTS: Introduction to Metrology, Standards of measurements - line and end standards, basic principle and applications of slip gauges, dial indicator and micrometers, angle slip gauges – sine bar.

UNIT-V
LIMITS AND FITS: Introduction, Normal size, Tolerance limits, Deviations, Allowance, Fits and their types – unilateral and bilateral tolerance system, hole and shaft basis systems – interchangeability and selective assembly.
ALIGNMENT TESTS: Alignment tests on Lathe.

TEXT BOOK

REFERENCES
PRE-REQUISITES: Mechanics of Solids

COURSE EDUCATIONAL OBJECTIVE:

The main objective of this course is to familiarize the steps involved in the design process of various machine elements.

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

CO1: Comprehend the simple stresses in machine parts subjected to static loads. (Understanding – L2)

CO2: Analyze the failure criterion of mechanical parts subjected to fatigue loads. (Analyzing – L4)

CO3: Estimate the strengths of welded & threaded joints subjected to various types of loads. (Applying – L3)

CO4: Design the shafts for various applications of engineering. (Applying – L3)

CO5: Design the various machine elements such as keys, cotter, knuckle joints & shaft couplings. (Applying – L3)

UNIT – I
INTRODUCTION: Basic procedure of machine design– Basic requirements of machine elements – Design analysis- Design synthesis – Introduction to Indian standards-Selection of Preferred numbers.


UNIT – II

UNIT – III
WELDED JOINTS: Butt joints -Strength of butt welds - Fillet joints, Strength of parallel fillet welds-Strength of transverse fillet welds.

THREADED JOINTS: Threaded Joints-Terminology of screw threads- Eccentric load with perpendicular to axis of bolt - Bolts of uniform strength.
UNIT – IV

SHAFTS: Shaft design on strength basis-Shafts subjected to combined twisting moment and bending Moment-Design of shafts based on rigidity.

UNIT – V

KEYS, COTTER AND KNUCKLE JOINTS: Types of keys- Design of square and flat keys- Cotter Joints-Socket and Spigot cotter joint-Design of Knuckle joint.

TEXT BOOKS


REFERENCES

PRE-REQUISITES: Thermodynamics, Applied Thermodynamics

COURSE EDUCATIONAL OBJECTIVE:
To provide the insights on different non-conventional energy sources, potential, salient features and utilization of solar, wind, geothermal, ocean thermal energy, bio energy and direct energy conversion systems.

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

CO1: Estimate the potentials of nonconventional energy sources and solar energy harnessing devices. (Understanding - L2)

CO2: Apply the principles of energy conversion to study wind and geothermal energy plants. (Applying - L3)

CO3: Understand the power generating capacities of tidal energy, wave energy and ocean thermal energy plants. (Understanding - L2)

CO4: Describe the biomass production system technologies and their capacities for generating power. (Understanding - L2)

CO5: Comprehend the direct energy conversion principles, systems and potential for power generation. (Understanding - L2)

UNIT - I


UNIT - II

UNIT - III

**TIDAL ENERGY:** Introduction, Origin of Tides, Tidal Power generation, Classification of Tidal Power Plant, Site requirements.

**WAVE ENERGY:** Introduction, Wave energy and Power, Wave Energy devices – Merits and Demerits.

**OCEAN THERMAL ENERGY:** Introduction, Working principle of Ocean Thermal Energy Conversion, OTEC Systems, Advantages and Disadvantages of OTEC plants.

UNIT - IV


UNIT - V


TEXT BOOKS:


REFERENCE BOOKS:

PRE-REQUISITES: Engineering Mechanics, Theory of Machines

COURSE EDUCATIONAL OBJECTIVES:

The main objective of this course is to cultivate the interest and ability to develop robotic systems for social and industrial needs.

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

CO 1: Understand the anatomy of robots, end effectors and its applications. (Understanding - L2)

CO 2: Familiarize the working principle of actuators and sensors for robots. (Understanding - L2)

CO 3: Comprehend the forward and inverse kinematics of robots and apply D-H parameters for solving robot kinematic problems. (Applying - L3)

CO 4: Solve the dynamic behavior of robot. (Applying - L3)

CO 5: Analyze the trajectory of robotic motion and comprehend the applications of robots. (Applying - L3)

UNIT - I


ROBOT END EFFECTORS: Introduction – Types of end effectors – Mechanical grippers – Vacuum cups, magnetic grippers, adhesive grippers, and others – Robot / End effectors interface – Considerations in gripper selection and design.

UNIT - II

ACTUATORS: Introduction, Characteristics of actuating system- pneumatic actuators-hydraulic actuators- electric actuators, Advantages, Limitations, and applications.

UNIT – III
MANIPULATOR KINEMATICS: Introduction – Coordinate Frames, Description of Objects in space, Rotation Matrices, Homogeneous Transformation, Transformation of robotic arm for position and orientation, Numericals

D-H PARAMETER REPRESENTATION: D-H representation – Numericals on forward kinematics, Introduction to Inversion Kinematics

UNIT - IV

UNIT - V

APPLICATIONS OF ROBOTS: Robot applications in Material transfer and machine loading / unloading applications – Processing operations – Assembly and inspection – Future applications.

TEXT BOOKS

REFERENCES
B.Tech. (V Sem.) 20ME15 - MECHANICAL VIBRATIONS

PRE-REQUISITES: Engineering Mechanics, Mechanics of solids

COURSE EDUCATIONAL OBJECTIVE:

The main objective of this course is to provide the knowledge of mathematical modeling of various degrees of freedom of systems under free and forced vibrations and also familiarize the systems to study the response of vibrating systems.

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

CO1. Formulate the governing equations for un-damped free vibrations of single degree of freedom systems and its solutions. *(Applying – L3)*

CO2. Calculate the damped parameters of single degree of freedom of systems subjected to free vibrations. *(Applying – L3)*

CO3. Understand the response of various mechanical systems under harmonic excitation conditions. *(Understanding – L2)*

CO4. Analyze the two degree of freedom systems to get their response in terms of natural frequencies and mode shapes. *(Analyzing – L4)*

CO5. Analyze the multi degree of freedom systems to find the response by using different methods. *(Analyzing – L4)*

UNIT – I

UNDAMPED FREE VIBRATIONS OF SINGLE DEGREE OF FREEDOM SYSTEMS:
Introduction- Differential equation and Solution of various systems - Torsional vibrations – Equivalent stiffness of spring combinations -Springs in series – Springs in parallel – Natural frequency of a vibration system by energy method.

UNIT – II

DAMPED FREE VIBRATIONS OF SINGLE DEGREE OF FREEDOM SYSTEMS:

UNIT – III

FORCED VIBRATIONS OF SINGLE DEGREE OF FREEDOM SYSTEMS:
Forced vibrations due to excitation of the support –Vibration isolation and transmissibility - Typical isolators and mount types – vibration measuring instruments.
UNIT – IV

TWO DEGREES OF FREEDOM SYSTEMS: Introduction – Principal modes of vibrations –
Other cases of simple two degrees of freedom systems – Two masses fixed on a tightly stretched string - Double pendulum – Torsional system – Undamped forced vibrations with harmonic excitation -Undamped dynamic vibration absorber.

