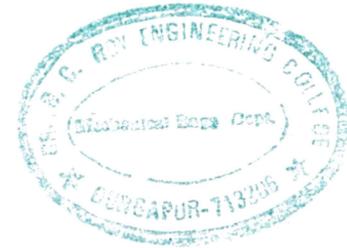
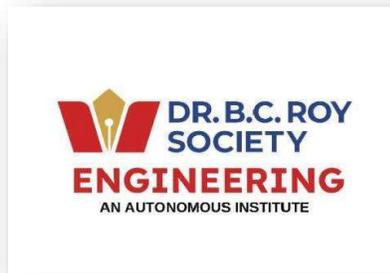


SYLLABUS
for
3rd SEMESTER
B.TECH. DEGREE
in
MECHANICAL ENGINEERING

(Applicable from the academic session 2024-2025)

Approved by BOS(ME) dt 5.11.2024 &
Academic Council, Agenda-01.02, dt 21.11.2024

Chatterjee



Dr. B. C. Roy Engineering College

An Autonomous Institution

Approved by: All India Council for Technical Education (AICTE)

Affiliated to: Maulana Abul Kalam Azad University of Technology, West Bengal (Formerly Known as -WBUT)

Jemua Road, Durgapur, West Bengal, India,713206

Course Name: Mathematics -III

Course Code: ME 301

(Semester III)

Course Broad Category: Basic Science

1. Course Prerequisite:

Knowledge in functions of several variables and ODE, Set Theory.

2. Course Learning Objectives:

The objective of these courses to familiarize the prospective engineers with techniques in applies the concept of partial differential equations like heat and wave equations. It aims to equip the students with the concepts and tools of probability and statistics. It will also aim to enhance the knowledge and techniques to solve problems numerically.

3. Teaching methodology and evaluation system for the course:

Teaching methodology – Lectures and Presentations, Interactive Discussions and Case Studies, Guest Lectures.

Evaluation System–

CIA-1-40 MARKS (Class Test (Objective + Subjective)): 25Marks, Assignment: 10 Marks, Attendance: 5 Marks

CIA-2-40 MARKS (Class Test (Objective + Subjective)): 25Marks, Assignment: 10 Marks, Attendance: 5 Marks

END SEMESTER EXAMINATION: 60 MARKS

4. Course Content:

Course Name: Mathematics-III

Course Code:ME 301

Hours per Week: 3L:1T:0P

Credits: 3

| Module | Topics | 36L |
|---------------|---|------------|
| 1. | Partial Differential Equations: Formation and Solution of Partial Differential equations, solutions of First order Linear PDEs, Second order linear equations and their classification, Solution to Homogeneous and Non-Homogeneous Linear PDEs of second order by complimentary function and particular integral method. | 8L |
| 2. | Application of Partial Differential Equations: D'Alembert's solution of the wave equation, Duhamel's principle for one dimensional wave equation, Heat diffusion and vibration problems, Separation of variable method. | 8L |

| | | |
|----|---|-----|
| 3. | <p>Basic concept in Probability and Statistics: Probability: Definition of various probability axioms, Independent events, Conditional event, Baye's Theorem, Random variable and Expectation, Moment Generating Function, Probability mass function (Binomial Distribution, Poisson's Distribution) and Probability density function (Normal Distribution), Poisson approximation to Binomial (application). Statistics: Measure of central tendency, Correlation- Regression, confidence interval and testing of hypothesis.</p> | 12L |
| 4. | <p>Numerical methods: Interpolation by polynomial: forward, backward, Lagrange, divided difference. Concept of simple Difference equations. Solution of nonlinear equations: fixed point iteration, Newton and secant methods. Convergence condition. Numerical Integration – trapezoidal and Simpson's one third Rule, solution of ODE – Euler's and RK method, Systems of ODE.</p> | 8L |

5. References:

TextBook:

- B. S. Grewal—Higher Engineering Mathematics; Publisher. Khanna **Publishers**.
- Ramana B. V. --- Higher Engineering Mathematics; **Publisher**. McGraw Hill Education.

ReferenceBooks:

- E. Kreyszig --- Advanced Engineering Mathematics (9th Edition)
- Bali & Goel---Text Book of Engineering Mathematics.
- H. K. Das ---Higher Engineering Mathematics
- Zafar Ahsan---Differential Equations and Their Applications
- R. K. Jain and I. C. Gupta ---Partial Differential Equations
- M.G. Nadkarni -----Partial Differential Equations: A Unified Approach
- Stanley J. Farlow ----Partial Differential Equations for Scientists and Engineers
- Sheldon Ross ---- A First Course on probability
- R N Hazra & Moloy Sarakar ----- Fundamental of Probability and Statistics
- Veerarajan T-----Probability and Statistics
- Dr. S. A. Mollah ----- Introduction to Numerical Analysis
- Rajaraman, V----- Numerical Methods.
- S. S. Sastry ---- Introductory Methods of Numerical Analysis
- Jain & Jain ----Numerical Analysis for Scientists and Engineers

6. Course Outcomes (CO):

| Course Outcomes | Details/Statement | Action Verb | Knowledge Level |
|-----------------|--|-------------|-----------------|
| ME 301.1 | Learn to apply different tools in Partial Differential Equations and Probability which would enable them to devise solutions to encounter engineering problems in their profession life. | Identify | Understand |

| | | | |
|-----------------|--|-----------|------------|
| ME 301.2 | Understand the concept of uses and applications of Probability and Statistics in applied sciences and engineering problems. | Explain | Understand |
| ME 301.3 | Apply the concept of Interpolation, Numerical Integration and Solution of nonlinear equations to find solutions in real life problems. | Implement | Apply |
| ME 301.4 | Analyze the ideas of mentioned mathematical tools to solve complex real-life problems. | Organize | Analyze |
| ME 301.5 | Evaluating the gradation of described Statistical and Numerical tools and determines the right approach to solve multidisciplinary engineering problems. | Assess | Evaluate |
| ME 301.6 | Build up logical and analytical skills to create a new idea appreciated by academics, research & emerging trends in industry. | Construct | Create |

7. Mapping of course out comes to module/course content

| Module | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 |
|--------|-----|-----|-----|-----|-----|-----|
| 1 | 3 | - | - | 2 | - | 1 |
| 2 | 2 | 3 | - | 1 | - | 1 |
| 3 | 2 | 3 | 3 | 2 | - | 1 |
| 4 | 3 | - | - | 2 | - | 1 |
| 5 | 2 | - | - | 1 | 3 | 1 |

