**ANNEXURE –I**

# Syllabus of III and IV Semester Courses for Four-Year Multidisciplinary Undergraduate B.Tech. Degree Programme in Mechanical Engineering

## (In view of NEP-2020)

**For students admitted in academic session 2025-26 and onwards**




**03/09/2026**

SHRI JAWAHARLAL DARDA EDUCATION SOCIETY'S
JAWAHARLAL DARDA
INSTITUTE OF ENGINEERING AND TECHNOLOGY, YAVATMAL
AN AUTONOMOUS INSTITUTE
Affiliated to Sant Gadge Baba Amravati University, Approved by AICTE, New Delhi and DTE Maharashtra
93VP+PWF: P6, MIDC Area, Lohara, Yavatmal - 445 001, Maharashtra (www.jdiet.ac.in)

## 1.Vision

The Mechanical Engineering Department aims to be recognized center for exceptional education and research leading to competent engineers to furnish the ever-changing industrial demands and societal needs.

## 2. Mission

1. Educate, Prepare and mentor the students to build their abilities and enhance their professional skill to make them competitive.
2. Provide adequate recourses and facilities conducive to quality learning
   environment.
3. Develop alliances with industry as well as government establishments to prepare students for careers and inculcate the attitude of entrepreneurship.
4. Perform mechanical engineering-based research and other scholarly activities.

## 3. Programme Education Objectives

PEO 1: To provide a solid foundation and core competency in manufacturing, thermal fluids and design of mechanical systems and practice lifelong learning to strengthen their knowledge and skills.
PEO 2: To develop analytical and reasoning abilities, creativity, effective communication and team work skills amongst the students.
PEO 3: To imbibe high ethical and professional standards within the students so that they render valuable services to their peers, employers and society as a whole.

## 4. SDG of United Nation

1. **No Poverty** – End poverty in all its forms everywhere.
2. **Zero Hunger** – End hunger, achieve food security and improved nutrition, and promote sustainable agriculture.
3. **Good Health and Well-being** – Ensure healthy lives and promote well- being for all at all ages.
4. **Quality Education** – Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.
5. **Gender Equality** – Achieve gender equality and empower all women and girls.
6. **Clean Water and Sanitation** – Ensure availability and sustainable management of water and sanitation for all.
7. **Affordable and Clean Energy** – Ensure access to affordable, reliable, sustainable, and modern energy for all.
8. **Decent Work and Economic Growth** – Promote sustained, inclusive, and sustainable economic growth, full and

productive employment, and decent work for all.

9. **Industry, Innovation, and Infrastructure** – Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation.
10. **Reduced Inequalities** – Reduce inequality within and among countries.
11. **Sustainable Cities and Communities** – Make cities and human settlements inclusive, safe, resilient, and sustainable.
12. **Responsible Consumption and Production** – Ensure sustainable consumption and production patterns.
13. **Climate Action** – Take urgent action to combat climate change and its impacts.
14. **Life Below Water** – Conserve and sustainably use the oceans, seas, and marine resources for sustainable development.
15. **Life on Land** – Protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation, and halt biodiversity loss.
16. **Peace, Justice, and Strong Institutions** – Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable, and inclusive institutions at all levels.
17. **Partnerships for the Goals** – Strengthen the means of implementation and revitalize the global partnership for sustainable development.

## 5. WK: Washington Accord Knowledge Profile-Attributes for engineering program

**WK1:** A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

**WK2:** Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modeling applicable to the discipline.

**WK3:** A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

**WK4:** Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

**WK5:** Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

**WK6:** Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.

**WK7:** Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.

**WK8:** Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

**WK9:** Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

## 6. Programme Outcomes (NBA, Jan 2025)

**PO1: Engineering Knowledge:** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization.

**PO2: Problem Analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development.

**PO3: Design/Development of Solutions:** Design creative solutions for complex engineering problems and design/ develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required.

**PO4: Conduct Investigations of Complex Problems:** Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions.

**PO5: Engineering Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems.

**PO6: The Engineer and The World:** Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment.

**PO7: Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws.

**PO8: Individual and Collaborative Team work:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

**PO9: Communication:** Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.

**PO10: Project Management and Finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

**PO11: Life-Long Learning:** Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change.

## 7. Programme Specific Indicators

**Thermal Power Industry**

1. Analyze thermodynamic cycles to optimize energy conversion in power plant operations.
2. Evaluate performance of boilers and turbines using tools like MATLAB and ANSYS-Fluent.
3. Design thermal systems to ensure energy efficiency and environmental compliance.
4. Simulate combustion processes to enhance fuel efficiency and reduce emissions.
5. Apply knowledge of fluid mechanics to design efficient piping and pumping systems.
6. Assess heat exchanger performance using HTRI or Aspen HYSYS software.
7. Interpret P&ID diagrams for installation, troubleshooting and control system integration.
8. Estimate plant load factor and thermal efficiency for economic viability assessment.

9. Integrate renewable sources in thermal systems for sustainable energy generation.
10. Interpret ASME codes and safety standards in boiler and pressure vessel design.
11. Optimize plant layout using AutoCAD or SolidWorks for efficient space and utility use.
12. Apply project planning tools like MS Project or Primavera for thermal plant construction.
13. Monitor and analyze thermal losses using IR thermography tools.
14. Develop standard operating procedures for thermal plant operations and safety audits.

**Manufacturing & Production Industry**

15. Design manufacturing processes using CAD/CAM tools.
16. Implement lean manufacturing principles for waste reduction and cost efficiency.
17. Analyze material properties for suitable selection in industrial manufacturing applications.
18. Simulate production line efficiency using Arena or Plant Simulation software.
19. Evaluate machining parameters to achieve optimum surface finish and dimensional accuracy.
20. Apply GD&T principles for accurate engineering drawing interpretation and quality control.
21. Utilize ERP systems like SAP or Oracle for inventory and production planning.
22. Design jigs and fixtures using SolidWorks or AutoDesk Inventor for productivity improvement.
23. Develop quality control procedures using SPC, Six Sigma, and Minitab tools.
24. Perform time and motion study to reduce cycle time and enhance throughput.
25. Conduct FMEA to identify and mitigate potential manufacturing process failures.
26. Manage supply chain effectively through digital tools like SAP SCM or Tally ERP.
27. Implement automation using PLC, SCADA, or Robotics in CNC-based production lines.
28. Evaluate product cost estimation and pricing strategy for competitiveness.
29. Apply ISO 9001 standards to maintain quality and consistency in production systems.

**Automotive Industry**

30. Analyze vehicle dynamics for design of suspension and steering systems.
31. Design automotive components using CATIA or SolidWorks for strength and performance.

32. Evaluate thermal management systems for IC engines using CFD tools.
33. Analyze emissions and apply solutions complying with Bharat Stage norms or Euro standards.
34. Design electric vehicle drive trains and battery management systems using MATLAB/Simulink.
35. Apply diagnostic tools like OBD-II for real-time automotive fault detection.
36. Assess brake system performance through simulation and experimental validation.
37. Use CAN and LIN protocols to implement automotive electronics and network communication.
38. Apply Kaizen and 5S for continuous improvement in automotive production plants.
39. Validate designs with testing and simulation tools like AVL Cruise and Adams Car.
40. Implement lightweight materials and sustainable practices in automotive part manufacturing.
41. Evaluate ergonomics and aesthetic design in vehicle interiors and exteriors.
42. Monitor and improve fuel efficiency using IC engine analysis software.
43.Demonstrate understanding of vehicle homologation, testing procedures, and regulatory standards.

**Design & Simulation Industry**

44. Create 3D models of mechanical components using tools like SolidWorks, CATIA, or Creo software.
45. Simulate stress and deformation using FEA tools like ANSYS or Abaqus.
46. Optimize mechanical designs for weight, strength, and cost using Topology Optimization.
47. Perform thermal analysis of mechanical systems using ANSYS Fluent or COMSOL.
48. Develop manufacturing-ready drawings using GD&T standards in CAD tools.
49. Apply CFD tools to simulate fluid flow in mechanical and HVAC systems.
50. Create assemblies and kinematic simulations using CAD-integrated modules.
51. Validate designs using physical prototyping and reverse engineering tools.
52. Incorporate design standards and safety codes such as ASME or ISO.
53. Generate BoM and material selection reports using CAD-integrated tools.
54. Use cloud-based platforms like Autodesk Fusion 360 for collaborative design.
55. Automate design tasks using parametric modeling and scripting.
56. Conduct design reviews using augmented/virtual reality platforms.

57. Enhance presentation of design concepts with rendering and animation tools.

**Industrial Automation & Mechatronics**

58. Design automation systems using PLC, SCADA, and HMI for industrial processes.
59. Apply sensor and actuator integration for feedback control systems in automation.
60. Develop ladder logic programs.
61. Analyze robotic kinematics and program tasks.
62. Design mechatronic systems combining mechanical, electrical, and control components.
63. Implement Industry 4.0 concepts with IoT and real-time monitoring.
64. Utilize machine vision systems for quality inspection in manufacturing.
65. Analyze motion control systems using servo motors and stepper drives.
66. Design pneumatic and hydraulic circuits using FluidSIM or Automation Studio.
67. Monitor and maintain automated systems using predictive maintenance tools.
68. Apply cyber security principles to protect industrial control systems.
69. Optimize energy usage through automation and smart systems.
70. Ensure compliance with safety regulations in design and operation of automated systems.

**Aerospace Industry**

71. Apply principles of fluid mechanics to improve aircraft aerodynamic efficiency and fuel economy.
72. Analyze stress and deformation in aerospace components using ANSYS or similar FEA software.
73. Develop and simulate propulsion systems ensuring optimal performance and emission control.
74. Implement quality control practices for aircraft manufacturing in accordance with international standards.
75. Perform fatigue analysis and lifecycle assessment of aircraft materials using specialized software.
76. Apply project management techniques for timely aerospace project delivery and resource optimization.
77. Conduct CFD analysis for aircraft components using software like Fluent or OpenFOAM.
78. Use 3D printing for rapid prototyping of aerospace parts ensuring accuracy and strength.
79. Evaluate aircraft performance data to enhance operational efficiency and safety standards.
80. Interpret global aerospace regulations and apply safety protocols in aircraft operations.
81. Troubleshoot maintenance issues using digital twin and predictive analysis tools.