UNIT – V


TEXT BOOKS


REFERENCES

B.Tech. (V Sem.)  20ME16 - OPERATIONS RESEARCH

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PRE-REQUISITES : Linear Algebra and Transformation Techniques, Numerical Methods and Integral Calculus

COURSE EDUCATIONAL OBJECTIVE:

The objective of this course is to introduce the concepts of formulating an engineering problem into a mathematical model to develop an optimal solution.

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

CO 1: Apply linear programming approach for optimizing the objectives of industrial oriented problems. (Applying - L3).

CO 2: Formulate and solve Transportation Models and assignment Models (Applying - L3).

CO 3: Implement the strategies in competitive situations and identify the replacement period of the equipment. (Applying - L3).

CO 4: Analyze the waiting situations in an organization and determine the optimum inventory level in the organization. (Applying - L3).

CO 5: Resolve the complex problem into simple problems by dynamic programming approach and apply optimum strategies. (Applying - L3).

UNIT –I

INTRODUCTION: Introduction to Operations Research, operations research models, applications.


UNIT-II

TRANSPORTATION PROBLEM: Formulation, Optimal solution, unbalanced transportation problem, Degeneracy.


UNIT-III

GAME THEORY: Minimax (maximin) Criterion and optimal strategy, Solution of games with saddle points, Rectangular games without saddle points, 2 X 2 games – dominance principle – mX2 and 2Xn games, graphical method.
THEORY OF REPLACEMENT: Introduction, Replacement of Equipment that Deteriorates Gradually, Replacement of Equipment that fails suddenly, Group Replacement.

UNIT-IV
WAITING LINES: Single Channel – Poisson arrivals – exponential service times – with infinite population and finite population models.

INVENTORY MODELS: Introduction, terminology, EOQ, deterministic models — Instantaneous production, finite production, continuous demand, no set up cost, shortages are not allowed – purchase inventory models with one price break and multiple price breaks.

UNIT-V

TEXT BOOK
1. S.D Sharma, —Operation Researchl, Kedar Nath and RamNath - Meerut, 2020

REFERENCES
B.Tech. (V Sem.) 20ME60 – THERMAL ENGINEERING LAB

L T P Cr. 3 1.5

PRE-REQUISITES: IC Engines and Gas Turbines, Applied Thermodynamics

COURSE EDUCATIONAL OBJECTIVE:

The main objective of this laboratory is to familiarize the basic principles and evaluation of various performance parameters of internal combustion engines, Refrigerator, Air Conditioner, and Air compressor apparatus.

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

CO 1: Examine the valve timing diagram and port timing diagram of internal combustion engines (Remembering – L1)

CO 2: Analyze the performance characteristics of an internal combustion engines (Analyzing – L4)

CO 3: Estimate the energy distribution and frictional power of diesel engine using heat balance and morse test (Applying - L3)

CO 4: Describe the performance parameters of refrigeration systems and air compressor (Understanding - L2).

LIST OF EXPERIMENTS

(Any 10 experiments may be conducted)

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
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.
15. Test on solar parabolic trough collector to analyze various characteristics.

REFERENCES:

➢ Thermal engineering lab manual
PRE-REQUISITES: Production Technology, Machine Tools and Metrology

COURSE EDUCATIONAL OBJECTIVE:

The main objective of this course is to provide hands on experience in using machine tools and metrological instruments.

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

CO 1: Develop sequence of machining operations to produce the component. (Applying - L3)

CO 2: Capable of manufacturing components according to given drawings using various machine tools. (Applying - L3)

CO 3: Perform linear, angular and gear measurements of machined components. (Applying - L3)

CO 4: Analyze the measurement of the surface roughness and perform alignment tests. (Applying - L3)

LIST OF EXPERIMENTS

PART-A: MACHINE TOOLS LAB (At least five experiments may be conducted)

1. Study of various machine tools.
2. To perform the step turning and taper turning operations on lathe machine.
3. To perform knurling and threading operations on lathe machine.
4. To prepare a single point cutting tool.
5. To produce a spur gear using milling machine.
6. To cut a rectangular groove or keyway using Shaper, Planar and Slotter machines.
7. To perform drilling and tapping operations using drilling machine.
8. To prepare a smooth flat surface using surface Grinding machine.

PART-B: METROLOGY LAB (At least five experiments may be conducted)

1. Measurement of lengths, heights, diameters using vernier calipers and micrometers.
3. Taper measurement using balls and rollers.
4. Check the gear parameters of a gear using Gear Teeth Vernier Calipers
5. Machine tool alignment test on the lathe.
7. Angle and taper measurements using Bevel Protractor, Slip Gauges and Sine bars, etc.
8. Thread measurement by three wire method.
9. Surface roughness measurement by Taly Surf.

REFERENCES: Lab Manuals
PRE-REQUISITES: Thermodynamics, Applied Thermodynamics

COURSE EDUCATIONAL OBJECTIVE:

To learn the physical mechanisms on modes of heat transfer, differential equations in heat transfer applications and the significance of Non-Dimensional Numbers.

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

CO 1: Understand the basic heat transfer principles and their practical relevance in Planes, Cylinders and Spherical components. (Understanding - L2)

CO 2: Analyze steady and unsteady state heat transfer concepts and fins. (Analyzing – L4)

CO 3: Formulate the expressions to solve free and forced convection problems related to external and internal flows. (Applying -L3)

CO 4: Apply the concepts of heat transfer in boiling, condensation and radiation thermal systems. (Applying -L3)

CO 5: Design the simple heat exchanger for engineering applications using the data hand book. (Analyzing – L4)

UNIT – I


ONE-DIMENSIONAL STEADY STATE CONDUCTION: Heat flow through plane wall and cylinder with constant thermal conductivity- Electrical analogy-Thermal resistance-Overall heat transfer coefficient-Applications-Heat flow through Composite Wall and Cylinder - Critical radius of insulation for Cylinder and Sphere

UNIT – II

ONE DIMENSIONAL STEADY STATE CONDUCTION: Heat flow through plane wall and cylinder with Variable Thermal conductivity - Uniform internal heat generation in Slabs and cylinders-Extended Surfaces- Analysis of Long Fin and Short fin with insulated tip - Fin efficiency and Effectiveness

ONE DIMENSIONAL TRANSIENT HEAT CONDUCTION: Systems with negligible internal resistance-Lumped Heat analysis–Significance of Biot and Fourier Numbers-systems with finite surface and internal resistance using Heisler Chart.
UNIT – III

**DIMENSIONAL ANALYSIS:** Introduction- Dimensional analysis -Buckingham Pi Theorem applied to Forced convection --Significance of Non Dimensional numbers-The boundary layer concept-The velocity and Thermal boundary layer.


**NATURAL CONVECTION:** Introduction, applications-Development of Hydrodynamic and thermal boundary layer along Vertical plate- Empirical correlations for Vertical plate, Vertical, Cylinder, Horizontal Plate and Horizontal Cylinder-Natural convection cooling in electronic equipment, heat pipe.

UNIT – IV

**BOILING AND CONDENSATION:** Applications of Boiling Heat transfer phenomena- Pool Boiling- Boiling regimes- Critical Heat Flux-Condensation-Film wise and Drop wise condensation- Laminar film wise condensation on Vertical plate.