8. Mapping of the Course out comes to Program Outcomes

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|-----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| ME 301.1 | 2 | 2 | 1 | 1 | 2 | - | - | - | - | - | 1 |
| ME 301.2 | 1 | 2 | 3 | 1 | - | - | - | - | - | - | 1 |
| ME 301.3 | 1 | 2 | 2 | 1 | 1 | - | - | - | - | - | 1 |
| ME 301.4 | 1 | 2 | 1 | 1 | 2 | - | - | - | - | - | 2 |
| ME 301.5 | 2 | 2 | 2 | 2 | 3 | - | - | - | - | - | 1 |
| ME 301.6 | 1 | 1 | 1 | 1 | - | - | - | - | - | - | 1 |

9. Mapping to Program Specific Outcome (PSO)

| | PSO1 | PSO2 |
|-----------------|------|------|
| ME 201.1 | 1 | 2 |
| ME 201.2 | 1 | 2 |
| ME 201.3 | 1 | 2 |
| ME 201.4 | 1 | 2 |
| ME 201.5 | 1 | 2 |
| ME 201.6 | 1 | 2 |

*** End of Syllabus***

Course Name: Engineering Materials

Course Code: ME-302

(Semester III)

Course Broad Category: Engineering Science Courses

1. Course Prerequisite:

Concept of Physics, Mathematics in 10+2 standard and undergraduate level introductory knowledge of Mechanical Engineering.

2. Course Learning Objectives:

- i. This course introduces the concepts of the correlation between the internal structure of materials, their mechanical properties and various methods to quantify their mechanical integrity and failure criteria.
- ii. Students will also learn different phases and equilibrium phase diagrams and heat treatment methods to tailor the properties of Fe-C alloys.

3. Teaching methodology and evaluation system for the course:

Teaching methodology – Lectures and Presentations, Interactive Discussions and Case Studies, Guest Lectures.

Evaluation System –

CIA-1-40 MARKS (Class Test (Objective + Subjective): 25 Marks, Assignment: 10 Marks, Attendance: 5 Marks)

CIA-2-40 MARKS (Class Test (Objective + Subjective): 25 Marks, Assignment: 10 Marks, Attendance: 5 Marks)

END SEMESTER EXAMINATION: 60 MARKS

4. Course Content:

Course Name: Engineering Materials

Course Code: ME-302

Hours per Week: 2L: 1T: 0P

Credits: 3

| Module No. | Topics | 44L |
|------------|---|-----|
| 1 | Introduction : Material Science—its importance in engineering; Classification of Materials—metals, polymers, ceramics, composites; Advanced materials semi-conductors, smart materials, nano-materials. Crystal Structure: Unit cells, Metallic crystal structures, atomic packing factor, FCC, BCC&HCP structures, Imperfection in solids: Point, line, interfacial, volume defects and crystal defect. Strengthening Mechanisms | 10L |

| | | |
|---|--|-----|
| 2 | Mechanical Property measurement: compression and torsion tests, Young's modulus, relations between true and engineering stress-strain curves, generalized Hooke's law, Yielding and yield strength, ductility, resilience, toughness, Hardness: Rockwell, Brinell and Vickers and their relation to Strength. Non Destructive testing of materials such as Radiography Testing, Dye Penetration Testing, Magnetic Particle Testing, Ultrasonic Testing, Eddy current testing. | 8L |
| 3 | Alloys, substitutional and interstitial solid solutions- Phase diagrams: Interpretation of binary phase diagrams and microstructure development; eutectic, peritectic, peritectoid and monotectic reactions. Iron-iron-carbide phase diagram and microstructural aspects of ledeburite, austenite, ferrite and cementite. Cast Iron: Grades, Alloy Cast Iron, Malleable Iron, S. G. Iron. Wrought Iron: Properties and uses. Steel: Classification of Steels, Properties and uses. | 10L |
| 4 | Heat treatment of Steel: Annealing, Normalising, Hardening, Tempering and Spheroidising, Isothermal transformation diagrams for Fe-C alloys and microstructures development. Case hardening, carburizing, nitriding, cyaniding, Carbonitriding, flame and induction hardening. | 8L |
| 5 | Classification of Steels, Properties and uses, Effects of alloying of steel, copper and copper alloys (Brass, bronze and copper-nickel), Aluminium and Al-Cu – Mg alloys- Titanium alloys. | 8L |

5. References:

Text Book:

- W. D. Callister, 2006, "Materials Science and Engineering-An Introduction", 6th Edition, Wiley India.
- V. Raghavan, "Material Science and Engineering", Prentice Hall of India Private Limited, 1999.

Reference Books:

- Kenneth G. Budinski and Michael K. Budinski, "Engineering Materials", Prentice Hall of India Private Limited, 4th Indian Reprint, 2002.
- U. C. Jindal, "Engineering Materials and Metallurgy", Pearson, 2011

6. Course Outcomes (CO):

| Course Outcomes | Details/Statement | Action Verb | Knowledge Level |
|-----------------|---|-------------|-----------------|
| ME-302.1 | Understand the necessity of engineering materials and its applications in various fields. | Understand | Understand (U) |
| ME-302.2 | Categorize crystal structures and imperfections in solids using unit cells and defect mechanisms. | Categorize | Analyze (A) |
| ME-302.3 | Compute mechanical properties of materials through testing. | Compute | Apply (P) |
| ME-302.4 | Discuss phase diagrams and microstructures in alloys, including the iron-carbide phase diagram and micro structural aspects of the given steel types. | Discuss | Understand (U) |

| | | | |
|-----------------|---|----------|----------------|
| ME-302.5 | Classify heat treatment techniques to control microstructure development in steel and understand the effects on properties. | Classify | Understand (U) |
| ME-302.6 | Examine the properties and applications of alloyed steels, cast irons, copper alloys, aluminium alloys, nickel-based super alloys, and titanium alloys. | Examine | Apply (P) |

7. Mapping of course outcomes to module / course content

| Module | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 |
|--------|-----|-----|-----|-----|-----|-----|
| 1 | 3 | 3 | - | - | - | - |
| 2 | - | - | 3 | - | - | - |
| 3 | - | - | - | 3 | - | - |
| 4 | - | - | - | - | 3 | - |
| 5 | - | - | - | - | - | 3 |