82. Demonstrate sustainable practices in aerospace engineering minimizing emissions and material waste.

**Renewable Energy Industry**

83. Design and analyze solar PV systems using software like PVsyst for optimal energy output.
84. Model and simulate wind energy systems for efficiency using MATLAB/SIMULINK.
85. Develop hybrid energy systems integrating solar, wind, and battery storage technologies.
86. Assess renewable energy project feasibility considering environmental, social and economic factors.
87. Analyze energy conversion efficiencies for thermal and hydroelectric renewable systems.
88. Apply electrical and mechanical interface knowledge in renewable power systems.
89. Design bioenergy systems using agricultural waste and simulate performance output.
90. Apply IoT-based monitoring in renewable energy systems for real-time data and control.
91. Understand and interpret renewable energy policies and safety standards for compliance.
92. Analyze grid integration challenges and suggest power quality enhancement strategies.
93. Optimize renewable system operations using digital tools and AI-based forecasting.
94. Evaluate carbon credits and sustainability impact of renewable energy systems.
95. Implement economic analysis techniques to evaluate life cycle cost of renewable projects.

**HVAC & Refrigeration Industry**

96. Design HVAC systems ensuring thermal comfort and energy efficiency using HAP or Carrier software.
97. Select and size refrigeration components using Duct Sizer and psychrometric charts.
98. Apply thermodynamic principles for efficient cooling cycle analysis and optimization.
99. Develop and simulate duct systems using AutoCAD MEP or Revit MEP.
100. Conduct heat load estimation and ventilation design based on building parameters.
101. Install and commission HVAC-R equipment ensuring operational safety and efficiency.
102. Perform maintenance and fault diagnosis in HVAC systems ensuring minimal downtime.
103. Integrate renewable sources such as solar with conventional HVAC systems for energy savings.

104. Evaluate indoor air quality and recommend control strategies for healthy living environment.
105. Interpret HVAC system layouts, specifications and tender documents for project execution.
106. Comply with ASHRAE standards in HVAC system design and maintenance procedures.
107. Optimize HVAC system operations using digital BMS tools and data analytics.

**Generic Competencies (Mechanical Engineering)**

**A. Problem-Solving Skills**

108. **Analytical Thinking**: Ability to analyze complex problems, break them down into smaller components, and find effective solutions.
109. **Critical Thinking**: Ability to evaluate multiple solutions to a problem and choose the best course of action based on available data, safety, and cost-efficiency.

**B. Communication Skills**

110. **Oral Communication**: Ability to communicate complex technical information clearly to a variety of audiences, including clients, stakeholders, contractors, and team members.
111. **Written Communication**: Proficiency in drafting reports, proposals, technical specifications, and documentation that are clear, concise, and accurate.
112. **Interpersonal Communication**: Ability to collaborate effectively with multidisciplinary teams, clients, and project stakeholders.

**C. Project Management**

113. **Time Management**: Efficiently managing time and prioritizing tasks to meet deadlines in a dynamic project environment.
114. **Resource Management**: Ability to plan, allocate, and manage resources such as labour, materials, and equipment to ensure project efficiency.
115. **Budgeting and Cost Control**: Skills in estimating project costs, monitoring budgets, and ensuring projects are completed within financial constraints.
116. **Risk Management**: Ability to identify, assess, and mitigate risks during the planning and execution of engineering projects.

**D. Teamwork and Leadership**

117. **Team Collaboration**: Working effectively as part of a team, contributing to the success of the project through collaboration, open communication, and respect for others' expertise.
118. **Leadership Skills**: Leading and motivating a team of engineers, contractors, and other stakeholders to meet project goals and deadlines.
119. **Conflict Resolution**: Ability to resolve conflicts between team members, clients, or contractors, ensuring that project objectives are still achieved.

**E. Attention to Detail**

120. **Accuracy**: Ensuring all engineering calculations, designs, and project plans are accurate and align with building codes, regulations, and standards.
121. **Quality Assurance**: Ensuring that the materials and processes used in construction adhere to high standards of quality and safety.

**F. Ethical and Professional Integrity**

122. **Ethical Decision Making**: Adhering to a strict code of ethics, ensuring public safety, environmental protection, and transparency in all dealings.
123. **Accountability**: Taking responsibility for the success or failure of a project, being proactive in addressing issues, and delivering results.

**G. Adaptability and Flexibility**

124. **Openness to Change**: Being able to adapt to new technologies, tools, and methods, as well as evolving project requirements or environmental conditions.
125. **Learning and Development**: Actively seeking opportunities for professional growth, staying current with industry trends, and acquiring new skills to remain competitive.

**H. Technical Competency**

126. **Understanding of Engineering Principles**: A strong foundation in the core principles of mechanical engineering, including thermodynamics, fluid mechanics, heat transfer, solid mechanics, materials science, manufacturing processes, and machine design.
127. **Technology Proficiency**: Proficiency in using mechanical engineering software, such as AutoCAD, SolidWorks, CATIA, ANSYS, MATLAB, and CNC simulation tools, to design, model, simulate, and optimize mechanical systems and processes.
128. **Data Analysis**: Ability to analyze experimental, simulation, and operational data from mechanical systems to evaluate performance, diagnose issues, and make informed engineering decisions.

**I. Creativity and Innovation**

129. **Creative Problem Solving**: Thinking outside the box and coming up with novel solutions to engineering challenges.
130. **Innovative Design**: Contributing new ideas for designs and processes that can improve efficiency, reduce costs, or make better use of resources.

**J. Cultural and Environmental Awareness**

131. **Sustainability Awareness**: Knowledge of sustainable construction methods, green building practices, and the importance of reducing the environmental impact of engineering projects.
132. **Cultural Sensitivity**: Understanding and respecting cultural differences when working in diverse teams or international projects.
133. **Environmental Impact Understanding**: Considering the environmental consequences of engineering decisions and striving to minimize negative impacts through design and construction

methods.

**K. Decision-Making Skills**

134. **Data-Driven Decisions**: Using available data, facts, and technical analysis to make informed decisions about the design, execution, and management of projects.
135. **Prioritizing Decisions**: Knowing which decisions need immediate attention and which can be deferred, especially in a high-pressure environment.

**L. Regulatory and Legal Knowledge**

136. **Familiarity with Building Codes and Standards**: Understanding and ensuring compliance with local, national, and international building codes, safety regulations, and legal standards.
137. **Health and Safety**: Knowledge of safety regulations and best practices for ensuring the health and safety of workers, the public, and the environment throughout the project lifecycle.

**M. Client-Focused Mindset**

138. **Client Management**: Building and maintaining strong relationships with clients, understanding their needs, and ensuring their expectations are met throughout the project.
139. **Customer Service Orientation**: Ensuring that client concerns are addressed promptly, and working toward providing value-added solutions that meet their goals.

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# 8. Scheme of Mechanical Engineering Department

**Jawaharlal Darda Institute of Engineering & Technology, Yavatmal (Autonomous Institute)**

**Curriculum Structure (Scheme) for Four Year Multidisciplinary B. Tech in Mechanical Engineering Degree Programme**

**Semester - I (First Year) [Group - A/B]**

| Sr. No. | Course Name | Course Category | Course Code | Course Plan per Week (Hrs.) | | | | | Credits | Theory Evaluation | | Theory (Total) | | Practical/Term Work Evaluation | | Practical/Term Work Evaluation (Total) | | Total Max Marks | Theory Exam Time (Hrs.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | SEE | CIA | | | EE | PA | | | | |
| | | | | L | T | P | SL | Total | | Max Marks | Max Marks | Max Marks | Min Marks | Max Marks | Max Marks | Max Marks | Min Marks | | |
| 1 | Mathematics - I | BSC | 1SH101BS1 | 3 | 0 | 0 | 3 | 6 | 3 | 60 | 40 | 100 | 40 | | | | | 100 | 3 Hrs. |
| 2 | Applied Physics | BSC | 1SH102BS1 | 3 | 0 | 0 | 3 | 6 | 3 | 60 | 40 | 100 | 40 | | | | | 100 | 3 Hrs. |
| 3 | Programming for Problem Solving | ESC | 1CS103ES1 | 3 | 0 | 0 | 3 | 6 | 3 | 60 | 40 | 100 | 40 | | | | | 100 | 3 Hrs. |
| 4 | Engineering Mechanics | ESC | 1CE104ES1 | 3 | 0 | 0 | 3 | 6 | 3 | 60 | 40 | 100 | 40 | | | | | 100 | 3 Hrs. |
| 5 | Applied Physics Lab | BSC | 1SH105BS1 | 0 | 0 | 2 | 0 | 2 | 1 | | | | | 25 | 25 | 50 | 25 | 50 | |
| 6 | Programming for Problem Solving Lab | ESC | 1CS106ES1 | 0 | 0 | 2 | 0 | 2 | 1 | | | | | 25 | 25 | 50 | 25 | 50 | |
| 7 | Engineering Mechanics Lab | ESC | 1CE107ES1 | 0 | 0 | 2 | 0 | 2 | 1 | | | | | 25 | 25 | 50 | 25 | 50 | |
| 8 | Workshop | ESC | 1ME108ES1 | 0 | 0 | 2 | 0 | 2 | 1 | | | | | 25 | 25 | 50 | 25 | 50 | |
| 9 | Computer Aided Drafting with CATIA | VSC | 1ME109VS1 | 1 | 0 | 2 | 1 | 4 | 2 | | | | | | 50 | 50 | 25 | 50 | |
| 10 | Communication Skills | AEC | 1SH110AE1 | 1 | 0 | 2 | 1 | 4 | 2 | | | | | 25 | 25 | 50 | 25 | 50 | |
| 11 | Sports & Yoga | CC | 1SH111CC1 | 0 | 0 | 4 | 0 | 4 | 2 | | | | | | 50 | 50 | 25 | 50 | |
| **Total** | | | | **14** | **0** | **16** | **14** | **44** | **22** | | | **400** | | | | **350** | | **750** | |

Notional Learning Hours: [Workload (teaching/guidance/practicum) 30x15 = 450 Hrs] + [Learner-engaged time 14x15 = 210 Hrs]