UNIT – V


Data Hand Book:


**NOTE:** Heat and Mass Transfer Data Hand Book by C.P. Kothandaraman and Subramanian- New Age Publications is to be allowed in Examination.
TEXT BOOKS


REFERENCES


PRE-REQUISITES: Design of Machine Elements-I, Machine Tools and Metrology

COURSE EDUCATIONAL OBJECTIVE:

The main objective of this course is to familiarize the principles of geometric modeling, numerical control and part programming.

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

CO 1: Comprehend the principles of CAD/CAM for design and manufacturing. (Understanding - L2)

CO 2: Formulate mathematical equations for geometrical entities like curves, surface, and solids. (Applying - L3)

CO 3: Write the program for part profiles to accomplish numerical control machining (Applying - L3)

CO 4: Discuss the codes for different parts using GT and apply in automated manufacturing systems. (Understanding - L2)

CO 5: Contrast CAQC techniques and comprehend the applications of Computer Integrated Manufacturing. (Understanding - L2)

UNIT - I

FUNDAMENTALS OF CAD: Introduction – Design process – Application of computers for design- Benefits of CAD.

COMPUTER GRAPHICS: Raster Scans Graphics-Transformation of geometry: Translation, scaling, reflection, rotation, shear and homogeneous transformations - Concatenated transformations.

UNIT – II

GEOMETRIC MODELING

REPRESENTATION OF CURVES: Introduction, wireframe models, wireframe entities, curve representation, parametric representation of analytical curves, parametric representation of Bezier and B-Spline curves.

REPRESENTATION OF SURFACES AND SOLIDS: Introduction to surfaces, surface models, surface entities. Introduction to solids, solid models, solid entities, fundamentals of solid modeling, boundary representation, CSG representation, sweep representation.
UNIT – III

COMPUTER NUMERICAL CONTROL: Introduction, numerical control, numerical control modes, numerical control elements, CNC machine tools, feedback devices, coordinate system.


UNIT - IV


FLEXIBLE MANUFACTURING SYSTEM: Introduction – FMS components – Benefits of FMS

UNIT - V

COMPUTER AIDED QUALITY CONTROL: Introduction – computers in QC – Contact Inspection methods and Non-contact inspection methods: optical, non-optical – Computer Aided Testing-Integration of CAQC with CAD/CAM.

COMPUTER INTEGRATED MANUFACTURING SYSTEMS: Introduction–Integration of CIM – Benefits of CIM.

TEXT BOOKS


REFERENCES

PRE-REQUISITES: Mechanical Engineering Design –I

COURSE EDUCATIONAL OBJECTIVE:

The main objective of this course is to understand and apply the standard procedure available for the design of mechanical components and IC engine components.

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

CO 1: Select suitable bearings under different load, speed, and life conditions. (Applying - L3)

CO 2: Design internal combustion engine components for safe and continuous operation. (Applying - L3)

CO 3: Select the belt and rope drives for elevators, cranes, and hoisting machinery. (Applying - L3)

CO 4: Design the springs under static and dynamic loads. (Applying - L3)

CO 5: Estimate the performance parameters of the gears for various loading conditions. (Applying - L3)

UNIT – I


ROLLING CONTACT BEARINGS: Ball and roller bearings – Static load carrying capacity – Dynamic load carrying capacity –Equivalent bearing load–Selection of bearing life –Design for cyclic loads and speeds.

UNIT – II

IC ENGINE COMPONENTS

PISTON: Forces acting on piston–Construction–Design and proportions of piston.

CONNECTING ROD: Forces on connecting rod– Buckling of connecting rod - Stress due to whipping action.

CRANK SHAFT: Crank shaft- Design of center crank.

UNIT – III


UNIT – IV


UNIT – V


TEXTBOOKS


REFERENCES


HANDBOOKSTOBEALLOWED

PRE-REQUISITES: Fluid Mechanics and Hydraulic Machinery, Heat Transfer

COURSE EDUCATIONAL OBJECTIVE:

To describe the governing equations, approaches, methodologies and applications used in CFD, distinguishes the importance of parabolic, elliptic and hyperbolic equations used in CFD and grid formations, consistency of CFD problems.

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

CO 1: Classify the mathematical models for FEM, FDM, FVM techniques. (Remembering – L1)

CO 2: Apply the mathematical and computational methods for fluid flow simulations. (Applying - L3)

CO 3: Analyze the computational problems related to fluid flows and heat transfer (Analyzing - L4).

CO 4: Distinguishes the grid sensitivity methods and compute the accuracy of a numerical solution. (Understanding – L2)

CO 5: Identify the correct numerical algorithm to solve 1D and 2D problems in steady and transient heat transfer conditions (Applying – L3).

UNIT - I
INTRODUCTION: Computational Fluid Dynamics as a Research and Design Tool, Applications of Computational Fluid Dynamics, Need for Computational Fluid Dynamics – Different numerical/CFD techniques – FDM, FEM, FVM, Governing Equations Of Fluid Dynamics, Control Volume, Substantial Derivative, Divergence of Velocity, Continuity Equation, Momentum Equation and Energy Equation

UNIT - II
UNIT - III


UNIT – IV

**HEAT CONDUCTION:** Finite Difference Applications in conduction and convection heat transfer – Heat conduction, steady and transient heat conduction in a rectangular geometry.

UNIT - V


**TEXT BOOK**


**REFERENCE BOOKS:**

PREREQUISITES: Machine Tools and Metrology

COURSE EDUCATIONAL OBJECTIVES:

The main objective of this course is to familiarize with unconventional machining processes and rapid prototyping.

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

CO 1: Assort appropriate unconventional machining processes for machining materials and to develop relevant industrial solutions for machining materials. (Understanding - L2)

CO 2: Understand the principles of Electro Chemical Machining Process for machining of materials. (Understanding - L2)

CO 3: Comprehend Electrical Discharge Machining principles for machining intricate components. (Understanding - L2)

CO 4: Differentiate the basic principles and applications of thermal machining processes like EBM, LBM and PAM. (Understanding - L2)

CO 5: Identify the appropriate Rapid Prototyping Processes for manufacturing various components. (Understanding - L2)

UNIT - I

INTRODUCTION: Need for unconventional machining methods-Classification of unconventional machining processes – considerations in process selection.

MECHANICAL PROCESSES: Basic principle, equipment, process variable and applications of ultrasonic machining, abrasive jet machining and water jet machining.

UNIT - II

ELECTROCHEMICAL PROCESSES: Introduction, principles, equipment and material removal rate in electrochemical machining, electrochemical grinding, electrochemical deburring and electrochemical honing-Chemical machining: principle, maskants, etchants, advantages and applications.

UNIT - III

ELECTRICAL DISCHARGE MACHINING: Introduction, Principle of Electrical Discharge Machining– Power circuits for EDM, Advantages, Limitations, and applications
PROCESS PARAMETERS OF EDM: Mechanics of metal removal in EDM, Process parameters, selection of tool electrode and dielectric fluids, Electric discharge wire cutting principle and applications.

UNIT - IV
ELECTRON BEAM, LASER BEAM AND PLASMA ARC MACHINING: Introduction, Principle, equipment and applications of electron beam machining, laser beam machining, plasma arc machining and hot machining.

UNIT - V

TEXT BOOKS:
1. Pandey P.C. and Shah H.S, Modern Machining Process / TMH.