8. Mapping of the Course outcomes to Program Outcomes

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| CO1 | 3 | 1 | 1 | 1 | - | - | - | - | - | - | 1 |
| CO2 | 1 | 3 | 2 | 1 | 1 | 1 | - | - | - | - | 1 |
| CO3 | 1 | 2 | 3 | 2 | 1 | 1 | - | - | - | - | 1 |
| CO4 | 3 | 1 | 2 | 1 | - | - | - | - | - | - | 1 |
| CO5 | 3 | 2 | 1 | 1 | 1 | 1 | - | - | - | - | 1 |
| CO6 | 3 | 1 | 1 | 2 | - | - | - | - | - | - | 1 |
| Avg. | | | | | | | | | | | |

9. Mapping to Program Specific Outcome (PSO)

| | PSO1 | PSO2 |
|-----|------|------|
| CO1 | 2 | 1 |
| CO2 | 2 | 1 |
| CO3 | 2 | 1 |
| CO4 | 2 | 1 |
| CO5 | 2 | 1 |
| CO6 | 2 | 1 |

***** End of Syllabus*****

Course Name: Strength of Materials
Course Code: ME-303
(Semester III)
Course Broad Category: Professional Core

1. Course Prerequisite:

Engineering Mechanics.

2. Course Learning Objectives:

The course aims to provide students with a strong foundation in the mechanical behavior of materials under various loading conditions. Students will learn to analyze stress, strain, and deformation in structural elements, applying fundamental principles of elasticity and plasticity. The course will enhance problem-solving skills related to axial, bending, shear, and torsional loading, ensuring an understanding of material failure theories and safety considerations. By the end of the course, students will be equipped to design and evaluate engineering components for strength and stability in real-world applications.

3. Teaching methodology and evaluation system for the course:

Teaching methodology – Lectures, Presentations and Tutorials, Interactive Discussions and Case Studies, Guest Lectures.

Evaluation System –

CIA-1: 40 Marks

(Class Test (Objective + Subjective): 25 Marks, Assignment: 10 Marks, Attendance: 5 Marks)

CIA-2: 40 Marks

(Class Test (Objective + Subjective): 25 Marks, Assignment: 10 Marks, Attendance: 5 Marks)

End-Semester Examination: 60 Marks

4. Course Content:

Course Name: Strength of Materials

Course Code: ME-303

Hours per Week: 2L: 1T: 0P

Credits: 3

| Module No. | Description of Topic | Contact Hrs. | CO |
|------------|----------------------|--------------|----|
| | | | |

| | | | |
|---|---|----|------------|
| 1 | Deformation in solids- Hooke's law, stress and strain- tension, compression and shear stresses-elastic constants and their relations- volumetric, linear and shear strains- principal stresses and principal planes- Mohr's circle. Stress-Strain diagrams for ductile and brittle materials, Strain energy under axial loads. Thermal stress and strain. | 12 | CO1 |
| 2 | Beams and types of transverse loading on beams- shear force and bend moment diagrams-Types of beam supports, simply supported and over-hanging beams, cantilevers. Theory of bending of beams, bending stress distribution and neutral axis, shear stress distribution, point and distributed loads. Strain energy in bending. Castigliano's theorem. | 12 | CO2 |
| 3 | Moment of inertia about an axis and polar moment of inertia, deflection of a beam using double integration method, computation of slopes and deflection in beams. Buckling of columns, Euler's theory, critical loads for different types of constraints. | 11 | CO3 CO4 |
| 4 | Torsion - stresses and deformation in circular and hollow shafts, stepped shafts, stresses and deflection of helical springs. Thin cylinders subjected to internal pressure - Introduction, Hoop stress, Longitudinal stress and change in volume of cylindrical and spherical pressure vessels. | 10 | CO5 CO6 |

5. References:

Text Book:

- S S Rattan, Strength of Materials, McGraw Hill Publishing Co. Ltd.
- S. P. Timshenko/ D. H. Young, Elements of Strength of Materials, Fifth Edition, East-West Press Private Limited.

Reference Books:

- D.S. Bedi, Strength of Materials, Sixth Edition, Khanna Publishing House, 2019.
- Egor P. Popov, Engineering Mechanics of Solids, Prentice Hall of India, New Delhi, 2001.
- R. Subramanian, Strength of Materials, Oxford University Press, 2007.
- R.K. Bansal, Strength of Materials, Laxmi Publications.
- Ferdinand P. Beer, Russel Johnson Jr and John J. Dewole, Mechanics of Materials, Tata McGraw Hill Publishing Co. Ltd., New Delhi 2005.
- Debabrata Nag and Abhijit Chanda, Fundamentals of Strength of Materials, Wiley India.

6. Course Outcomes (CO): After completing the course, the students will be able to

| Course Outcomes | Details/Statement | Action Verb | Knowledge Level |
|-----------------|---|-------------|-----------------|
| CO 1 | EXPLAIN the concept of normal and shear stresses and strains and the relation amongst three elastic constants (E, K, G). | Identify | Remember |
| CO 2 | Discuss the bending theory to CALCULATE shear force and bending moment. | Explain | Understand |
| CO 3 | DETERMINE the slope and deflection of cantilever, simply supported under the given loading conditions (UDL, point load, varying loads). | Implement | Apply |
| CO 4 | CALCULATE the critical load by using the buckling theory of columns. | Assess | Evaluate |
| CO 5 | SOLVE the parameters (maximum shear stress, diameter, working stress, factor of safety) of the given problem related to torsion of circular shaft, helical springs. | Assess | Evaluate |
| CO 6 | CALCULATE the hoop and longitudinal stresses in thin/ thick walled cylindrical/ spherical pressure vessels. | Organize | Analyze |

7. Mapping of course outcomes to module / course content

| Module | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 |
|--------|-----|-----|-----|-----|-----|-----|
| 1 | 3 | - | - | - | - | - |
| 2 | - | 3 | - | - | - | - |
| 3 | - | - | 2 | 2 | - | - |
| 4 | - | - | - | - | 2 | 2 |