**Jawaharlal Darda Institute of Engineering & Technology, Yavatmal (Autonomous Institute)**

**Curriculum Structure (Scheme) for Four Year Multidisciplinary B. Tech in Mechanical Engineering Degree Programme**

**Semester - II (First Year) [Group - A/B]**

| Sr. No. | Course Name | Course Category | Course Code | Course Plan per Week (Hrs.) | | | | | Credits | Theory Evaluation | | Theory (Total) | | Practical/Term Work Evaluation | | Practical/Term Work Evaluation (Total) | | Total Max Marks | Theory Exam Time (Hrs.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | SEE | CIA | | | EE | PA | | | | |
| | | | | L | T | P | SL | Total | | Max Marks | Max Marks | Max Marks | Min Marks | Max Marks | Max Marks | Max Marks | Min Marks | | |
| 1 | Mathematics - II | BSC | 2SH112BS1 | 3 | 0 | 0 | 3 | 6 | 3 | 60 | 40 | 100 | 40 | | | | | 100 | 3 Hrs. |
| 2 | Applied Chemistry | BSC | 2SH113BS1 | 3 | 0 | 0 | 3 | 6 | 3 | 60 | 40 | 100 | 40 | | | | | 100 | 3 Hrs. |
| 3 | Basic Electrical Engineering | ESC | 2EE114ES1 | 3 | 0 | 0 | 3 | 6 | 3 | 60 | 40 | 100 | 40 | | | | | 100 | 3 Hrs. |
| 4 | Engineering Graphics | ESC | 2ME115ES1 | 2 | 0 | 0 | 2 | 4 | 2 | 60 | 40 | 100 | 40 | | | | | 100 | 4 Hrs. |
| 5 | Elements of Mechanical Engineering | PCC | 2ME116PC1 | 1 | 0 | 2 | 1 | 4 | 2 | | | | | | 50 | 50 | 25 | 50 | |
| 6 | Indian heritage in Mechanical Engineering | IKS | 2ME117IK1 | 1 | 0 | 2 | 1 | 4 | 2 | | | | | | 50 | 50 | 25 | 50 | |
| 7 | Applied Chemistry - Lab | BSC | 2SH118BS1 | 0 | 0 | 2 | 0 | 2 | 1 | | | | | 25 | 25 | 50 | 25 | 50 | |
| 8 | Basic Electrical Engineering - Lab | ESC | 2EE119ES1 | 0 | 0 | 2 | 0 | 2 | 1 | | | | | 25 | 25 | 50 | 25 | 50 | |
| 9 | Engineering Graphics/CAD Lab | ESC | 2ME120ES1 | 0 | 0 | 2 | 0 | 2 | 1 | | | | | 25 | 25 | 50 | 25 | 50 | |
| 10 | Universal Human Values | SEC | 2SH121VS1 | 1 | 0 | 2 | 1 | 4 | 2 | | | | | | 50 | 50 | 25 | 50 | |
| 11 | Digital Wellness | CC | 2SH122CC1 | 1 | 0 | 2 | 1 | 4 | 2 | | | | | | 50 | 50 | 25 | 50 | |
| **Total** | | | | **15** | **0** | **14** | **15** | **44** | **22** | | | **400** | | | | **350** | | **750** | |

Notional Learning Hours: [Workload (teaching/guidance/practicum) 29x15 = 435 Hrs] + [Learner-engaged time 15x15 = 225 Hrs]

| **Exit Option (Level 4.5) for Undergraduate Certificate in Odd Semester of next Academic Year as approved by BOS** | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12 | Welding Technology / Joining Processes | EC | 3ME123EC1 | 2 | 0 | 4 | 2 | 8 | 4 | 30 | 20 | 50 | 20 | 25 | 25 | 50 | 25 | 100 | 2 Hrs. |
| 13 | Metal Forming Processes | EC | 3ME124EC1 | 2 | 0 | 4 | 2 | 8 | 4 | 30 | 20 | 50 | 20 | 25 | 25 | 50 | 25 | 100 | 2 Hrs. |
| **OR** | | | | | | | | | | | | | | | | | | | |
| 14 | Internship / Apprenticeship in Industry | EI | 3ME125EI1 | 0 | 0 | 16 | 0 | 288 | 8 | | | | | 100 | 100 | 200 | 100 | 200 | |
| **OR** | | | | | | | | | | | | | | | | | | | |
| 15 | Two MOOC/NPTEL Courses | EC | 3ME126OC_ | 8 | 0 | 0 | 8 | 16 | 8 | | | | | | | | | | |

**Jawaharlal Darda Institute of Engineering & Technology, Yavatmal (Autonomous Institute)**

**Curriculum Structure (Scheme) for Four Year Multidisciplinary B. Tech in Mechanical Engineering Degree Programme**

**Semester - III (Second Year)**

| Sr. No. | Course Name | Course Category | Course Code | Course Plan per Week (Hrs.) | | | | | Credits | Theory Evaluation | | Theory (Total) | | Practical/Term Work Evaluation | | Practical/Term Work Evaluation (Total) | | Total Max Marks | Theory Exam Time (Hrs.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | SEE | CIA | | | EE | PA | | | | |
| | | | | L | T | P | SL | Total | | Max Marks | Max Marks | Max Marks | Min Marks | Max Marks | Max Marks | Max Marks | Min Marks | | |
| 1 | Thermal Engineering -I | PCC | 3ME201PC1 | 3 | 0 | 0 | 3 | 6 | 3 | 60 | 40 | 100 | 40 | | | | | 100 | 3 Hrs. |
| 2 | Fluid Mechanics | PCC | 3ME202PC1 | 2 | 0 | 0 | 2 | 4 | 2 | 60 | 40 | 100 | 40 | | | | | 100 | 3 Hrs. |
| 3 | Strength of Material | PCC | 3ME203PC1 | 3 | 0 | 0 | 3 | 6 | 3 | 60 | 40 | 100 | 40 | | | | | 100 | 3 Hrs. |
| 4 | Multidisciplinary Minor - I | MDM | 3_204MD_ | 2 | 0 | 0 | 2 | 4 | 2 | 30 | 20 | 50 | 20 | | | | | 50 | 2 Hrs. |
| 5 | Open Elective - I | OE | 3_205OE_ | 3 | 0 | 0 | 3 | 6 | 3 | 60 | 40 | 100 | 40 | | | | | 100 | 3 Hrs. |
| 6 | Thermal Engineering- I - Lab | PCC | 3ME206PC1 | 0 | 0 | 2 | 0 | 2 | 1 | | | | | 25 | 25 | 50 | 25 | 50 | |
| 7 | Fluid Mechanics - Lab | PCC | 3ME207PC1 | 0 | 0 | 2 | 0 | 2 | 1 | | | | | 25 | 25 | 50 | 25 | 50 | |
| 8 | Strength of Material - Lab | PCC | 3ME208PC1 | 0 | 0 | 2 | 0 | 2 | 1 | | | | | 25 | 25 | 50 | 25 | 50 | |
| 9 | Entrepreneurship in Mechanical Engineering | EEM | 3ME209EM1 | 2 | 0 | 0 | 2 | 4 | 2 | | | | | | 50 | 50 | 25 | 50 | |
| 10 | Constitutional Values and Fundamental Duties | VEC | 3SH210VE1 | 2 | 0 | 0 | 2 | 4 | 2 | | | | | | 50 | 50 | 25 | 50 | |
| 11 | Field Project | FP | 3ME400FP1 | 0 | 0 | 4 | 0 | 4 | 2 | | | | | 25 | 25 | 50 | 25 | 50 | |
| 12 | Disaster Management and Preparedness | NC | 3AL001NC1 | 2 | 0 | 0 | 0 | 2 | - | | | | | | | | | | |
| **Total** | | | | **19** | **0** | **10** | **17** | **46** | **22** | | | **450** | | | | **300** | | **750** | |

Notional Learning Hours: [Workload (teaching/guidance/practicum) 29x15 = 435 Hrs] + [Learner-engaged time 17x15 = 255 Hrs]

| **Optional Course for Double Minor / Honours Degree** | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 13 | Double Minor / Honours Course - I | DH | 3__211DH_ | 3 | 0 | 0 | 3 | 6 | 3 | 60 | 40 | 100 | 40 | | | | | 100 | 3 Hrs. |

## Jawaharlal Darda Institute of Engineering & Technology, Yavatmal (Autonomous Institute)
## Curriculum Structure (Scheme) for Four Year Multidisciplinary B. Tech in Mechanical Engineering Degree Programme
### Semester - IV (Second Year)

| Sr. No. | Course Name | Course Category | Course Code | Course Plan per Week (Hrs.) | | | | | Credits | Theory Evaluation | | Theory (Total) | | Practical/Term Work Evaluation | | Practical/Term Work Evaluation (Total) | | Total Max Marks | Theory Exam Time (Hrs.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | SEE | CIA | | | EE | PA | | | | |
| | | | | L | T | P | SL | Total | | Max Marks | Max Marks | Max Marks | Min Marks | Max Marks | Max Marks | Max Marks | Min Marks | | |
| 1 | Manufacturing Processes | PCC | 4ME212PC1 | 3 | 0 | 0 | 3 | 6 | 3 | 60 | 40 | 100 | 40 | | | | | 100 | 3 Hrs. |
| 2 | Material Science & Nano Technology | PCC | 4ME213PC1 | 2 | 0 | 0 | 2 | 4 | 2 | 60 | 40 | 100 | 40 | | | | | 100 | 3 Hrs. |
| 3 | Hydraulic and Pneumatic Systems | PCC | 4ME214PC1 | 2 | 0 | 0 | 2 | 4 | 2 | 60 | 40 | 100 | 40 | | | | | 100 | 3 Hrs. |
| 4 | Multidisciplinary Minor - II | MDM | 4_215MD_ | 2 | 0 | 0 | 2 | 4 | 2 | 30 | 20 | 50 | 20 | | | | | 50 | 2 Hrs. |
| 5 | Open Elective - II | OE | 4_216OE_ | 3 | 0 | 0 | 3 | 6 | 3 | 60 | 40 | 100 | 40 | | | | | 100 | 3 Hrs. |
| 6 | Material Science & Nano Technology - Lab | PCC | 4ME217PC1 | 0 | 0 | 2 | 0 | 2 | 1 | | | | | 25 | 25 | 50 | 25 | 50 | |
| 7 | Hydraulic and Pneumatic Systems - Lab | PCC | 4ME218PC1 | 0 | 0 | 2 | 0 | 2 | 1 | | | | | 25 | 25 | 50 | 25 | 50 | |
| 8 | Manufacturing Processes - Lab | VSC | 4ME219VS1 | 0 | 0 | 4 | 0 | 4 | 2 | | | | | | 50 | 50 | 25 | 50 | |
| 9 | Technical Writing | AEC | 4SH220AE1 | 1 | 0 | 2 | 1 | 4 | 2 | | | | | | 50 | 50 | 25 | 50 | |
| 10 | Fundamentals of Book Keeping and Accounting | EEM | 4SH221EM1 | 1 | 0 | 2 | 1 | 4 | 2 | | | | | | 50 | 50 | 25 | 50 | |
| 11 | Environmental Science | VEC | 4CE222VE1 | 2 | 0 | 0 | 2 | 4 | 2 | 30 | 20 | 50 | 20 | | | | | 50 | 2 Hrs. |
| **Total** | | | | **16** | **0** | **12** | **16** | **44** | **22** | | | **500** | | | | **250** | | **750** | |