REFERENCES
2. VK Jain, Advanced Machining Processes// Allied publishers.
PRE-REQUISITES : Theory of Machines

COURSE EDUCATIONAL OBJECTIVE:

The main objective of this course is to understand the mechanical condition monitoring and associated instrumentation for different monitoring areas through fault diagnosis.

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

CO 1: Understand basic principles of condition monitoring techniques. (Understanding – L2)

CO 2: Analyze the vibration characteristics of machinery through condition monitoring. (Analyzing – L4)

CO 3: Identify the faults through various monitoring techniques. (Applying – L3)

CO 4: Comprehend the various thermal monitoring methods. (Understanding – L2)

CO 5: Suggest suitable sensors for condition monitoring in various fields of applications. (Applying – L3)

UNIT-I

INTRODUCTION: Introduction to condition monitoring, Maintenance strategies, concept of condition monitoring and methods involved- vibration monitoring, visual monitoring, Oil & debris analysis, signature analysis noise monitoring, temperature monitoring, wear and corrosion monitoring.

UNIT-II

VIBRATION MONITORING: Basic vibration theory, vibration measurement and analysis, Rotational machine faults and vibration characteristics. Vibration monitoring to rotating machines. Vibration monitoring and frequency-based spectrum analysis to detect machine condition and faults in bearings and gears.

UNIT - III

FAULT DIAGNOSIS: Dynamic testing of machines and structures, experimental modal analysis, machine condition monitoring and diagnostics. Condition monitoring and signature analysis applications- noise monitoring, temperature monitoring, wear behavior monitoring, corrosion monitoring, performance trend monitoring.
UNIT –IV
THERMAL MONITORING: Introduction to thermal monitoring, thermal monitoring techniques, application of thermal monitoring to manufacturing processes. Thermal imaging camera tool and its application.

UNIT – V
SENSORS FOR CONDITION MONITORING: Accelerometers, strain gauges, eddy current probes and LVDT for measurement of displacement, velocity, and acceleration. Lock in amplifier for signal conditioning. Thermocouples, thermistors, resistance thermometers and junction semiconductor devices for temperature measurement. Radiation pyrometers for temperature measurement, Thermal imaging devices.

TEXT BOOKS

REFERENCES
PREREQUISITES: Production Technology

COURSE EDUCATIONAL OBJECTIVES:

The course educational objective is to familiarize the principles of automation in production, material handling and manufacturing systems.

COURSE OUTCOMES: After completion of the course students are able to

CO 1: Understand the basic elements in automation and production systems. (Understanding – L2)

CO 2: Comprehend the techniques of automated material handling and storage equipments. (Understanding – L2)

CO 3: Identify the types of manufacturing systems and single station manufacturing cells. (Understanding – L2)

CO 4: Differentiate manual assembly and automated flow lines. (Understanding – L2)

CO 5: Understand the concepts of automated assembly systems and adaptive control systems. (Understanding – L2)

UNIT – I

INTRODUCTION TO AUTOMATION: Basic elements of automated system, advanced automation functions, levels of automation. Production System Facilities, Manufacturing Support systems, Automation in Production systems, Automation principles & Strategies.

UNIT – II

AUTOMATED MATERIAL HANDLING: Types of equipment, considerations in material system design, the ten principles of material handling.

MATERIAL TRANSPORT SYSTEMS: Industrial trucks, automated guided vehicle systems, rail guided vehicles, conveyor systems, cranes and hoists.

STORAGE SYSTEMS: Storage system performance, storage location strategies, conventional storage methods and equipment, automated storage systems.

UNIT – III

INTRODUCTION TO MANUFACTURING SYSTEMS: Components of a Manufacturing system, Classification of Manufacturing Systems, overview of Classification Scheme, manufacturing progress functions.
SINGLE STATION MANUFACTURING CELLS: Single Station Manned Workstations and Single Station Automated Cells, applications, analysis of single station cells.

UNIT – IV
MANUAL ASSEMBLY LINES: fundamentals, alternative assembly systems, design for assembly, analysis of single model assembly lines, line balancing algorithms, mixed model assembly lines.

AUTOMATED FLOW LINES: Fundamentals of automated production lines, applications of automated production lines, analysis of transfer lines with no internal storage, analysis of transfer lines with storage buffers.

UNIT – V
AUTOMATED ASSEMBLY SYSTEMS: Fundamentals, design for automated assembly, quantitative analysis of assembly systems.

ADAPTIVE CONTROL SYSTEMS: Introduction, adaptive control with optimization, Adaptive control with constraints, Application of A.C. in Machining operations. Use of various parameters such as cutting force, Temperatures, vibration and acoustic emission.

TEXT BOOKS

REFERENCES
PREREQUISITES: Heat Transfer

COURSE EDUCATIONAL OBJECTIVE:

The objective of this course is to understand the modes of heat transfer in various heat transfer equipments used for different applications by conducting experiments.

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

CO 1: Estimate the thermal conductivity of different materials and powders. (Applying - L3)

CO 2: Estimate the value of heat transfer coefficient in free and forced convection. (Applying - L3)

CO 3: Validate the Stefan Boltzman constant and estimate emissivity of grey body.

(Applying - L3)

CO 4: Compare the parallel and counter flow heat exchanger performance characteristics.

(Analyzing - L4).

LIST OF EXPERIMENTS

(At least 10 Experiments are required to be conducted)

1. Composite Slab Apparatus – Overall heat transfer co-efficient.
2. Heat transfer through lagged pipe.
3. Heat Transfer through a Concentric Sphere
4. Thermal Conductivity of given metal rod.
5. Heat transfer in pin-fin apparatus.
6. Experiment on Transient Heat Conduction
8. Heat transfer in natural convection
9. Parallel and counter flow heat exchanger.
10. Emissivity apparatus.
11. Stefan Boltzmann Apparatus.
15. Study of Two – Phase flow.

REFERENCES

➢ Lab Manuals
PRE-REQUISITES: Computer Aided Machine Drawing, CAD/CAM

COURSE EDUCATIONAL OBJECTIVE:

The main objective of this course is to design, assemble, analyze and manufacture engineering components using computer aided tools.

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

CO 1: Design and assemble the mechanical components using CAD Software (Analyzing - L4)
CO 2: Apply finite element analysis for components using analysis software. (Applying - L3)
CO 3: Develop NC code for different part profiles and perform machining on CNC Machine tools. (Applying - L3)
CO 4: Simulate part program to perform various operations on CNC machine (Applying - L3)

LIST OF EXPERIMENTS

(At least 10 experiments are to be conducted)

1. Design and Assembly Modeling of Knuckle joint using CAD software
2. Design and Assembly Modeling of Universal Coupling using CAD software
3. Design and Assembly Modeling of Piston, Connecting Rod parts using CAD software
4. Analysis of trusses using ANSYS
5. Analysis of Beams using ANSYS
6. Analysis of 3D solids using ANSYS
7. Steady state heat transfer analysis using ANSYS.
8. Estimation of natural frequencies and mode shapes for simple problems using ANSYS
9. Development of NC code using CAM packages
10. Machining of simple components on CNC Turning by transferring NC Code from CAM package
11. Machining of Simple components on CNC-Mill by transferring NC Code from CAM Package
12. Robot programming, simulation, and execution.
13. Analysis of aero foil wing using computational fluid dynamics using ANSYS

SOFTWARE PACKAGES: CATIA /ANSYS / Iron CAD etc.