8. Mapping of the Course outcomes to Program Outcomes

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| CO1 | 3 | 3 | 2 | 2 | 1 | 1 | - | - | - | 1 | 1 |
| CO2 | 3 | 3 | 2 | 2 | 1 | 1 | - | - | - | 1 | 1 |
| CO3 | 3 | 3 | 2 | 2 | 1 | 1 | - | - | - | 1 | 1 |
| CO4 | 3 | 3 | 2 | 2 | 1 | 1 | - | - | - | 1 | 1 |
| CO5 | 3 | 3 | 2 | 2 | 1 | 1 | - | - | - | 1 | 1 |
| CO6 | 3 | 3 | 2 | 2 | 1 | 1 | - | - | - | 1 | 1 |

9. Mapping to Program Specific Outcome (PSO)

| | PSO1 | PSO2 |
|-----|------|------|
| CO1 | 3 | 2 |
| CO2 | 3 | 2 |
| CO3 | 3 | 2 |
| CO4 | 3 | 2 |

| | | |
|------------|---|---|
| CO5 | 3 | 2 |
| CO6 | 3 | 2 |

***** End of Syllabus*****

Course Name: Engineering Thermodynamics
Course Code: ME 304
(Semester III)
Course Broad Category: Professional Core Courses

1. Course Prerequisite:

Concept of Concept of Physics in 10+2 standard.

2. Course Learning Objectives:

To learn about work and heat interactions, and balance of energy between system and its surroundings

To learn about application of law to various energy conversion devices

To evaluate the changes in properties of substances in various processes

To understand the difference between high grade and low grade energies and III law limitations on energy conversion.

3. Teaching methodology and evaluation system for the course:

Teaching methodology – Lectures and Presentations, Interactive Discussions and Case Studies, Guest Lectures.

Evaluation System –

CIA-1-40 MARKS (Class Test (Objective + Subjective)): 25Marks, Assignment: 10 Marks, Attendance: 5 Marks

CIA-2-40 MARKS (Class Test (Objective + Subjective)) :25Marks, Assignment: 10 Marks, Attendance: 5 Marks

END SEMESTER EXAMINATION: 60 MARKS

4. Course Content:

Course Name: Engineering Thermodynamics

Course Code: ME 304

Hours per Week: 3L: 0T: 0P

Credits: 3

| Module | Topics | 45L |
|--------|---|-----|
| 1. | Introduction: Microscopic and Macroscopic viewpoints in thermodynamics. Fundamental concepts of System, Control volume, State, Property, Equilibrium, Processes. etc. Displacement work; Path dependence of displacement work and illustrations for simple processes. | 11L |
| | Temperature, Definition of thermal equilibrium and Zeroth law; Temperature scales; Various Thermometers- Definition of heat; examples of heat/work interaction in systems- First Law for Cyclic & Non-cyclic processes; Concept of total energy E; Demonstration that E is a property; Various modes of energy, Internal energy and Enthalpy. | |
| 2. | First law of thermodynamics: Statement, Corollaries and its application to closed and open systems, Steady and unsteady flow processes. | 12L |
| | Second law of thermodynamics: Concepts of heat reservoir and heat engine, Kelvin-Planck and Clausius statements of second law of thermodynamics, Carnot cycle, Carnot's theorem, Refrigerator and heat | |

| | | |
|----|--|-----|
| | pump. | |
| 3. | Clausius inequality; Definition of entropy S; Demonstration that entropy is a property; Evaluation of S for solids, liquids, ideal gases and ideal gas mixtures undergoing various processes; Determination of s from steam tables- Principle of increase of entropy; Illustration of processes in T-s coordinates; Definition of Isentropic efficiency for compressors, turbines and nozzles- Irreversibility and Availability, Availability function for systems and Control volumes undergoing different processes, Lost work. Second law analysis for a control volume. Exergy balance equation and Exergy analysis. | 10L |
| 4. | Properties of pure substances: Thermodynamic properties of pure substances in solid, liquid and vapour phases. P- V - T behaviour of simple compressible substances. Phase rule. State postulate. Thermodynamic property tables and charts. Ideal and Real gases. Equations of state. Compressibility factor. Generalised compressibility chart. Problems. Use of steam tables, Mollier's chart. Thermodynamic cycles-Basic Rankine cycle; Basic Brayton cycle; Basic vapor compression cycle and comparison with Carnot cycle. | 12L |

5. References:

1. Sonntag,R.E,Borgnakke,C.andVanWylen,G.J.,2003,6thEdition,*Fundamentals of Thermodynamics*, John Wiley and Sons.
2. Jones,J. B.andDuggan, R.E., 1996, *Engineering Thermodynamics*,Prentice-Hallof India
3. Moran,M.J.andShapiro,H.N.,1999,*Fundamentals of Engineering Thermodynamics*,John Wiley and Sons.
4. Nag,P.K,1995,*Engineering Thermodynamics*,TataMcGraw-HillPublishingCo.Ltd.
5. M.P.Poonia&S.C.Sharma,Basics of Mechanical Engineering,Khanna Publishing House,N. Delhi

6. Course Outcomes (CO):

| Course Outcomes | Details/Statement | Action Verb | Knowledge Level |
|-----------------|---|-------------|-----------------|
| ME 304.1 | Explain the fundamental thermodynamic properties to solve the problems involving thermodynamic properties viz. Internal energy, enthalpy, entropy, temperature, pressure and specific volume etc | Explain | Remember |
| ME 304.2 | Interpret the phases of the pure substances from their thermodynamic properties. | Interpret | Understand |
| ME 304.3 | Evaluate changes in thermodynamic properties of pure substances. | Evaluate | Evaluate |
| ME 304.4 | Apply the first and second law of thermodynamics to the thermodynamic process, cycles and devices. | Apply | Apply |
| ME 304.5 | Analyze thermodynamic systems using entropy and exergy. | Analyze | Analyze |
| ME 304.6 | Understand the basics of Vapour power cycles and Gas Power cycles | Understand | Understand |

7. Mapping of course outcomes to module / course content

| Module | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 |
|--------|-----|-----|-----|-----|-----|-----|
| 1 | 3 | - | - | - | - | - |
| 2 | 1 | - | - | 3 | 2 | - |
| 3 | 1 | 2 | 1 | 2 | 3 | - |
| 4 | 1 | - | 3 | 1 | - | 2 |