Notional Learning Hours: [Workload (teaching/guidance/practicum) 28x15 = 420 Hrs] + [Learner-engaged time 16x15 = 240 Hrs]

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Optional Course for Double Minor / Honours Degree** | | | | | | | | | | | | | | | | | | | |
| 12 | Double Minor / Honours Course - II | DH | 4__223DH_ | 4 | 0 | 0 | 4 | 8 | 4 | 60 | 40 | 100 | 40 | | | | | 100 | 3 Hrs. |
| **Exit Option (Level 5) for Undergraduate Diploma in Odd Semester of next Academic Year as approved by BOS** | | | | | | | | | | | | | | | | | | | |
| 13 | Lathe Machine | EC | 5ME224EC1 | 2 | 0 | 4 | 2 | 8 | 4 | 30 | 20 | 50 | 20 | 25 | 25 | 50 | 25 | 100 | 2 Hrs. |
| 14 | Casting Process | EC | 5ME225EC1 | 2 | 0 | 4 | 2 | 8 | 4 | 30 | 20 | 50 | 20 | 25 | 25 | 50 | 25 | 100 | 2 Hrs. |
| **OR** | | | | | | | | | | | | | | | | | | | |
| 15 | Internship / Apprenticeship in Industry | EI | 5ME226EI1 | 0 | 0 | 16 | 0 | 288 | 8 | | | | | 100 | 100 | 200 | 100 | 200 | |
| **OR** | | | | | | | | | | | | | | | | | | | |
| 16 | Two MOOC/NPTEL Courses | EC | 5ME227OC_ | 8 | 0 | 0 | 8 | 16 | 8 | | | | | | | | | | |

**Jawaharlal Darda Institute of Engineering & Technology, Yavatmal (Autonomous Institute)**

**Curriculum Structure (Scheme) for Four Year Multidisciplinary B. Tech in Mechanical Engineering Degree Programme**

**Semester - V (Third Year)**

| Sr. No. | Course Name | Course Category | Course Code | Course Plan per Week (Hrs.) | | | | | Credits | Theory Evaluation | | Theory (Total) | | Practical/Term Work Evaluation | | Practical/Term Work Evaluation (Total) | | Total Max Marks | Theory Exam Time (Hrs.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | SEE | CIA | | | EE | PA | | | | |
| | | | | L | T | P | SL | Total | | Max Marks | Max Marks | Max Marks | Min Marks | Max Marks | Max Marks | Max Marks | Min Marks | | |
| 1 | Theory of Machines | PCC | 5ME228PC1 | 3 | 0 | 0 | 3 | 6 | 3 | 60 | 40 | 100 | 40 | | | | | 100 | 3 Hrs. |
| 2 | Metrology and Quality Control | PCC | 5ME229PC1 | 3 | 1 | 0 | 4 | 8 | 4 | 60 | 40 | 100 | 40 | | | | | 100 | 3 Hrs. |
| 3 | Thermal Engineering-II | PCC | 5ME230PC1 | 3 | 0 | 0 | 3 | 6 | 3 | 60 | 40 | 100 | 40 | | | | | 100 | 3 Hrs. |
| 4 | Programme Elective Course - I | PEC | 5ME231PE_ | 3 | 0 | 0 | 3 | 6 | 3 | 60 | 40 | 100 | 40 | | | | | 100 | 3 Hrs. |
| 5 | Multidisciplinary Minor - III | MDM | 5_232MD_ | 3 | 0 | 0 | 3 | 6 | 3 | 60 | 40 | 100 | 40 | | | | | 100 | 3 Hrs. |
| 6 | Open Elective - III | OE | 5_233OE_ | 2 | 0 | 0 | 2 | 4 | 2 | 30 | 20 | 50 | 20 | | | | | 50 | 2 Hrs. |
| 7 | Theory of Machines - Lab | PCC | 5ME234PC1 | 0 | 0 | 2 | 0 | 2 | 1 | | | | | 25 | 25 | 50 | 25 | 50 | |
| 8 | Thermal Engineering II- Lab | PCC | 5ME235PC1 | 0 | 0 | 2 | 0 | 2 | 1 | | | | | 25 | 25 | 50 | 25 | 50 | |
| 9 | Programme Elective Course - I - Lab | PEC | 5ME236PE_ | 0 | 0 | 2 | 0 | 2 | 1 | | | | | 25 | 25 | 50 | 25 | 50 | |
| 10 | Multidisciplinary Minor - III - Lab | MDM | 5_237MD_ | 0 | 0 | 2 | 0 | 2 | 1 | | | | | 25 | 25 | 50 | 25 | 50 | |
| **Total** | | | | **17** | **1** | **8** | **18** | **44** | **22** | | | **550** | | | | **200** | | **750** | |

Notional Learning Hours: [Workload (teaching/guidance/practicum) 26x15 = 390 Hrs] + [Learner-engaged time 18x15 = 270 Hrs]

| **Optional Course for Double Minor / Honours Degree** | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11 | Double Minor / Honours Course - III | DH | 5__238DH_ | 4 | 0 | 0 | 4 | 8 | 4 | 60 | 40 | 100 | 40 | | | | | 100 | 3 Hrs. |

**Jawaharlal Darda Institute of Engineering & Technology, Yavatmal (Autonomous Institute)**

**Curriculum Structure (Scheme) for Four Year Multidisciplinary B. Tech in Mechanical Engineering Degree Programme**

**Semester - VI (Third Year)**

| Sr. No. | Course Name | Course Category | Course Code | Course Plan per Week (Hrs.) | | | | | Credits | Theory Evaluation | | Theory (Total) | | Practical/Term Work Evaluation | | Practical/Term Work Evaluation (Total) | | Total Max Marks | Theory Exam Time (Hrs.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | SEE | CIA | | | EE | PA | | | | |
| | | | | L | T | P | SL | Total | | Max Marks | Max Marks | Max Marks | Min Marks | Max Marks | Max Marks | Max Marks | Min Marks | | |
| 1 | Heat Transfer | PCC | 6ME239PC1 | 3 | 0 | 0 | 3 | 6 | 3 | 60 | 40 | 100 | 40 | | | | | 100 | 3 Hrs. |
| 2 | Design of Machine Elements | PCC | 6ME240PC1 | 3 | 0 | 0 | 3 | 6 | 3 | 60 | 40 | 100 | 40 | | | | | 100 | 3 Hrs. |
| 3 | Production Estimation and Management | PCC | 6ME241PC1 | 3 | 0 | 0 | 3 | 6 | 3 | 60 | 40 | 100 | 40 | | | | | 100 | 3 Hrs. |
| 4 | Programme Elective Course - II | PEC | 6ME242PE_ | 3 | 0 | 0 | 3 | 6 | 3 | 60 | 40 | 100 | 40 | | | | | 100 | 3 Hrs. |
| 5 | Programme Elective Course - III | PEC | 6ME243PE_ | 3 | 0 | 0 | 3 | 6 | 3 | 60 | 40 | 100 | 40 | | | | | 100 | 3 Hrs. |
| 6 | Multidisciplinary Minor - IV | MDM | 6_244MD_ | 2 | 0 | 0 | 2 | 4 | 2 | 30 | 20 | 50 | 20 | | | | | 50 | 2 Hrs. |
| 7 | Heat Transfer - Lab | PCC | 6ME245PC1 | 0 | 0 | 2 | 0 | 2 | 1 | | | | | 25 | 25 | 50 | 25 | 50 | |
| 8 | Design of Machine Elements - Lab | PCC | 6ME246PC1 | 0 | 0 | 2 | 0 | 2 | 1 | | | | | 25 | 25 | 50 | 25 | 50 | |
| 9 | Programme Elective Course - II - Lab | PEC | 6ME247PE_ | 0 | 0 | 2 | 0 | 2 | 1 | | | | | 25 | 25 | 50 | 25 | 50 | |
| 10 | Personal Skills (GD & PI) | SEC | 6SH248VS1 | 1 | 0 | 2 | 1 | 4 | 2 | | | | | | 50 | 50 | 25 | 50 | |
| **Total** | | | | **18** | **0** | **8** | **18** | **44** | **22** | | | **550** | | | | **200** | | **750** | |

Notional Learning Hours: [Workload (teaching/guidance/practicum) 26x15 = 390 Hrs] + [Learner-engaged time 18x15 = 270 Hrs]

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Optional Course for Double Minor / Honours Degree** | | | | | | | | | | | | | | | | | | | |
| 11 | Double Minor / Honours Course - IV | DH | 6__249DH_ | 4 | 0 | 0 | 4 | 8 | 4 | 60 | 40 | 100 | 40 | | | | | 100 | 3 Hrs. |
| **Exit Option (Level 5.5) for B. Voc in Odd Semester of next Academic Year as approved by BOS** | | | | | | | | | | | | | | | | | | | |
| 12 | CNC Lathe | EC | 7ME250EC1 | 2 | 0 | 4 | 2 | 8 | 4 | 30 | 20 | 50 | 20 | 25 | 25 | 50 | 25 | 100 | 2 Hrs. |
| 13 | Milling Machine | EC | 7ME251EC1 | 2 | 0 | 4 | 2 | 8 | 4 | 30 | 20 | 50 | 20 | 25 | 25 | 50 | 25 | 100 | 2 Hrs. |
| **OR** | | | | | | | | | | | | | | | | | | | |
| 14 | Internship / Apprenticeship in Industry | EI | 7ME252EI1 | 0 | 0 | 16 | 0 | 288 | 8 | | | | | 100 | 100 | 200 | 100 | 200 | |
| **OR** | | | | | | | | | | | | | | | | | | | |
| 15 | Two MOOC/NPTEL Courses | EC | 7ME253OC_ | 8 | 0 | 0 | 8 | 16 | 8 | | | | | | | | | | |