REFERENCES:

➢ Lab-Manual
PRE-REQUISITES: Engineering Mechanics, Theory of Machines, Robotics

COURSE EDUCATIONAL OBJECTIVES:

The main objective of this course is to demonstrate and analysis of various types of robots.

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

CO 1: Simulate forward and inverse kinematic movements of a robot using Robo Analyzer and MATLAB. (Understanding - L2)

CO 2: Perform the demo operations on SCARA and PUMA using Robo analyzer software. (Applying - L3)

CO 3: Experiment the robot operations like palletizing, gluing, spray painting, polishing, loading and Unloading. (Applying - L3)

CO 4: Develop Robot Programmes to use to control commands. (Analyzing - L4)

LIST OF EXPERIMENTS
(At least 10 Experiments are required to be conducted)

1. Study the anatomy of robots.
2. Analysis of robot configuration and Simulation of Robot with 2 Dof, to6 Dof using Robo Analyzer.
3. Forward and Inverse Kinematics Analysis of Robot using Robo Analyzer.
7. Program for commands like a line command, circle command.
8. Program for commands SPLINE command (continues path).
9. Program for Point to Point (PTP) command.
11. Loading/Unloading.
14. Polishing.
15. Simulate forward and inverse kinematics RR Manipulator using MATLAB.
16. Simulate forward and inverse kinematics RP Manipulator using MATLAB.

SOFTWARE PACKAGES: ARISTO ROBOT, C Prog, Robo Analyzer, MAT Lab

REFERENCES:
➢ Lab Manuals
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
**PRE-REQUISITES:** Thermodynamics.

**COURSE EDUCATIONAL OBJECTIVES:**

This course provides understanding and analyzing the refrigeration and air conditioning systems. It covers the different refrigeration cycles and its analysis and also the concepts of psychrometry and psychrometry process used for the purpose of air conditioning. Further, the comfort air conditioning and cooling load design and estimation also addressed in this course.

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

CO1: Describe the basic concepts of refrigeration and its applications. *(Understanding - L2).*

CO2: Evaluate the performance parameters of refrigeration systems. *(Applying – L3).*

CO3: Identify the desirable refrigerants and its use in various refrigeration systems *(Remembering – L1).*

CO4: Analyze the psychometric properties and processes used in air conditioning systems *(Analyzing – L4).*

CO5: Estimate the performance parameters of air conditioning systems. *(Applying – L3)*

**UNIT - I**

**REFRIGERATION:** Introduction- Necessity and applications, unit of refrigeration and C.O.P- Heat Engine, Refrigerator and Heat pump-Types of Refrigeration systems, and its Applications.

**REFRIGERANTS:** Classification of refrigerants- Desirable Properties-Nomenclature-Commonly used refrigerants- Alternate refrigerants –Green house effect, global warming, and Ozone layer depletion and Global warming potential.

**AIR REFRIGERATION SYSTEM:** Introduction-Air refrigeration system working on Reversed Carnot cycle – Air refrigeration system working on Bell Coleman cycle- COP- Open and Dense air systems, Applications.

**UNIT - II**

**VAPOUR COMPRESSION REFRIGERATION SYSTEM:** Working principle-Simple vapour compression refrigeration cycle – COP- Representation of cycle on T-s and P-h charts- Effect of Sub cooling and Super heating --Actual vapour compression cycle and its applications- Compound Compression with Inter cooling, Multiple Evaporator and Cascade System.

**VCR SYSTEM COMPONENTS:** Compressors-Classification-Working -Condensers – Classification-Working-Evaporators –Classification-Working, Expansion devices –Types-Working.
UNIT - III
VAPOUR ABSORPTION REFRIGERATION SYSTEM: Description and working of Aqua-Ammonia system- Calculation of maximum COP- Lithium Bromide- Water system-Principle of operation of three fluid absorption systems, Applications.

STEAM JET REFRIGERATION SYSTEM: Principle of working – Analysis - Applications.
Non Conventional Refrigeration Systems- Thermo electric Refrigeration, Vortex tube refrigeration, adiabatic demagnetization Refrigeration.

UNIT - IV


UNIT - V
AIR CONDITIONING SYSTEMS: Introduction-Components of Air conditioning system-Classification of Air conditioning systems-Central and Unitary systems- Packaged air conditioning systems-summer, winter and Year round systems, AC equipments-Fans and blowers-Types of fans, Ducts-its types and air distribution.

DESIGN OF AIR CONDITION SYSTEMS: Cooling load estimation, summer air conditioning – ADP-System with Ventilated and re-circulated air with and without bypass factor- RSHF, GSHF and ESHF and Infiltration design conditions.

NOTE: M.S.Mathur and F.S.Mehta, Refrigerant and Psychometric properties (Tables and Charts), Jain Brothers, data book will be supplied in the exam.

TEXT BOOKS

REFERENCES

COURSE EDUCATIONAL OBJECTIVE:
The main objective of the course is to acquaint the students with the knowledge of additive manufacturing process, tooling and applications.

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

CO1: Understand the working principle of additive manufacturing processes. (Understanding-L2)

CO2: Distinguish the essential characteristics of additive manufacturing processes. (Understanding-L2)

CO3: Identify high energy based systems and materials for manufacturing components. (Applying-L3)

CO4: Describe rapid tooling and relevant processes. (Understanding-L2)

CO5: Apply various post processing techniques for additive manufacturing applications. (Applying-L3)

UNIT-I
INTRODUCTION TO ADDITIVE MANUFACTURING: Introduction to Additive Manufacturing, Additive Manufacturing evolution, Distinction between Additive Manufacturing & CNC machining, Other Associated Technologies, Classification of Additive Manufacturing processes, Commonly Used Terms, Advantages of Additive Manufacturing, Types of Additive Manufacturing materials, Software’s, STL files, Creating STL Files, Slicing and types, problems with STL Files, Additive Manufacturing Applications like Medical, Aerospace and Automotive.

UNIT-II

UNIT - III
Powder Fusion Mechanisms, Processes, mechanism of bonding, development of lattice structure through powder bed pressure processes.

**DIRECT ENERGY DEPOSITION PROCESSES:**
Directed Energy Deposition Processes (DEDM), **Process** Description, Material, DED Systems, process, benefits and drawbacks, Applications.

**UNIT – IV**

**UNIT – V**
**POST PROCESSING METHODS:** Support Material Removal, Surface Texture Improvement, Accuracy Improvement, Aesthetic Improvement, Preparation for use as a Pattern, Property Enhancements using Non-thermal and Thermal Techniques.

**TEXT BOOKS**

**REFERENCES**

COURSE EDUCATIONAL OBJECTIVE:

The main objective of this course is to understand the principles of finite elements and to develop finite models for engineering applications.

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

CO1: Formulate the equilibrium equations for solving static engineering problems. (Applying-L3)

CO2: Compute the characteristics of flexural elements under different loading conditions. (Applying-L3)

CO3: Analyze 2-D structures with iso-parametric elements along with Axi-symmetric problems. (Analyzing-L4)

CO4: Apply the finite element techniques for solving thermal problems of different geometries. (Applying-L3)

CO5: Compute the Eigen values and vectors for bar and beam elements for dynamic analysis. (Analyzing-L4)

UNIT - I

INTRODUCTION TO FINITE ELEMENT METHOD: Stress and Equilibrium-Strain-Displacement relations- Stress – strain relations.