8. Mapping of the Course outcomes to Program Outcomes

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| ME 304.1 | 3 | 2 | 2 | 2 | 1 | 1 | - | 1 | 2 | - | 2 |
| ME 304.2 | 3 | 2 | 2 | 2 | 2 | 2 | - | 2 | 2 | - | 2 |
| ME 304.3 | 3 | 2 | 2 | 2 | 1 | 1 | - | 1 | 2 | - | 2 |
| ME 304.4 | 3 | 2 | 2 | 2 | 2 | 1 | - | 1 | 2 | - | 2 |
| ME 304.5 | 3 | 2 | 3 | 2 | 2 | 2 | - | 2 | 2 | - | 2 |
| ME 304.6 | 3 | 2 | 2 | 2 | 1 | 2 | - | 2 | 2 | - | 2 |

9. Mapping to Program Specific Outcome (PSO)

| | PSO1 | PSO2 |
|----------|------|------|
| ME 304.1 | 3 | 2 |
| ME 304.2 | 3 | 2 |
| ME 304.3 | 3 | 2 |
| ME 304.4 | 3 | 2 |
| ME 304.5 | 3 | 2 |
| ME 304.6 | 3 | 2 |

*** End of Syllabus***

Course Name: Manufacturing Processes
Course Code: ME - 305
(Semester III)

Course Broad Category: Professional Core

1. Course Prerequisite:

A fundamental understanding of engineering concepts such as forces, motion, and material properties.

2. Course Learning Objectives:

The objective of these courses to gain an understanding of various manufacturing processes like casting, machining, forming, welding, and more & learn the principles and mechanics behind each of these processes.

3. Teaching methodology and evaluation system for the course:

Teaching methodology – Lecture sand Presentations, Interactive Discussions and Case Studies, Guest Lectures.

Evaluation System–

CIA-1-40 MARKS (Class Test (Objective + Subjective): 25 Marks, Assignment: 10 Marks, Attendance: 5 Marks

CIA-2-40 MARKS (Class Test (Objective + Subjective): 25 Marks, Assignment: 10 Marks, Attendance: 5 Marks

END SEMESTER EXAMINATION: 60 MARKS

4. Course Content:

Course Name: Manufacturing Processes

Course Code: ME- 305

Hours per Week: 3L: 0T:0P

Credits: 3

| Module | Topics | 48L |
|---------------|---|------------|
| 1. | <p>Unit1:Manufacturing process: Definition, Classification of manufacturing process, Sand Casting: Pattern – materials, allowances, types, molding types, molding procedure, molding and properties, cores, core materials, properties of core making. Design of casting and riser, casting defects and inspection.</p> <p>Unit2:Special casting: Shell mould casting, Investment casting, permanent mould casting, Die casting, and centrifugal casting.</p> | 18L |
| 2. | <p>Joining Process: Welding: Fusion welding processes:, oxy-fuel gas welding, arc welding Processes-I (consumable electrode): principle, equipment, power sources, principle of metal transfer, Electrodes, Submerged Arc welding, Gas Metal Arc Welding.</p> | 10L |

| | | |
|----|--|-----|
| 3. | Arc welding processes-II (non-consumable electrode): Gas Tungsten Arc Welding, Plasma Arc Welding, Other welding processes: Thermit welding, Laser beam welding, Friction welding, Resistance welding, Defects in welding, Brazing, soldering. | 10L |
| 4. | Metal Forming Process: Extrusion: Classification, Advantages, Limitations and applications Wire Drawing: Classification, Advantages, Limitations and applications Rolling: Cold and Hot Rolling processes, Classification, Advantages, Limitations and applications, Sheet Metal Working: Deep drawing process | 10L |

5. References:

Text Book:

- Manufacturing Technology (Foundation Forming & Welding) - P.N. Rao, Tata McGraw Hill.
- Principles of manufacturing material sand processes - J.S.Campbell, Tata McGraw Hill.
- Basic Manufacturing Process-D. Mishra India Tech Publisher, New Delhi

Reference Books:

- Principles of manufacturing materials and processes- J.S.Campbell, Tata McGraw Hill.
- Manufacturing Engineering and Technology, 4th Edition-S.Kalpakjian and S.R.Scsimid, Pearson Education.
- Material sand processes in manufacturing-DeGarmo, Black and Kohser, Prentice Hall of India.
- Principle of Metal Casting-Heine, Loper and Rosenthal, Tata McGraw Hill.

6. Course Outcomes (CO):

| Course Outcomes | Details/Statement | Action Verb | Knowledge Level |
|-----------------|--|-------------|-----------------|
| ME-305.1 | Describe the fundamental principles and concepts of various manufacturing Processes used in industry | Describe | Remember |
| ME-305.2 | Apply the knowledge of metal casting principles to effectively address shrinkage, casting defects, and residual Stresses in manufacturing | Apply | Apply |
| ME-305.3 | Describe the Special casting processes | Describe | Remember |
| ME-305.4 | Discuss the physics behind welding, brazing, and soldering processes | Discuss | Understand |
| ME-305.5 | Describe the special welding processes | Describe | Remember |
| ME-305.6 | Explain the fundamentals of metal Forming process hot and cold working | Explain | Analyze |

7. Mapping of course out comes to module/course content

| Module | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 |
|--------|-----|-----|-----|-----|-----|-----|
| 1 | 2 | 3 | 3 | - | - | - |
| 2 | - | - | - | 3 | 2 | - |
| 3 | - | - | - | 2 | 3 | - |
| 4 | - | - | - | - | - | 3 |

8. Mapping of the Course outcomes to Program Outcomes

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| CO1 | 3 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| CO2 | 3 | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 |
| CO3 | 3 | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 |
| CO4 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| CO5 | 3 | 2 | 2 | 1 | 1 | 1 | - | 1 | 1 | 1 | 1 |
| CO6 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

9. Mapping to Program Specific Outcome (PSO)

| | PSO1 | PSO2 |
|-----|------|------|
| CO1 | 3 | 2 |
| CO2 | 3 | 2 |
| CO3 | 3 | 2 |
| CO4 | 3 | 2 |
| CO5 | 3 | 2 |
| CO6 | 3 | 2 |

*****End of Syllabus*****

Course Name: Machine Drawing Lab
Code: ME-391 (Semester III)
Course Broad Category: Professional Core Courses

1. Course Prerequisite: **Engineering Drawing**

2. **Course Learning Objectives:**

- > Course Learning Objectives for the Machine Drawing Lab (PC ME391), aiming to streamline the response and capture all necessary skills and including manual and CAD-based drawing, geometric dimensioning and tolerancing, and comprehension of engineering drawings.
- > Students will enhance their technical skills by designing and executing experiments related to mechanical assembly and disassembly. They will learn to analyze and interpret data, thereby reinforcing their understanding of machine drawing techniques and practical applications.
- > Students will develop a deep understanding of the fundamental concepts in machine drawing and effectively integrate modeling, science, and engineering principles to address complex design challenges.