**Jawaharlal Darda Institute of Engineering & Technology, Yavatmal (Autonomous Institute)**

**Curriculum Structure (Scheme) for Four Year Multidisciplinary B. Tech in Mechanical Engineering Degree Programme**

**Semester - VII (Final Year)**

| Sr. No. | Course Name | Course Category | Course Code | Course Plan per Week (Hrs.) | | | | | Credits | Theory Evaluation | | Theory (Total) | | Practical/Term Work Evaluation | | Practical/Term Work Evaluation (Total) | | Total Max Marks | Theory Exam Time (Hrs.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | SEE | CIA | | | EE | PA | | | | |
| | | | | L | T | P | SL | Total | | Max Marks | Max Marks | Max Marks | Min Marks | Max Marks | Max Marks | Max Marks | Min Marks | | |
| 1 | Refrigeration and Air Conditioning | PCC | 7ME301PC1 | 3 | 0 | 0 | 3 | 6 | 3 | 60 | 40 | 100 | 40 | | | | | 100 | 3 Hrs. |
| 2 | Artificial Intelligence & Robotics | PCC | 7ME302PC1 | 2 | 0 | 0 | 2 | 4 | 2 | 60 | 40 | 100 | 40 | | | | | 100 | 3 Hrs. |
| 3 | Programme Elective Course - IV | PEC | 7ME303PE_ | 2 | 0 | 0 | 2 | 4 | 2 | 60 | 40 | 100 | 40 | | | | | 100 | 3 Hrs. |
| 4 | Programme Elective Course - V | PEC | 7ME304PE_ | 3 | 0 | 0 | 3 | 6 | 3 | 60 | 40 | 100 | 40 | | | | | 100 | 3 Hrs. |
| 5 | Multidisciplinary Minor - V | MDM | 7_305MD_ | 2 | 0 | 0 | 2 | 4 | 2 | 30 | 20 | 50 | 20 | | | | | 50 | 2 Hrs. |
| 6 | Refrigeration and Air Conditioning - Lab | PCC | 7ME306PC1 | 0 | 0 | 2 | 0 | 2 | 1 | | | | | 25 | 25 | 50 | 25 | 50 | |
| 7 | Programme Elective Course - IV-Lab | PEC | 7ME307PE_ | 0 | 0 | 2 | 0 | 2 | 1 | | | | | 25 | 25 | 50 | 25 | 50 | |
| 8 | Research Methodology | RM | 7ME401RM1 | 2 | 0 | 4 | 2 | 8 | 4 | 30 | 20 | 50 | 20 | | 50 | 50 | 25 | 100 | 2 Hrs. |
| 9 | Project | PR | 7ME402PR1 | 0 | 0 | 8 | 0 | 8 | 4 | | | | | 50 | 100 | 150 | 75 | 150 | |
| **Total** | | | | **14** | **0** | **16** | **14** | **44** | **22** | | | **500** | | | | **300** | | **800** | |

Notional Learning Hours: [Workload (teaching/guidance/practicum) 30x15 = 450 Hrs] + [Learner-engaged time 14x15 = 210 Hrs]

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Optional Course for Double Minor / Honours Degree** | | | | | | | | | | | | | | | | | | | |
| 10 | Double Minor / Honours Course - V | DH | 7__308DH_ | 3 | 0 | 0 | 3 | 6 | 3 | 60 | 40 | 100 | 40 | | | | | 100 | 3 Hrs. |
| **Optional Course for Honours with Research Degree** | | | | | | | | | | | | | | | | | | | |
| 12 | Research Project | RP | 7ME403RP1 | 0 | 0 | 18 | 0 | 18 | 9 | 0 | 0 | 0 | 0 | 100 | 100 | 200 | 100 | 200 | |

**Jawaharlal Darda Institute of Engineering & Technology, Yavatmal (Autonomous Institute)**
**Curriculum Structure (Scheme) for Four Year Multidisciplinary B. Tech in Mechanical Engineering Degree Programme**
**Semester - VIII (Final Year)**

| Sr. No. | Course Name | Course Category | Course Code | Course Plan per Week (Hrs.) | | | | | Credits | Theory Evaluation | | Theory (Total) | | Practical/Term Work Evaluation | | Practical/Term Work Evaluation (Total) | | Total Max Marks | Theory Exam Time (Hrs.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | SEE | CIA | | | EE | PA | | | | |
| | | | | L | T | P | SL | Total | | Max Marks | Max Marks | Max Marks | Min Marks | Max Marks | Max Marks | Max Marks | Min Marks | | |
| 1 | Automobile Engineering & EV Technology (Online) | PCC | 8ME309PC1 | 3 | 0 | 0 | 3 | 6 | 3 | 60 | 40 | 100 | 40 | | | | | 100 | 3 Hrs. |
| 2 | Programme Elective Course - VI (Online)* | PEC | 8ME310PE_ | 3 | 0 | 0 | 3 | 6 | 3 | 60 | 40 | 100 | 40 | | | | | 100 | 3 Hrs. |
| 3 | Multidisciplinary Minor - VI (Online) | MDM | 8_311MD_ | 2 | 0 | 0 | 2 | 4 | 2 | 30 | 20 | 50 | 20 | | | | | 50 | 2 Hrs. |
| 4 | On Job Training (Internship/Apprenticeship) | OJT | 8ME404IN1 | 0 | 0 | 24 | 0 | 24 | 12 | | | | | 100 | 100 | 200 | 100 | 200 | |
| **Total** | | | | **8** | **0** | **24** | **8** | **40** | **20** | | | **250** | | | | **200** | | **450** | |
| Notional Learning Hours: [Workload (teaching/guidance/practicum) 32x15 = 480 Hrs] + [Learner-engaged time 8x15 = 120 Hrs] | | | | | | | | | | | | | | | | | | | |
| **Optional Course for Honours with Research Degree** | | | | | | | | | | | | | | | | | | | |
| 5 | Research Project | RP | 8ME405RP1 | 0 | 0 | 18 | 0 | 18 | 9 | 0 | 0 | 0 | 0 | 100 | 100 | 200 | 100 | 200 | |

## 9. List of Programme Elective Courses

Students will have an option to choose the PEC offered by their respective Major Discipline offered during semester V to VIII

Programme Elective Courses offered by Mechanical Engineering

| Sr. No. | Semester | Programme Elective Course/Subjects Name | Course Code |
|---|---|---|---|
| 1 | V | Computer-Aided Design and Manufacturing (PEC-I) | 5ME231PE1 |
| 2 | | Computer-Aided Design and Manufacturing – Lab (PEC- Lab I) | 5ME236PE1 |
| | | OR | |
| 3 | | Power Plant Engineering (PEC-I) | 5ME231PE2 |
| 4 | | Power Plant Engineering – Lab (PEC- Lab I) | 5ME236PE2 |
| 5 | VI | Internal Combustion Engine (PEC- II) | 6ME242PE1 |
| 6 | | Internal Combustion Engine -Lab (PEC-Lab II) | 6ME246PE1 |
| | | OR | |
| 7 | | Measurement System (PEC-II) | 6ME242PE2 |
| 8 | | Measurement System- Lab (PEC- Lab II) | 6ME246PE2 |
| 9 | | Mechanical Innovations & Entrepreneurship (PEC- III) | 6ME243PE1 |
| | | OR | |
| 10 | | Additive Manufacturing (PEC- III) | 6ME243PE2 |
| 11 | VII | Automation Engineering (PEC- IV) | 7ME303PE1 |
| 12 | | Automation Engineering - Lab (PEC-Lab IV) | 7ME307PE1 |
| | | OR | |
| 13 | | Non- Conventional Energy Sources (PEC-IV) | 7ME303PE2 |
| 14 | | Non- Conventional Energy Sources – Lab (PEC-Lab IV) | 7ME307PE1 |
| 15 | | Production & Operation Management (PEC-V) | 7ME304PE1 |
| | | OR | |
| 16 | | Die, Mould & Tool Engineering (PEC-V) | 7ME304PE2 |
| 17 | VIII | Mechatronics (Online)* (PEC-VI) | 8ME310PE1 |
| | | OR | |
| 18 | | Finite Element Analysis (Online)* (PEC-VI) | 8ME310PE2 |

## 10. Syllabus for Semester III & IV

| Level: **5** | Course Code: **3ME201PC1** | | Course Category: **PCC** | | |
|---|---|---|---|---|---|
| Course Name | **Thermal Engineering -I** | | | | |
| Credits | **03** | Total L:T:P etc. Hours | 3:0:0 **45 Hrs** | Total SL Hours | **45 Hrs** |
| Total Credit Hours | **90 Hrs** | | | | |
| SEE Marks | **60** | SEE Time | **3 Hrs** | CIA Marks | **40** |
| EE Marks | **--** | PA Marks | **--** | Total Marks | **100** |

**Course Description:**
Subject Code 3ME201PC1 Thermal Engineering -I is a compulsory Program Core Course for Second Year B.Tech. Mechanical Engineering Program.

**Course Objectives:**
This course develops a strong understanding of thermodynamic principles and laws to analyze energy systems, interpret thermodynamic properties, and evaluate major power cycles for real life engineering applications.