UNIT - II

ANALYSIS OF BEAMS: Hermite shape functions - Element stiffness matrix for two nodes, two degrees of freedom per node beam element – Treatment of boundary conditions.

UNIT – III

CONSTANT STRAIN TRAINGLE: Finite element modelling of two-dimensional stress analysis with Constant Strain Triangles and treatment of boundary conditions.

AXISYMMETRIC LOADING: Finite element modelling of Axi-symmetric solids subjected to Axi-symmetric loading with triangular elements. Two dimensional four noded-isoparametric elements, problems on isoperimetric formulation of four noded- quadrilateral element.
UNIT - IV

HEAT TRANSFER ANALYSIS: Heat conduction in plane walls, convection heat transfer in fins. Two-dimensional analysis of thin plate with triangular elements-Element conductivity matrix

Convection Matrix-Heat rate vector.

UNIT - V


TEXT BOOKS:


REFERENCE BOOKS:

B.Tech. (VII Sem.) 20ME27 - PROJECT MANAGEMENT

PRE-REQUISITES: Nil

COURSE EDUCATIONAL OBJECTIVE:

The main objective of this course is to create awareness of project management concepts.

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

CO1: Describe the principles of project management in managing the product life cycle. (Understanding-L2)

CO2: Analyse the feasibility studies for effective implementation of projects. (Analysing-L4)

CO3: Evaluate the projects using PERT & CPM techniques. (Applying-L3)

CO4: Establish financial planning of the project. (Applying –L3)

CO5: Identify and manage risks, while handling the projects. (Understanding –L2)

UNIT-I

INTRODUCTION TO PROJECT MANAGEMENT: Definition, functions, evolution of Project Management, classification of projects, Project Management in different environments

UNIT-II

PROJECT FEASIBILITY STUDY: Developing a project plan, market and technical analysis, financial analysis, evaluation of project proposals, risk analysis, sensitivity analysis, social cost benefit analysis

UNIT-III

PROJECT PLANNING: Planning fundamentals, project master plan, work breakdown structure and other tools of project planning, work packages project organization structure and responsibilities.


UNIT-IV

COST ESTIMATING & BUDGETING: Cost estimating process elements of budgeting, project cost accounting and management information systems, cost schedules and forecasts.
UNIT-V

MANAGING RISKS IN PROJECTS: Risk concept and identification, risk assessment, risk priority, risk response planning, risk management methods.

PROJECT CONTROL: Information monitoring, internal and external project control, cost accounting systems for project control, control process, performance analysis, variance limits, and issues in project control.

TEXT BOOK


REFERENCE BOOKS

PRE-REQUISITES: Thermodynamic, IC Engines and Gas Turbines.

COURSE EDUCATIONAL OBJECTIVES:

The main objective of this course is to provide the knowledge of various alternative fuels and control of engine pollution. It also covers the viability of alternate fuels and their application to the diesel engines. Further, the course covers the various pollutants formed from the engine exhaust and their possible control techniques.

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

CO1: Comprehend various fuels and basics of combustion principles (Understanding – L2).

CO2: Describe the process of making alternative fuels from different vegetable oils (Understanding – L2).

CO3: Identify various waste resources for alternative fuels and methods of biomass processing. (Understanding – L2).

CO4: Analyze the various pollutants released from the engine exhaust (Analyzing-L4).

CO5: Apply different pollution control techniques to reduce the emissions (Applying-L3).

UNIT-1


UNIT-II

VEGETABLE OILS AS ALTERNATE FUELS: Need of alternative fuels, Different types of vegetable oils, Vegetable oil properties and their importance, Transesterification process, need of blending of vegetable oils, Performance and emission characteristics of vegetable fuels, Advantages, and drawbacks with usage of vegetable oils, Usage of various fuel additives and their influence on engine characteristics, split injection strategy in Biodiesel fuelled engines.

UNIT-III

ALTERNATE FUELS FROM WASTE RESOURCES: Introduction, Overview of Waste resources around the world, Biomass conversion technologies, Biomass as solar energy, Biomass as an automobile fuel, Primary Biomass energy sources, Secondary Biomass sources.
BIO MASS PROCESSING METHODS: Physical processing of biomass, Thermo chemical and Biochemical processing of Biomass, Environmental considerations of biomass, Economics, and future aspects of biomass.

UNIT-IV
ENGINE POLLUTION: Types of Pollutants- Oxides of Nitrogen, Unburnt hydrocarbon, Carbon monoxide emissions, Particulate Emissions, Measurement of emissions- Oxides of Nitrogen, Unburnt hydrocarbon, Carbon monoxide emissions, Particulate Emissions, Health and environmental effects of pollution,
POLLUTION CONTROL TECHNIQUES: Exhaust Gas recirculation, Thermal reactors, Catalytic Convertors, Selective catalytic reduction, NOx traps, Diesel Particulate filters, Continuously Regenerating Trap (CRT), Oxidation Catalysts, Engine modifications to reduce emissions.

UNIT-V
ELECTRIC AND HYBRID VEHICLES: Introduction, Components of electric vehicles, General layout of electric vehicles, Types of electric vehicles, working principle of electric vehicles, Comparison with Internal combustion engines, Merits and demerits of electric vehicles, Hybrid electric vehicles, General layout of hybrid vehicles, comparison with electric vehicles.

TEXT BOOKS:

REFERENCES:
PRE-REQUISITES: Thermodynamics, IC engines and gas turbines

COURSE EDUCATION OBJECTIVES:

The objective of this course is to make students learn about automobile layout, Engine Emissions, working of Transmission system, Steering system, Suspension system, Braking system, Fuel system and different Electrical systems.

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

CO1: List and illustrate the basic components of Automobile (Remembering – L2).

CO2: Differentiate the Fuel supply systems in petrol and Diesel Engines (Understanding – L2).

CO3: Comprehend the function of various Electrical systems in Automobile (Understanding – L2).

CO4: Distinguish various transmission systems, Wheels & Tyres (Understanding – L2).

CO5: Compare various types of Steering systems, Braking systems and Suspension systems. (Understanding – L2).

UNIT-I

INTRODUCTION: Components of Automobile, Classification of Automobiles, Chassis and Frame, Rear wheel drive- Front wheel drive-Four wheel drive.

ENGINE CONSTRUCTION: Cylinder Block and Crankcase- Cylinder Head- Oil Pan- Manifolds- Gaskets- Cylinder Liners- Piston- Connecting Rod- Engine Valves, Firing Order.

ENGINE EMISSIONS AND CONTROL: Nitrogen oxides, Carbon monoxide, Hydrocarbons, Particulates and Soot, Types of pollutants in SI and CI Engines, Thermal Convertors, Three way catalytic convertor, Exhaust gas recirculation.

UNIT- II

ENGINE SERVICING: Engine Removal, Cylinder Head, Gaskets, Valves, Piston-connecting Rod Assembly.

UNIT - III

IGNITION SYSTEM: Battery Ignition system- Components of Battery Ignition system, Spark plug construction, Magneto Ignition system, Electronic Ignition system- Capacitive discharge Ignition system, Ignition timing.