3. **Teaching methodology and evaluation system for the course:**

Teaching methodology - Conduction laboratory experiments, Correlate with Theory by Interactive Discussions and Case Studies.

Evaluation System -

- A. Internal Assessment (60 Marks) - Formative Continuous Assessment
- B. End-Semester Exam (40 Marks) - [Continuous Assessment] Summative

4. **Course Content:**

Course Name: Machine Drawing Lab
Semester: Third
Course Code: ME-391
Hours per Week: 0L: 0T: 2P
Credits: 2

5. **List of Experiments**

A) Manual Drafting (On Drawing Board): -

Module # 01 Simple Mechanical Assembly Drawing, Number of Week: 08

- a. Screw Jack
- b. Machine Vice
- c. Pipe vice
- d. Tail stock
- e. Plummer block
- f. Steam stop valve
- g. Stuffing box for vertical steam engine
- h. Spring loaded safety valve
- i. Tool head for shaping machine

j. Crane hook

Module # 02, Number of Week: 02

A Use of Product Symbol,

- a. Electrical & Electronic Circuit
- b. Machine Drawing
- c. Welding Symbols

B Pipe joints of various types

- a. Hydraulic pipe joints
- b. Union pipe joints

Module # 03 Fasteners, Number of Week: 01

- a. Drawings of various views of
 - Metric.
 - BSW Threads.
 - Square Threads.
 - Multi Start Threads.
- b. Drawings of various views of
 - Nut & bolts, Washers.
 - Setscrew.
 - Locknuts.
- c. Foundation Bolts.

B) Computer Aided Drafting: -

**Module # 04 CAD drawing based applications. 03
(At least six sheets & weekly Assignment)**

6. Course Outcomes (CO):

| Course Outcomes | Details/Statement | Action Verb | Knowledge Level |
|-----------------|--|-------------|-----------------|
| CO 1 | Understand the basic concepts of machine drawing and the use of standard conventions for various mechanical components. | Understand | U (L2) |
| CO 2 | Apply knowledge of drawing principles to create standard views of mechanical components such as fasteners, threads, and joints. | Apply | A (L3) |
| CO 3 | Analyze the assembly drawings of mechanical systems and assess the relationships between different components. | Analyze | N (L4) |
| CO 4 | Evaluate the accuracy and clarity of mechanical drawings with respect to engineering standards and codes. | Evaluate | E (L5) |
| CO 5 | Create detailed assembly and component drawings of mechanical systems using manual drafting techniques. | Create | C (L6) |
| CO 6 | Use CAD tools to design and draft mechanical components, improving drawing precision and productivity. | Apply | A (L3) |

7. Mapping of course outcomes to module / course content

| MODULE | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 |
|---------------|------------|------------|------------|------------|------------|------------|
| 1 | 3 | | 3 | 3 | 3 | |
| 2 | | 3 | | | | |
| 3 | | 3 | | | | |
| 4 | | | | | | 3 |

8. Mapping of the Course outcomes to Program Outcomes

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|
| CO1 | 1 | 1 | 1 | 2 | 3 | - | 1 | 1 | 1 | 1 | 1 |
| CO2 | 1 | 2 | 2 | 2 | 3 | - | 1 | 1 | 2 | 2 | 2 |
| CO3 | 1 | 2 | 3 | 2 | 3 | - | 1 | 1 | 2 | 2 | 2 |
| CO4 | 1 | 2 | 3 | 2 | 3 | - | 1 | 1 | 2 | 2 | 2 |
| CO5 | 1 | 2 | 3 | 2 | 3 | - | 1 | 1 | 2 | 2 | 2 |
| CO6 | 1 | 2 | 3 | 2 | 3 | - | 1 | 1 | 2 | 2 | 2 |

9. Mapping to Program Specific Outcome (PSO)

| | PSO 1 | PSO 2 |
|------------|--------------|--------------|
| CO1 | 3 | 1 |
| CO2 | 3 | 1 |
| CO3 | 3 | 1 |
| CO4 | 3 | 1 |
| CO5 | 3 | 1 |
| CO6 | 3 | 1 |

*** End of Syllabus***

Course Name: Manufacturing Practice Lab
Course Code: ME-392
(Semester III)
Course Broad Category: Professional Core

1. Course Prerequisite:

A fundamental understanding of engineering concepts such as forces, motion, and material properties.

2. Course Learning Objectives:

The objective of these courses to gain hands-on experience with a variety of manufacturing processes such as machining, casting, welding, and forming & Learn how to operate different machines and tools used in manufacturing, such as lathes, milling machines, welding equipment.

3. Teaching methodology and evaluation system for the course:

Teaching methodology – Lectures and Presentations, Interactive Discussions and Case Studies, Guest Lectures.

Evaluation System –

- A. Mid-Term Exam (60 Marks)- Summative Assessment (PCIA)
- B. Practical End-Semester Exam (40 Marks)- Summative Assessment.