**Course Outcomes:**
After completing the course students will be able to:

| CO | Course Outcome | Domain Level |
|---|---|---|
| 3ME201PC1.1 | Explain the basic concepts, laws, and properties related to thermodynamic systems and processes, with the purpose of building a strong foundational understanding of thermodynamics. | C-2 |
| 3ME201PC1.2 | Interpret various forms of energy and apply the First Law of Thermodynamics to closed and open systems, in order to understand energy interactions and conservation principles in practical applications. | C-2 |
| 3ME201PC1.3 | Describe steam properties and analyze steam formation processes using steam tables and diagrams, for the purpose of enabling accurate evaluation of steam-based thermodynamic systems. | C-2 |
| 3ME201PC1.4 | Apply the First Law of Thermodynamics to steady-flow devices such as turbines, compressors, and nozzles, to develop the ability to analyze and solve real-world engineering problems. | C-3 |

| | | |
|---|---|---|
| 3ME201PC1.5 | Evaluate the performance of heat engines, refrigerators, and heat pumps using the Second Law of Thermodynamics, with the purpose of assessing efficiency and identifying performance improvements. | C-4 |
| 3ME201PC1.6 | Analyze air standard and vapor cycles using thermodynamic principles and diagrams, for the purpose of selecting and optimizing cycles for engineering applications. | C-4 |

**Course Contents:**

| | | |
|---|---|---|
| Unit 1 | **Fundamentals:** Introduction to basic concepts of thermodynamics, Macroscopic and microscopic approaches, properties of system, state, processes and cycle, thermodynamic equilibrium, types of thermodynamic systems, Temperatures and Zeroth law of thermodynamics, Quasi-static process, Gas Laws and Ideal gas equation of states, gas constant and universal gas constant. | 7 Hrs |
| Unit 2 | **Energy, Energy Transfer and Energy Analysis:** Energy and various forms of energy, Internal Energy, Heat and energy transfer by Heat, Mechanism of Heat Transfer; Work, Electrical Work and forms of Mechanical Work; First Law of Thermodynamics and Energy Balance, Mechanisms of energy transfer to and from a system, Flow Energy, Energy conversion efficiencies, Implications of energy conversion on environment. | 7 Hrs |
| Unit 3 | **Properties of Steam**: Formation of Steam, Triple Point and Critical Point, Sensible Heat, Latent Heat, Superheat and Total Heat of Steam. Wet Steam, Dryness Fraction, Internal energy of steam, External work of Evaporation, Specific Volume, Enthalpy, Internal Energy and Entropy of Steam. T-S Diagram and Steam Table and their use. Difference between Vapour and Gas, Dryness Fraction &Measurement of by Separating, Throttling, and Combine Calorimeter | 7 Hrs |
| Unit 4 | **First Law applied to flow processes:** Steady state, steady flow process, equation for work done in steady flow process and its representation on P-V diagram, mass balance and energy balance in steady flow process, steady flow energy equation and its application to nozzles and diffusers, turbine and compressor pumps, heat exchangers, Throttle valve etc. work done and Heat transfer during steady flow processes. | 8 Hrs |

| | | |
|---|---|---|
| Unit 5 | **Second Law of thermodynamics:**<br>Limitations of First law, Thermal energy reservoir, heat engines refrigerator and heat pumps, COP and tonne of refrigeration, COP for heat pump and refrigerator, Kelvin-Plank and Clausius statements, their equivalence, reversible and irreversible processes, Carnot cycle, Carnot theorem | 8 Hrs |
| Unit 6 | **Air Standard Cycles:**<br>Otto, Diesel, Brayton, Sterling and joule cycles etc., their efficiencies, comparison of auto, diesel and dual cycles.<br>Vapour Cycles: Rankine Cycle. Comparison of Rankine and Carnot cycle, representation on P-V, T-S and H-S diagram. | 8 Hrs |

**Text Books:**

1. Yunus Çengel and Michael, Boles,Thermodynamics: An Engineering Approach, Tata McGraw Hill.
2. P. K. Nag,Basic and Applied Thermodynamics, Tata McGraw Hill Education.
3. R.Yadav, Fundamentals of Engineering Thermodynamics, Central Publishing House (CPH), Allahabad.
4. V. Ganeshan, Thermodynamics Basics and Applied, Tata McGraw Hill Education.
5. Mahesh M. Rathore, Thermal Engineering, Tata McGraw Hill Education.

**Reference Books:**

1. ReynerJoel, Basic Engineering Thermodynamics, Pearson Education
2. C.P.Arora, Thermodynamics, Tata McGraw Hill Education.
3. G. J.Vanwylen, Fundamentals of ClassicalThermodynamics, Wiley (John Wiley & Sons).
4. P. Chattopadhyay, Engineering Thermodynamics, Oxford University Press.
5. Gordon Rogers, Yon Mayhew, Pearson, Engineering Thermodynamics, Pearson Education.

**E-Resources:**

1. https://ncert.nic.in/textbook/pdf/keph204.pdf
2. https://www.sfu.ca/~mbahrami/ENSC%20388/Notes/First%20Law%20of%20Thermodynamics_Closed%20Systems.pdf
3. https://www.sfu.ca/~mbahrami/ENSC%20388/Notes/Intro%20and%20Basic%20Concepts.pdf
4. https://coursecontent.indusuni.ac.in/wp-content/uploads/sites/8/2021/11/3.1.-PROPERTIES-OF-STEAM.pdf
5. http://www.rshanthini.com/tmp/ThermoBook/ThermoChap10.pdf
6. https://www.sfu.ca/~mbahrami/ENSC%20388/Notes/Second%20Law%20of%20Thermodynamics.pdf
7. https://www.sathyabama.ac.in/sites/default/files/course-material/2020-10/UNIT-1.PDF

**Mapping of CO with PO& PSO**

| CO | PO | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **1** | **2** | **3** |
| 3ME201PC1.1 | 3 | 2 | - | - | 1 | - | - | - | - | - | 1 | 3 | 1 | 1 |
| 3ME201PC1.2 | 3 | 3 | - | 2 | 2 | - | - | - | - | - | 1 | 3 | 1 | 1 |
| 3ME201PC1.3 | 3 | 2 | - | - | 2 | - | - | - | - | - | 1 | 3 | 1 | 1 |
| 3ME201PC1.4 | 2 | 3 | 2 | 3 | 3 | - | - | - | - | - | 1 | 3 | 2 | 1 |
| 3ME201PC1.5 | 2 | 3 | 2 | 2 | 2 | 2 | - | - | - | - | 2 | 3 | 2 | 1 |
| 3ME201PC1.6 | 2 | 3 | 2 | 2 | 3 | 2 | - | - | - | - | 2 | 3 | 2 | 1 |
| 3ME201PC1 | 3 | 3 | 1 | 2 | 2 | 1 | - | - | - | - | 1 | 3 | 2 | 1 |

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

| Level: **5** | Course Code: **3ME202PC1** | | Course Category: **PCC** | | |
|---|---|---|---|---|---|
| Course Name | **Fluid Mechanics** | | | | |
| Credits | **02** | Total L:T:P etc. Hours | 2:0:0 **30 Hrs** | Total SL Hours | **30 Hrs** |
| Total Credit Hours | **60 Hrs** | | | | |
| SEE Marks | **60** | SEE Time | **3 Hrs** | CIA Marks | **40** |
| EE Marks | **--** | PA Marks | **--** | Total Marks | **100** |

**Course Description:**
Subject Code 3ME202PC1Fluid Mechanicsis a compulsory Program Core Course for Second Year B.Tech. Mechanical Engineering Program.

**Course Objectives:**
To impart fundamental knowledge of fluid properties and behaviour in various flow conditions, including hydrostatics, buoyancy, stability, boundary layer concepts, and the application of mass, momentum, and energy equations to analyze flow systems and associated losses.

**Course Outcomes:**
After completing the course students will be able to:

| CO | Course Outcome | Domain Level |
|---|---|---|
| 3ME202PC1.1 | To enable students to understand the basic physical properties of fluids and apply principles of fluid statics and kinematics to describe fluid behavior at rest and in motion. | C-3 |
| 3ME202PC1.2 | To develop the ability to evaluate buoyant forces, stability, and equilibrium conditions of bodies immersed in fluids for engineering applications. | C-5 |
| 3ME202PC1.3 | To equip students with the analytical skills required to study fluid motion by applying kinematic and dynamic principles to real flow situations. | C-3 |
| 3ME202PC1.4 | To enable students to calculate head losses and analyze energy dissipation in pipe flow systems for efficient design and operation. | C-3 |
| 3ME202PC1.5 | To help students understand the effects of viscosity on fluid motion and analyze laminar and turbulent flow behavior in practical systems. | C-4 |
| 3ME202PC1.6 | To develop competence in evaluating forces due to jet impingement and applying momentum principles in hydraulic and mechanical systems. | C-5 |

**Course Contents:**

| | | |
|---|---|---|
| Unit 1 | **Basic properties of fluid:** Density, Specific weight, Specific Volume, Specific gravity, Viscosity of fluid, Surface Tension, Capillarity, vapour pressure & cavitation. pressure & its measurement: Pascal's law, Hydrostatic law of pressure & pressure variation in fluid, measurement of pressure by Manometers. | 5 Hrs |
| Unit 2 | **Buoyancy & floatation:** Concept of buoyancy, Centre of buoyancy. Stability of floating body, Metacentre& metacentric height. Condition of equilibrium of floating & sub-merged body. Hydrostatic pressure force on plane surfaces. Measurement of total pressure & Centre of pressure | 5 Hrs |
| Unit 3 | **Kinematics of fluid flow:** Methods of describing fluid motion, Types of flow, rate of flow, streamline, potential line, flow net, velocity & acceleration, continuity equation in three-dimensional flow. Dynamics of fluid flow: Euler's equation of motion, Bernoulli's equation measurement of fluid flow with venturimeter. | 5 Hrs |
| Unit 4 | **Flow through pipes:** Losses in pipe, major losses, Darcy‘s Weisbach equation, minor losses due to sudden enlargement, contraction, entry, exit & pipe fitting. Flow through series & parallel pipes, concept of water hammer in pipes | 5 Hrs |
| Unit 5 | **Motion of viscous fluid:** Introduction to Laminar & Turbulent flow, Concept of Boundary layer & its type, Boundary layer separation, Reynolds number & its significance. Drag & Lift force on object | 5 Hrs |
| Unit 6 | **Impact of Jet:** Force exerted by fluid jet on plane, curved, stationary & moving vanes. Velocity diagrams, work done & efficiency. | 5 Hrs |

**Text Books:**

1.R. K. Bansal, Fluid Mechanics and Hydraulic Machines, Laxmi Publications, New Delhi, India
2. R. K. Rajput, Engineering fluid Mechanics, S. Chand & Company Pvt. Ltd., New Delhi, India.