CHARGING SYSTEM & STARTING SYSTEMS: Batteries- Types, Lead-acid battery, Battery Ratings, Charging system- Introduction- Principle of Generator and constructional details- Generator output control, Starting Motor, Starting drives, Bendix rives, Solenoid switch.

UNIT - IV


WHEELS AND TYRES: Types of Wheels, Wheel dimensions, Tyre- Types of Tyres, Carcass types, Tyre Materials, Tyre designations, Sensors-Speed control, Traction Control.

UNIT - V

FRONT AXLE AND STEERING: Front Axle, Types of stub axle, Steering geometry- Camber- Kingpin inclination- Combined angle and scrub radius- Castor- Toe in and Toe out, Under steer and Over steer, Power steering, Types of Steering gears.

SUSPENSION SYSTEM: Introduction, Types of Suspension springs, Leaf springs, Coil springs, Torsion bars, Shock Absorbers, Independent suspension- Types, Air-suspension, Suspension Sensors-Types.

BRAKING SYSTEM: Braking Requirements, Types of Brakes, Drum brakes and Disc Brakes, Hydraulic Brakes, Air brakes, Anti-lock braking systems.

TEXT BOOKS

4. Automobile Engineering, William Course, TMH Distributors
REFERENCES
PRE-REQUISITES: Nil

COURSE EDUCATIONAL OBJECTIVES:

The main objective of this course is to provide overview of production planning and control.

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

CO1: Describe the production planning and control for operating economy, effectiveness, and cost control. *(Understanding - L2)*

CO2: Apply the forecasting techniques in estimating the number of products. *(Applying - L3)*

CO3: Implement the inventory management techniques to determine the optimum quantity of material. *(Applying - L3)*

CO4: Prepare the route sheet required for a production process / activity. *(Applying - L3)*

CO5: Implement the aggregate planning and prepare the dispatch procedure required for a production process and other activities. *(Applying - L3)*

UNIT - I

INTRODUCTION: Definition – Objectives of Production Planning and Control – Functions of production planning and control – Elements of production control – Types of production – Organization of production planning and control department – Internal organization of department.

UNIT - II

FORECASTING: Objectives and Importance of forecasting – Types of forecasting, forecasting techniques–simple moving average method, weighted moving average method, exponential smoothing method, linear regression and Delphi method. Errors in forecasting-MAD, MSE, MAPE, MFE.

UNIT - III


MATERIAL REQUIREMENT PLANNING: Introduction to MRP, inputs to MRP, Bill of material, JIT inventory – Kanban system. ERP systems – Components, Modules, Implementation, advantages, and disadvantages.
UNIT - IV


UNIT - V


TEXT BOOKS


REFERENCES

PRE-REQUISITES: Mechanical Engineering Design-I.

COURSE EDUCATIONAL OBJECTIVE:
This course provides the knowledge on principles of Tribology (friction, wear, lubrication), with particular emphasis on lubricating system, surface characterization techniques, experimental techniques in Tribology.

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

CO1: Illustrate the characteristic features of tribology. (Understanding-L2)

CO2: Comprehend friction, wear theories and their measurement techniques. (Understanding-L2)

CO3: Apply theories of hydrodynamic lubrication for effective lubrication in bearings. (Applying-L3)

CO4: Analyze the various design parameters of hydrostatic lubricated bearings under different loading conditions. (Analyzing-L4)

CO5: Identify appropriate materials for designing anti frictional bearings. (Understanding-L2)

UNIT- I

INTRODUCTION TO TRIBOLOGY: Tribology and their characteristic feature, analysis and assessment of surface, Topography, Deterministic and Stochastic, Tribo models for asperity contacts, Techniques of surface examination, and Technological properties of surfaces. Viscosity, flow of fluids, viscosity, and its variation - absolute and kinematic viscosity, temperature variation, viscosity index determination of viscosity, different viscometers, Viscosity standards.

UNIT - II

FRICTION AND WEAR: Types of friction, Theories of friction, Study of current concepts of boundary friction and dry friction, friction reducing measures. Causes of wear, Types of wear, Mechanism of various types of wear, laws of wear, and effects of wear.

UNIT – III

INTRODUCTION TO LUBRICATION: Boundary lubrication; hydrodynamics, hydrostatic and elasto-hydrodynamic lubrication, Functions of lubricants, Types of lubricants and their physical properties, industrial applications; SAE classification.
THEORY OF HYDRODYNAMIC LUBRICATION: Petroff’s equation, Reynolds’s equation in two dimensions, bearing modulus, Somerfield number, Effects of side leakage, pressure, flow, load capacity and friction calculations, heat balance, minimum oil film thickness, oil whip and whirl.

UNIT - IV

THEORY OF HYDROSTATIC LUBRICATION: Hydrostatic step bearing, pivoted pad thrust bearing, hydrostatic lifts, hydrostatic squeeze films, pressure, flow, load capacity and friction calculations, oil rings, pressure feed bearing, partial bearings, externally pressurized bearings, Air lubricated bearing, Advantages, and disadvantages.


UNIT - V

ANTI-FRICTION BEARINGS AND BEARING MATERIALS: Anti-friction bearings, types, Advantages and disadvantages, General requirements of bearing materials, types of bearing materials, General bearing design considerations.

TEXTBOOKS:

REFERENCES:
PRE-REQUISITES: Applied Thermodynamics and Heat Transfer

COURSE EDUCATIONAL OBJECTIVE:

This course provides understanding of the power plant engineering fundamentals which includes the details of steam, hydro, gas nuclear, combined cycle power plants along with solar, wind and geothermal power energy systems in addition to the direct energy conversion systems. The economics of power generation and the environmental aspect of power generation are also being addressed in this course.

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

CO1: Describe the energy scenario, the energy generation sources and various circuitry systems in power plants.  (Understanding – L2)

CO2: Draw the layout of different power plants. (Remembering – L1)

CO3: Compute the power generation from different power plants. (Applying – L3)

CO4: Analyze the input parameters requirement for power generation from various power plant systems. (Analyzing-L4)

CO5: Calculate the economics of power generation from various power plants, pollution issues from power plant systems. (Applying – L3)

UNIT - I


UNIT - II

DIESEL POWER PLANT: General layout, Components of Diesel power plant, Performance of diesel power plant, fuel system, lubrication system, air intake and admission system, supercharging system, exhaust system, diesel plant operation and efficiency, heat balance, Site selection of diesel power plant, Comparative study of diesel power plant with steam power plant.

UNIT - III


UNIT - IV


UNIT - V

ECONOMICS OF POWER GENERATION: Factors affecting the economics, Load factor, Utilization factor, Performance and operating characteristics of Power Plants-Economic load sharing, Depreciation-Energy Rates-Criteria for optimum loading-Specific economic energy generation problems.

POLLUTION AND CONTROL: Introduction- Particulate and gaseous pollutants-Air and Water pollution by Thermal plants and its control—Acid rains -Methods to control pollution.

TEXTBOOKS


REFERENCES

3. P.K.Nag, power plant engineering-2020
Pre-requisites: Thermodynamics, Applied Thermodynamics

Course Educational Objective:

To provide the insights on the significance of energy conservation and its management in wide variety of utilities of thermal and electrical systems and estimating the economics of energy systems.