4. Course Content:

Course Name: Manufacturing Practice Lab
Course Code: ME-392
Hours per Week: 0L: 0T: 4P
Credits: 2

5. List of Experiments:

| Module | Topics | 40L |
|--------|--|-----|
| 1. | Pattern Making: wooden patterns to make (Solid) | 4 |
| 2. | Pattern Making: wooden patterns to make (Split) | 4 |
| 3. | Moulding by wooden pattern | 4 |
| 4. | Casting | 4 |
| 5. | Smithy Shop: Practicing upsetting & Drawing down | 4 |
| 6. | Welding Shop: Practicing SMAW | 4 |
| 7. | Welding Shop: Practicing Gas Welding | 4 |
| 8. | Welding Shop: Practicing GMAW | 4 |
| 9. | Fitting operations | 4 |
| 10. | Sheet metal works | 4 |

6. Course Outcomes (CO):

| Course Outcomes | Details/Statement | Action Verb | Knowledge Level |
|-----------------|--|-------------|-----------------|
| ME-392.1 | Practice of solid pattern & split pattern making | Practice | Apply |
| ME-392.2 | Practice of mould making & casting | Practice | Apply |
| ME-392.3 | Perform basic forging processes | Perform | Apply |
| ME-392.4 | Practice fitting operations using hand tools | Practice | Apply |
| ME-392.5 | Practice sheet metal works | Practice | Apply |
| ME-392.6 | Practice of Gas Welding, GMAW & SMAW | Practice | Apply |

7. Mapping of course outcomes to module / course content

| Module | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 |
|--------|-----|-----|-----|-----|-----|-----|
| 1 | 2 | 3 | 3 | - | - | - |
| 2 | - | - | - | 3 | 2 | - |
| 3 | - | - | - | 2 | 3 | - |
| 4 | - | - | - | - | - | 3 |

8. Mapping of the Course outcomes to Program Outcomes

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| CO1 | 2 | 1 | 3 | 1 | - | - | - | 1 | 1 | 1 | 1 |
| CO2 | 2 | 1 | 3 | 1 | - | - | - | 1 | 1 | 1 | 1 |
| CO3 | 2 | 1 | 3 | 1 | - | - | - | 1 | 1 | 1 | 1 |
| CO4 | 2 | 1 | 3 | 1 | - | - | - | 1 | 1 | 1 | 1 |
| CO5 | 2 | 1 | 3 | 1 | - | - | - | 1 | 1 | 1 | 1 |
| CO6 | 2 | 1 | 3 | 1 | - | - | - | 1 | 1 | 1 | 1 |

9. Mapping to Program Specific Outcome (PSO)

| | PSO1 | PSO2 |
|-----|------|------|
| CO1 | 3 | 1 |
| CO2 | 3 | 1 |
| CO3 | 3 | 1 |
| CO4 | 3 | 1 |
| CO5 | 3 | 1 |
| CO6 | 3 | 1 |

10. References:

Text Book:

- Manufacturing Technology (Foundation Forming & Welding)- P.N. Rao, Tata McGraw Hill.
- Principles of manufacturing materials and processes - J.S. Campbell, Tata McGraw Hill.
- Basic Manufacturing Process- D. Mishra IndiaTech Publisher, New Delhi

Reference Books:

- Principles of manufacturing materials and processes- J.S.Campbell, Tata McGraw Hill.
- Manufacturing Engineering and Technology, 4th Edition- S.Kalpakjian and S.R. Scsimid, Pearson Education.
- Materials and processes in manufacturing- DeGarmo, Black and Kohser, Prentice Hall of India.
- Principle of Metal Casting- Heine, Loper and Rosenthal, Tata McGraw Hill.

***** End of Syllabus*****

Course Name: Strength of Material & Material Testing Lab
Course Code: ME-393
(Semester III)
Course Broad Category: Professional Core

1. Course Prerequisite:

Concept of Strength of Materials, Engineering Materials.

2. Course Learning Objectives:

It aims to equip students with practical knowledge of material properties and mechanical behavior through hands-on experimentation. Students will conduct standardized tests such as tensile, compression, impact, hardness, and torsion tests to evaluate material strength and failure mechanisms. By analyzing stress-strain behavior and interpreting experimental data, they will relate theoretical concepts to real-world applications in engineering.

3. Teaching methodology and evaluation system for the course:

Teaching methodology – Conduction laboratory experiments, correlate with theory by Interactive Discussions and Case Studies.

Evaluation System –

- A. Internal Assessment (60 Marks) - Formative Continuous Assessment [Continuous Assessment]
- B. End-Semester Exam (40 Marks)- Summative Assessment.

4. Course Content:

Course Name: Strength of Material & Material Testing Lab

Course Code: ME-393

Hours per Week: 0L:0T:4P

Credits: 2

| Expt. No. | Experiments | Contact Hrs. | CO |
|-----------|---|--------------|------|
| 1 | Rockwell hardness test on metallic specimens. | 4 | CO1 |
| 2 | Brinell hardness test on metallic specimens. | 4 | CO 1 |
| 3 | Izod impact test on a metallic specimen. | 4 | CO 1 |
| 4 | Charpy impact test on a metallic specimen. | 4 | CO 1 |
| 5 | Torsion test on mild steel rod. | 4 | CO 1 |
| 6 | Bending deflection test on beam. | 4 | CO 2 |
| 7 | Uniaxial tensile test on mild steel rod in UTM. | 4 | CO 3 |
| 8 | Surface / subsurface crack testing by using DP test, Magnaflux test, ultrasonic test. | 4 | CO 4 |

| | | | |
|----|---|---|------|
| 9 | Draw ability test of sheet metals. | 4 | CO 5 |
| 10 | Fatigue test. | 4 | CO 5 |
| 11 | Study of micro- structural changes after heat treatment of different materials. | 4 | CO6 |

5. Reference Books:

1. D.S. Bedi, Strength of Materials, Sixth Edition, Khanna Publishing House, 2019.
2. R.K. Bansal, Strength of Materials, Laxmi Publications.
3. U. C. Jindal, "Engineering Materials and Metallurgy", Pearson, 2011.

6. Course Outcomes (CO):

| Course Outcomes | Details/Statement | Action Verb | Knowledge Level |
|-----------------|---|-------------|-----------------|
| CO 1 | ANALYZE mechanical properties like hardness, impact resistance, tensile strength, and torsional strength in metallic specimens by performing and interpreting hardness, impact, torsion, and tensile tests. | Identify | Remember |
| CO 2 | DETERMINE the deflection characteristics and bending strength of beams, enhancing their understanding of material behavior under various load conditions. | Explain | Understand |
| CO 3 | COMPARE the responses of materials, such as mild steel, to different types of loads—uniaxial tension, torsion, and impact—and explain the resulting deformation behaviors. | Implement | Apply |
| CO 4 | ASSESS the structural integrity of materials by conducting non-destructive testing methods such as dye penetrant, Magnaflux, and ultrasonic testing. | Organize | Analyze |
| CO 5 | CONDUCT fatigue tests and drawability tests on sheet metals, interpreting the implications of these properties for material performance in real-world applications. | Assess | Evaluate |
| CO 6 | ANALYZE microstructural changes in materials post-heat treatment, correlating these changes with mechanical properties. | Assess | Evaluate |