**Reference Books:**

1. S. Ramamrutham, Hydraulic, Fluid Mechanics &Fluid Machines, Dhanpat Rai Publishing Company, New Delhi, India
2. Modi & Sheth, Fluid Mechanics & Machinery, Standard Book House, New Delhi, India
3. CRSP. Ojha, Fluid mechanics & Machinery, R. Berndtsson,Oxford University Press (OUP India)
4. Strecter, Fluid Mechanics, Mcgraw Hill Education,McGraw-Hill Education (India / International Editions)

**E-Resources:**

1. https://onlinecourses.nptel.ac.in/noc22_ce85/preview?utm
2. https://www.nptelprep.in/courses/105103192/materials?utm
3. https://onlinecourses.nptel.ac.in/noc25_me41/preview?utm
4. https://www.nptelprep.in/courses/105103192?utm
5. https://www.vssut.ac.in/lecture_notes/lecture1427495313.pdf?utm

**Mapping of COs with POs & PSOs**

| CO | PO | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 1 | 2 | 3 |
| 3ME202PC1.1 | 3 | 2 | - | - | - | - | - | - | - | - | - | 3 | 1 | - |
| 3ME202PC1.2 | 3 | 2 | 1 | 1 | - | - | - | - | - | - | - | 3 | 2 | - |
| 3ME202PC1.3 | 3 | 2 | 1 | 1 | - | - | - | - | - | - | - | 3 | 2 | 1 |
| 3ME202PC1.4 | 3 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | 3 | 2 | 1 |
| 3ME202PC1.5 | 3 | 2 | 1 | 1 | - | - | - | - | - | - | - | 3 | 1 | 1 |
| 3ME202PC1.6 | 3 | 3 | 2 | 2 | 3 | 2 | - | - | - | - | 1 | 3 | 2 | 1 |
| 3ME202PC1 | 3 | 3 | 1 | 1 | 1 | 2 | - | - | - | - | 1 | 3 | 2 | 1 |

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

| Level: **5** | Course Code: **3ME203PC1** | | Course Category: **PCC** | | |
|---|---|---|---|---|---|
| Course Name | **Strength of Materials** | | | | |
| Credits | **03** | Total L:T:P etc. Hours | 3:0:0 **45Hrs** | Total SL Hours | **45Hrs** |
| Total Credit Hours | **90Hrs** | | | | |
| SEE Marks | **60** | SEE Time | **3Hrs** | CIA Marks | **40** |
| EE Marks | **--** | PA Marks | **--** | Total Marks | **100** |

**Course Description:**
Subject Code 3ME203PC1 Strength of Materials is a compulsory Program CoreCourse for Second Year B.Tech Mechanical Engineering.

**Course Objectives:**
The objective of this course is to develop the ability in students to understand the mechanical behaviour of materials and to analyze stresses, strains, internal forces, bending, torsion, principal stresses, and deflection in structural and machine components, so that they can design safe and efficient engineering systems.

**Course Outcomes:**
After completing the course students will be able to:

| CO | Course Outcome | Domain Level |
|---|---|---|
| 3ME203PC1.1 | Explain stresses, strains, and material properties to understand the mechanical behavior of materials under different loading conditions. | C2 |
| 3ME203PC1.2 | Construct shear force and bending moment diagrams for evaluating internal force distribution in beams. | C3 |
| 3ME203PC1.3 | Apply bending theory to compute stresses and assess strength of beam cross-sections. | C3 |
| 3ME203PC1.4 | Analyze torsion, springs, and impact loading to assess stress behavior in shafts and energy-absorbing elements. | C4 |
| 3ME203PC1.5 | Determine principal stresses and strains for examining biaxial stress conditions in thin pressure vessels. | C4 |
| 3ME203PC1.6 | Calculate slope and deflection of beams to evaluate deformation and serviceability under various boundary conditions. | C3 |

**Course Contents:**

| | | |
|---|---|---|
| Unit 1 | **Stresses and Strain:**<br>Mechanical Properties of Materials, Concept of direct, bending and shear stresses and strains, Stress-strain relations, Bi-axial and Tri-axial loading, Elastic constants, Poission's ratio and their relationship, Stress-strain diagrams and their characteristics for mild steel, Factor of safety and its significance. Stresses and strains in compound bars in uni-axial tension and compression, Thermal stresses in simple restrained bars and compound bars of two metals. | 10 Hrs |
| Unit 2 | **Shear Force and Bending Moment:**<br>Types of Beams and concept of Shear force and Bending moment. Axial force, shear force & bending moment diagrams for - Simply supported Beams, Overhanging Beams and Cantilever Beams subjected to Point load, uniformly distributed load. Relation between shear force, bending moment and loading intensity. | 07 Hrs |
| Unit 3 | **Theory of simple bending**:<br>section modulus, moment of resistance.<br>**Bending and Shear Stresses:**<br>Bending stresses in solid, hollow and built-up section. Shear stress distribution on beams with Rectangular and Circular cross sections. | 07 Hrs |
| Unit 4 | **Torsion:**<br>Theory of torsion & assumptions, derivation of torsion equation. Polar modulus, Stresses in solid & hollow circular shaft. Power transmitted by solid and hollow shaft and their equivalence.<br>**Spring:**<br>Basic Terminology of Spring, Closed coiled helical spring with axial load. Strain energy under uni-axial tension and compression. Gradually, Suddenly and Impact loads and instantaneous stresses and strain. | 07 Hrs |
| Unit 5 | **Thin cylinders and thin spherical shells:**<br>Thin cylinders and thin spherical shells subjected to internal pressures.<br>**Biaxial stress system**:<br>principal stresses, principal planes. Mohr's circle of stresses, principal strains, principal planes. | 07 Hrs |
| Unit 6 | **Slope and Deflection:**<br>Slope and Deflection for Simply supported and Cantilever Beams - subjected to Point loads and uniformly distributed load by Macaulay's method. End Conditions. | 07 Hrs |

**Text Books:**

1. R. K. Bansal, A Textbook of Strength of Materials, Laxmi Publications
2. S. Ramamrutham, Strength of Materials (SI Units) ,DhanpatRai Publications
3. R. K. Rajput, Strength of Materials, S. Chand Publications
4. S. S. Bhavikatti, Strength of Materials, Vikas Publishing House
5. R. S. Khurmi, Strength of Materials, S. Chand Publications

**Reference Books:**

1. S. P. Timoshenko, Strength of Materials, Vol. I, CBS Publishers / Van Nostrand
2. S. P. Timoshenko, Strength of Materials, Vol. II – CBS Publishers / Van Nostrand
3. Dr. B. C. Punmia, Strength of Materials, Laxmi Publications
4. L. N. Srinath, Advanced Mechanics of Solids, McGraw Hill Education
5. S. M. A. Kazimi, Solid Mechanics, Tata McGraw Hill

**E-Resources:**

1. Strength of Materials by Prof. S.K. Bhattacharyya, IIT Kharagpur (https://nptel.ac.in/courses/105105108)
2. Strength of Materials (Open Textbook) https://engineeringmechanicsoer.github.io/StrengthBook/?utm_source=chatgpt.com

**Mapping of COs with POs**

| CO | PO | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 1 | 2 | 3 |
| 3ME203PC1.1 | 3 | 2 | 1 | 1 | - | - | 1 | 1 | - | 1 | - | 3 | 2 | - |
| 3ME203PC1.2 | 3 | 3 | 3 | 2 | 1 | - | 1 | 1 | - | 1 | - | 2 | 3 | - |
| 3ME203PC1.3 | 3 | 3 | 3 | 3 | 1 | - | 1 | 1 | - | 1 | - | 2 | 3 | - |
| 3ME203PC1.4 | 3 | 3 | 2 | 3 | 1 | - | 1 | 1 | - | 1 | - | 3 | 2 | 1 |
| 3ME203PC1.5 | 3 | 3 | 2 | 2 | 1 | - | 1 | 1 | - | 1 | - | 3 | 2 | - |
| 3ME203PC1.6 | 3 | 2 | 2 | 2 | 1 | 1 | 3 | 2 | 1 | 2 | 1 | 2 | 2 | 1 |
| 3ME203PC1 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 3 | 1 |

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

| Level: **5** | Course Code: **3ME204MD1** | | Course Category: **MDM** | | |
|---|---|---|---|---|---|
| Course Name | **Foundation of Mechanical Engineering** | | | | |
| Credits | **02** | Total L:T:P etc. Hours | 2:0:0 **30 Hrs** | Total SL Hours | **30 Hrs** |
| Total Credit Hours | **60 Hrs** | | | | |
| SEE Marks | **30** | SEE Time | **2 Hrs** | CIA Marks | **20** |
| EE Marks | **--** | PA Marks | **--** | Total Marks | **50** |

**Course Description:**
Subject Code 3ME204MD1Foundation of Mechanical Engineering is a compulsory Multidisciplinary Minor Course offered by the department of Mechanical Engineering for other Second Year B. Tech., major disciplines.

**Course Objectives:**
The objective of the course is to introduce fundamental concepts of mechanical engineering, and to impart knowledge of energy, materials, manufacturing, and thermal-fluid sciences.

**Course Outcomes:**
After completing the course students will be able to:

| CO | Course Outcome | Domain Level |
|---|---|---|
| 3ME204MD1.1 | Apply the basic principles of thermodynamics and energy conversion to evaluate engineering systems and processes. | C-3 |
| 3ME204MD1.2 | Identify materials and manufacturing processes relevant to engineering to select appropriate engineering materials and manufacturing processes based on functional requirements, performance, and economic considerations. | C-2 |
| 3ME204MD1.3 | Apply fundamental concepts of fluid mechanics and heat transfer to analyze and design practical engineering systems. | C-3 |

**Course Contents:**

| | | |
|---|---|---|
| Unit 1 | **Fundamentals of Mechanical Engineering & Thermodynamics:**<br>Scope and importance of Mechanical Engineering in industries.<br>**Introduction to mechanical systems:**<br>Machine elements, mechanisms and power transmission.<br>**Basics of Thermodynamics:**<br>Systems, properties, state, process, cycle. Zeroth law, First law of thermodynamics, applications to closed and open systems. Concepts of internal energy, enthalpy, work and heat interactions.<br>Heat engines, refrigerators, and heat pumps – performance parameters (efficiency, COP). | 10 Hrs |
| Unit 2 | **Materials and Manufacturing:**<br>Classification of engineering materials: metals, polymers, ceramics, composites.<br>Properties: mechanical, thermal, electrical, corrosion resistance.<br>**Manufacturing Processes:**<br>Casting, forming, welding, and machining (basic principles).<br>Additive manufacturing – introduction to 3D printing. | 9 Hrs |
| Unit 3 | **Fluid Mechanics, Heat Transfer & Applications:** Properties of fluids: density, viscosity, compressibility, surface tension. Fluid statics: pressure, Pascal's law, manometers, buoyancy. Fluid kinematics: continuity equation, Bernoulli's principle and applications.<br>**Introduction to Heat Transfer:**<br>Modes – conduction, convection, radiation. Fourier's law, Newton's law of cooling, Stefan–Boltzmann law (basic form). Applications: pumps, turbines, boilers, heat exchangers. | 11 Hrs |

**Text Books:**


1. R. K. Purohit, Foundation of Mechanical Engineering, 4th Edition, Scientific Publishers.
2. Dr. D. S. Kumar, Fundamentals of Mechanical Engineering, S.K. Kataria & Sons.
3. R. K. Rajput, Fundamentals of Mechanical Engineering, Laxmi Publications Pvt Ltd.