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

CO1: Understand the principles of energy conservation and audit. (Understanding-L2)
CO2: Estimate the thermal load for building heating and cooling applications. (Applying-L3)
CO3: Apply the energy conservation programme for different utilities. (Applying-L3)
CO4: Describe the energy and power management opportunities in electrical industries. (Understanding-L2)
CO5: Compute the payback periods for the economic analysis of energy conservation and management. (Applying-L3)

UNIT - I

PRINCIPLES OF ENERGY CONSERVATION AND MANAGEMENT: Introduction, Energy scenario, general principles of energy management and energy management planning, energy audit instruments, energy audit report, monitoring, evaluating and following up energy saving measures in utilities, Energy consumption patterns, Resource availability.

UNIT - II


UNIT - III

ORGANIZING ENERGY CONSERVATION PROGRAMME: Introduction, energy audit and energy information system, technology for energy conservation, co-generation of process, steam & electricity.

CASE STUDIES: Case studies of energy conservation, energy conservation opportunity, Energy conservation in I. C. Engine, commercial options in waste heat recovery equipment, Computer controlled energy management.
UNIT - IV

ELECTRICAL ENERGY CONSERVATION: Strategies for electricity and management, setting up an energy management programme, electricity saving technique by category of end use, electrical end use in industries, energy & power management in industry, energy management strategies for industry, demand management.

UNIT - V

ENERGY ECONOMICS AND MANAGEMENT: Importance and role of energy management, Energy economics, Payback period, Internal rate of return, financial evaluation of energy projects, evaluation of proposals, profitability index, life cycle costing approach, investment decision and uncertainty.

TEXT BOOKS:

REFERENCE BOOKS:
PRE-REQUISITES: Metallurgy and Material Science

COURSE EDUCATIONAL OBJECTIVE:

To impart the fundamentals of composite materials with different reinforcement, matrix materials and comprehend the types of manufacturing methods for advance composite materials to meet various engineering requirements.

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

CO1: Identify the behaviour of reinforced composite materials for specific applications (Understanding-L2)

CO2: Illustrate various reinforcements and fibre matrices. (Applying-L3)

CO3: Comprehend the design process and analysis for composite structures. (Applying-L3)

CO4: Describe different manufacturing methods for composite materials. (Understanding-L2)

CO5: Distinguish the characteristics of metal matrix, ceramic matrix, and carbon matrix composites (Understanding-L2).

UNIT- I


UNIT - II


UNIT – III


DESIGN ANALYSIS STAGES: Material selection - Configuration selection - Laminate joints - Design requirements and design failure criteria.
UNIT – IV

UNIT - V

TEXTBOOKS:

REFERENCES:
5. Web Portal: Composite Materials {NPTEL. Mechanical Engineering}
PRE-REQUISITES: Nil

COURSE EDUCATIONAL OBJECTIVE:

The main objective of this course is to familiarize the concepts of quality management techniques in industries.

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

CO1: Comprehend the principles and strategies of quality control. (Understanding - L2)

CO2: Apply the principles of total quality management to improve the quality of the product. (Applying - L3)

CO3: Choose the appropriate statistical quality control tool to check the process capability. (Applying - L3)

CO4: Examine various TQM techniques for industrial applications. (Applying - L3)

CO5: Interpret ISO quality standards in an organization. (Understanding - L2)

UNIT - I

INTRODUCTION: Evolution of total quality management, Definition of Quality, Quality costs, Quality Council, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

UNIT - II

TQM PRINCIPLES: Customer satisfaction- Types of Customers, customer supply chain, customer perception of quality, customer feedback, customer retention, Service quality. Employee Involvement, Motivation, Maslow’s hierarchy of needs, Herzberg theory, Empowerment and Team work, Performance appraisal, Benefits.


UNIT - III

STATISTICAL PROCESS CONTROL: The seven tools of quality, Statistical Fundamentals, Population and Sample, Normal curve, Control charts for variables and attributes, Process Capability.

SIX SIGMA:

Introduction to six sigma, indicators of six sigma, principle, elements, process, advantages, limitations, applications.
UNIT - IV

TQM TOOLS: Benchmarking, Benchmarking Process, Quality Function Deployment (QFD), House of Quality, QFD Process, Taguchi Quality Loss Function, Total Productive Maintenance-Concept, improvement needs, FMEA- Stages of FMEA.

UNIT - V


TEXT BOOK


REFERENCES

PRE-REQUISITES: Nil

COURSE EDUCATIONAL OBJECTIVE:

The main objective of this course is to familiarize the concepts of quality management techniques in industries.

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

CO1: Comprehend the principles of Management. (Understanding-L2)

CO2: Estimate the budget requirements considering break even analysis for industrial applications. (Applying-L3)

CO3: Implement work study techniques to identify the effective method of production. (Applying-L3)

CO4: Apply the principles of quality control to check the process capability and quality of the product. (Applying-L3)

CO5: Describe the functions of human resource management. (Understanding-L2)

UNIT-I


ORGANIZATIONAL STRUCTURE: - Organization structures: Line organization, Line and staff organization, Functional organization, Committee organization, Matrix organization, Advantages, Limitations, Applications

UNIT-II

COST ANALYSIS: Cost concepts. Break-even Analysis (BEA)-Determination of Break-Even Point (simple problems) - Managerial Significance.

CAPITAL BUDGETING: Capital and its significance, Types of Capital, Estimation of Fixed and Working capital requirements, Methods and sources of raising capital - Trading Forecast, Capital Budget, Cash Budget.
UNIT-III
OPERATIONS MANAGEMENT: Plant location, Factors influencing location, Principles and types of plant layouts - Methods of production: job, batch and mass production, Applications

WORK STUDY: Work study - Basic procedure involved in method study and Work measurement, advantages, limitations, applications.

UNIT-IV
QUALITY AND MATERIALS MANAGEMENT: Statistical quality control - Meaning Variables and attributes - X chart, R Chart, C Chart, P Chart, simple Problems, Acceptance sampling, Sampling plans, Deming’s contribution to quality.

UNIT-V
HUMAN RESOURCE MANAGEMENT (HRM): Concepts of HRM, Personal management and industrial relations,

FUNCTIONS OF HR MANAGER: Manpower planning, Recruitment, Selection, Training and development, Placement, Wage and salary administration, Promotion, Transfers Separation, performance appraisal, Job evaluation and merit rating.

TEXT BOOK

REFERENCES
2. Khan MI; Industrial Ergonomics; PHI Learning
Pre-Requisites: Knowledge gained in all the theory, practical courses, industrial training, mini project and internship.

Course Educational Objective: The main objective of this course is to make the student to plan and execute a project as an individual and team using the available resources within and outside the institute.

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

CO1: Apply the engineering knowledge to prepare the prototype and experimental setup layouts. (Applying –L3)

CO2: Analyze the complex engineering problems relevant to society, industry, environment and sustainability. (Analyzing -L4)

CO3: Design and develop a prototype models and experimental setups with the knowledge of mathematics, science and engineering. (Designing –L6)

CO4: Implement the project management and modern IT Tools to make a project reports with results and discussions. (Analyzing -L4)

CO5: Exhibit the individual and team work skills with professional and ethical values and communicate the project works effectively with society. (Applying- L3)