7. Mapping of course outcomes to experiments / course content

| Experiment No. | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 |
|----------------|-----|-----|-----|-----|-----|-----|
| 1 | 3 | - | - | - | - | - |
| 2 | 3 | - | - | - | - | - |
| 3 | 3 | - | - | - | - | - |
| 4 | 3 | - | - | - | - | - |

| | | | | | | |
|----|---|---|---|---|---|---|
| 5 | 3 | - | - | - | - | - |
| 6 | - | 3 | - | - | - | - |
| 7 | - | - | 3 | - | - | - |
| 8 | - | - | - | 3 | - | - |
| 9 | - | - | - | - | 3 | - |
| 10 | - | - | - | - | 3 | - |
| 11 | - | - | - | - | - | 3 |

8. Mapping of the Course outcomes to Program Outcomes

| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 |
|------------|------|------|------|------|------|------|------|------|------|-------|-------|
| CO1 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| CO2 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| CO3 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| CO4 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| CO5 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| CO6 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

9. Mapping to Program Specific Outcome (PSO)

| | PSO1 | PSO2 |
|------------|------|------|
| CO1 | 2 | 3 |
| CO2 | 2 | 3 |
| CO3 | 2 | 3 |
| CO4 | 2 | 3 |
| CO5 | 2 | 3 |
| CO6 | 2 | 3 |

*** End of Syllabus***



Course Name: Data Structure and Algorithm Laboratory

Course Code: ME-394

(Semester III)

Course Broad Category: Open Elective

1. Course Prerequisite:

Basic reasoning skills

2. Course Learning Objectives:

- Understand the basics of Data Structure
- Apply data structure techniques to mechanical engineering problems
- Analyze and interpret data from mechanical systems

3. Teaching methodology and evaluation system for the course:

Teaching methodology – Lectures and Presentations, Interactive Discussions and Case Studies, Guest Lectures.

Evaluation System –

- A. Mid-Term Exam (60 Marks)- Summative Assessment (PCIA)
- B. Practical End-Semester Examination (40 Marks) – Summative Assessment

4. Course Content:

Course Name: Data Structure and Algorithm Laboratory

Course Code: ME-394

Hours per Week: 0L: 1T: 3P

Credits: 1

| Module | Topics | 48H |
|---------------|--|------------|
| 1. | <p>Linear Data Structure</p> <p>1 Implementation of array operations</p> <p>2 Stacks and Queues: adding, deleting elements Circular Queue: Adding & deleting elements</p> <p>3 Merging Problem: Evaluation of expressions operations on Multiple stacks & queues:</p> <p>4 Implementation of linked lists: inserting, deleting, inverting a linked list. Implementation of stacks & queues using linked lists</p> <p>Polynomial addition, Polynomial multiplication</p> | 28H |

| | | |
|----|--|-----|
| 2. | Non Linear Data Structure 6 Recursive and Non-recursive traversal of Trees 7 Threaded binary tree traversal. AVL tree implementation 8 Application of Trees. Application of sorting and searching algorithms 9. Hashtables implementation: searching ,inserting and deleting, searching & sorting techniques. | 20H |
|----|--|-----|

5. References:

Text Book:

1. Data Structures” by S. Lipschutz.
2. “Introduction to Algorithms” by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein
3. Data Science Handbook by Jake Vander Plas

Reference Books:

- Data Structures and Program Design In C”, 2/E by Robert L. Kruse, Bruce P. Leung.
- “Data Structure & Algorithms Using C”, 5thEd., Khanna Publishing House (AICTE Recommended –2018)
- “Fundamentals of Data Structures of C” by Ellis Horowitz, Sartaj Sahni, Susan Anderson - freed.
- “Data Structures in C”by Aaron M. Tenenbaum.
- “Data Structures Using C” by Reema Thareja.
- “Data Structure Using C”, 2/e by A. K. Rath, A. K. Jagadev.
- “Data Structures through C” by Yashwant Kanetkar, BPB Publications.
- “Expert Data Structures with C++” by R.B Patel, Khanna Publishing House
-

6. Course Outcomes (CO):

| Course Outcomes | Details/Statement | Action Verb | Knowledge Level |
|-----------------|---|-------------|-----------------|
| ME-394.1 | Construct algorithms from problems. | Construct | Create |
| ME-394.2 | Understand the basics of Stack, Queue. | Understand | Understand |
| ME-394.3 | Categorize the necessarily of linked list and array implementation. | Categorize | Analyze |
| ME-394.4 | Learn the real life use of Tree and graph. | Learn | Apply |
| ME-394.5 | Compare different sorting and searching methods. | Compare | Analyze |
| ME-394.6 | Understand the implementation mechanism of sorting and searching. | Understand | Understand |

7. Mapping of course outcomes to module / course content

| Module | CO1 | CO2 | CO3 | CO4 | CO5 | CO6 |
|---------------|------------|------------|------------|------------|------------|------------|
| 1 | 1 | 3 | 2 | 2 | 3 | - |
| 2 | 2 | - | 2 | 3 | - | 1 |

8. Mapping of the Course outcomes to Program Outcomes

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|
| CO1 | 3 | - | - | 2 | 1 | 1 | - | 1 | 1 | - | 1 |
| CO2 | 3 | - | - | 2 | 1 | 1 | - | 1 | 1 | - | 1 |
| CO3 | 3 | - | - | 2 | 1 | 1 | - | 1 | 1 | - | 1 |
| CO4 | 3 | - | - | 2 | 1 | 1 | - | 1 | 1 | - | 1 |
| CO5 | 3 | - | - | 2 | 1 | 1 | - | 1 | 1 | - | 1 |
| CO6 | 3 | - | - | 2 | 1 | 1 | - | 1 | 1 | - | 1 |

9. Mapping to Program Specific Outcome (PSO)

| | PSO1 | PSO2 |
|------------|-------------|-------------|
| CO1 | 1 | 2 |
| CO2 | 1 | 2 |
| CO3 | 1 | 2 |
| CO4 | 1 | 2 |
| CO5 | 2 | 2 |
| CO6 | 2 | 2 |

***** End of Syllabus*****