**Reference Books:**


1. P.K. Nag, Engineering Thermodynamics, McGraw-Hill Education.
2. R. K. Bansal, Fluid Mechanics and Hydraulic Machines, Laxmi Publications.
3. A. Ghosh & A.K. Mallik, Manufacturing Science, Affiliated East-West Press.
4. V. Raghavan, Engineering Materials & Metallurgy, PHI Learning.

**E-Resources:**

1. https://alison.com/course/mechanical-engineering-principles-and-design-conceptsAlison.
2. https://opencourser.com/course/f9crix/basics-of-mechanical-engineeringopencourser.com.
3. https://www.classcentral.com/course/swayam-basics-of-mechanical-engineering-1-292635Class Central.
4. https://ocw.mit.edu/courses/2-72-elements-of-mechanical-design-spring-2009/pages/lecture-notes/

**Mapping of COs with POs**

| CO | PO | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **1** | **2** | **3** |
| 3ME204MD1.1 | 3 | 2 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| 3ME204MD1.2 | 2 | 2 | - | - | - | 1 | - | - | - | - | - | - | 3 | - |
| 3ME204MD1.3 | 3 | 3 | - | - | - | - | - | - | - | - | 2 | - | - | - |
| 3ME204MD1 | 3 | 2 | - | - | - | 1 | - | - | - | - | 1 | 1 | 1 | - |

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

| Level: | **5** | Course Code: | **3SH205OE1** | Course Category: | **OE** |
|---|---|---|---|---|---|
| Course Name | **Soft Skills & Profile Building** | | | | |
| Credits | **03** | Total L:T:P Hours | 3:0:0 **45 Hrs** | Total SL Hours | **45 Hrs** |
| Total Credit Hours | **90 Hrs** | | | | |
| SEE Marks | **60** | SEE Time | **3 Hrs** | CIA Marks | **40** |
| EE Marks | **--** | PA Marks | **--** | Total Marks | **100** |

**Course Description:**
Subject Code 3SH205OE1 Soft Skills & Profile Building is a compulsory Open Elective Course for Second Year B. Tech All Branch Students.

**Course Objectives:**
The objective of this course is to focus on developing advanced communication skills, leadership qualities and professional etiquette among engineering graduates.

**Course Outcomes:**
After completing the course students will be able to:

| CO | Course Outcome | Domain Level |
|---|---|---|
| 3SH205OE1.1 | Apply advanced interpersonal, analytical, and persuasive communication techniques in professional contexts for effective professional interactions. | C-3 |
| 3SH205OE1.2 | Demonstrate professional workplace etiquette, business communication, and group discussion skills to enhance employability. | C-3<br>A-3 |
| 3SH205OE1.3 | Analyze leadership styles, emotional intelligence, and team dynamics for effective collaboration. | C-4<br>A-3 |
| 3SH205OE1.4 | Design a structured and realistic career plan aligned with industry expectations and personal goals for professional growth. | C-6 |
| 3SH205OE1.5 | Create ATS-friendly résumés, professional portfolios, and digital profiles for personal branding. | C-6<br>P-4 |
| 3SH205OE1.6 | Perform effectively in interviews, workplace simulations, and job-search processes with professional confidence for enhanced employability. | C-3<br>P-3<br>A-3 |

**Course Contents:**

| | | |
|---|---|---|
| Unit 1 | **Advanced Communication Dynamics:** Advanced interpersonal communication strategies; speech articulation; structuring thoughts and fluency techniques; analytical and critical communication; storytelling techniques for impactful presentations; persuasive communication models. | 7 Hrs |
| Unit 2 | **Global Workplace Etiquettes, Email Writing & GD–PI Perspective:** Professional greetings and workplace conduct; giving and receiving feedback; handling criticism and adaptability issues; professional values such as punctuality and attire; types of handshakes and significance; effective business email writing; types of Group Discussions, purpose of GDs; mock GDs (video-based); interview strategies and techniques. | 8 Hrs |
| Unit 3 | **Leadership, Team Dynamics & Corporate Skills:** Personality types using 9/9 matrix; leadership styles; emotional intelligence and leadership relationship; conflict resolution and negotiation techniques; team-building skills (Johari Window perspective); cross-cultural communication; creativity and design thinking; structured problem-solving and decision-making**.** | 7 Hrs |
| Unit 4 | **Strategizing Career Planning:** SMART goal setting; mapping skills to career paths; understanding industry expectations; emerging futuristic soft and hard skills (domain-wise); personalized career roadmap; certification planning (technical and non-technical); networking skills and participation in professional communities | 7 Hrs |
| Unit 5 | **Profile Building, Portfolio & Personal Branding:** ATS-friendly résumé preparation and common mistakes; video résumé creation and self-marketing pitch; LinkedIn profile optimization and networking strategies; developing online portfolios using platforms such as GitHub, Behance, Google Sites, and Toastmasters | 8 Hrs |
| Unit 6 | **Employment Readiness & Industry Integration:** Workplace simulation activities (mock emails, meetings, discussions); mock personal interviews; understanding sector-specific industry dynamics; unconventional career opportunities after engineering; job-hunting strategies and popular job platforms | 8 Hrs |

**Text Books:**

1. Alex K., Soft Skills, S. Chand Publishing
2. Meenakshi Raman & Prakash Singh, Business Communication, Oxford University Press

**Reference Books:**

1. Stephen R. Covey,The 7 Habits of Highly Effective People, Free Press Publication
2. Daniel Goleman, Emotional Intelligence, published by Bantam Books.
3. Shiv Khera, You Can Win, published by Bloomsbury Publishing
4. Richard N. Bolles, What Color Is Your Parachute? Published by Ten Speed Press, Crown Publishing Group

**E Resources**:

1. NPTEL: Soft Skills and Personality Development
2. LinkedIn Learning – Communication & Career Development Courses
3. Harvard Business Review – Communication & Leadership Articles
4. Coursera /edX – Career Development & Employability Skills Modules

**Mapping of COs with POs & PSO**

| CO | PO | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 1 | 2 | 3 |
| 3SH205OE1.1 | 2 | 3 | 2 | – | – | – | – | 2 | 3 | – | – | 1 | 2 | 1 |
| 3SH205OE1.2 | – | 2 | – | – | – | 2 | 3 | 3 | 3 | – | – | 1 | 2 | 2 |
| 3SH205OE1.3 | – | 3 | 2 | – | – | 2 | 2 | 3 | – | – | – | 1 | 2 | 2 |
| 3SH205OE1.4 | – | 3 | 3 | – | – | 2 | – | – | – | 2 | 3 | – | 3 | – |
| 3SH205OE1.5 | – | 2 | 3 | – | 3 | – | – | – | 2 | – | 2 | – | 3 | 1 |
| 3SH205OE1.6 | – | 2 | 2 | – | 2 | 2 | – | 2 | 3 | – | 2 | 1 | 2 | 2 |
| 3SH205OE1CO | 1 | 3 | 2 | - | 1 | 2 | 1 | 2 | 2 | 1 | 1 | 1 | 2 | 2 |

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

| Level: | 5 | Course Code: | 3SH205OE2 | Course Category: | OE |
|---|---|---|---|---|---|
| Course Name | **Team Building & Management** | | | | |
| Credits | **03** | Total L:T:P Hours | 3:0:0 **45 Hrs** | Total SL Hours | **45 Hrs** |
| Total Credit Hours | **90 Hrs** | | | | |
| SEE Marks | **60** | SEE Time | **3 Hrs** | CIA Marks | **40** |
| EE Marks | **--** | PA Marks | **--** | Total Marks | **100** |

**Course Description:**
Subject Code 3SH205OE2 Team Building & Management is a compulsory Open Elective Course for Second Year B. Tech All Branch Students.

**Course Objectives:**
The Objective of the course is to develop teamwork capabilities, leadership and managerial skills, collaborative problem-solving abilities, conflict management techniques, and effective decision-making skills required in professional and organizational settings.

**Course Outcomes:**
After completing the course students will be able to:

| CO | Course Outcome | Domain Level |
|---|---|---|
| 3SH205OE2.1 | Explain the principles and importance of effective team building in organizations to foster collaborative work culture. | C-2 |
| 3SH205OE2.2 | Apply team dynamics and collaboration strategies to achieve common goals. | C-3<br>A-3 |
| 3SH205OE2.3 | Analyze leadership styles and managerial roles for effective team performance. | C-4 |
| 3SH205OE2.4 | Demonstrate conflict resolution, negotiation, and interpersonal management skills for effective team performance. | C-3<br>A-3 |
| 3SH205OE2.5 | Apply motivation and performance management techniques in team-based environments for achieving organizational goals. | C-3 |
| 3SH205OE2.6 | Perform effectively as a team member or leader in simulated managerial scenarios to develop leadership competencies | C-3<br>P-3<br>A-3 |

**Course Contents:**

| | | |
|---|---|---|
| Unit 1 | **Fundamentals of Team Building:** Concept of teams; types of teams; stages of team development; characteristics of effective teams; roles and responsibilities of team members; barriers to effective teamwork; team norms and values. | 7Hrs |
| Unit 2 | **Team Dynamics & Interpersonal Relationships:** Group behavior and dynamics; interpersonal communication in teams; trust and collaboration; listening as a team skill; diversity and inclusion in teams; cross-cultural team management | 8Hrs |
| Unit 3 | **Leadership in Teams:** Leadership concepts; leadership styles; emotional intelligence and leadership; situational leadership; influence and power in teams; leadership ethics and responsibilities. | 7 Hrs |
| Unit 4 | **Conflict Management & Negotiation:** Sources and types of conflict; conflict resolution techniques; negotiation strategies; managing difficult team members; stress management; maintaining team harmony | 7 Hrs |
| Unit 5 | **Motivation, Performance & Team Effectiveness:** Motivation theories; team motivation techniques; goal setting and performance measurement; feedback and appraisal systems; decision-making in teams; problem-solving techniques. | 8 Hrs |
| Unit 6 | **Managerial Skills & Team-Based Applications:** Managerial roles and functions; planning, organizing, and controlling teams; delegation and coordination; workplace simulations (team meetings, role plays); case studies on team management; team performance evaluation. | 8 Hrs |

**Text Books:**

1. Stephen P. Robbins, Organizational Behavior, Pearson Education
2. L.M. Prasad, Management Principles and Practices, published by Sultan Chand & Sons

**Reference Books:**

1. Patrick Lencioni, The Five Dysfunctions of a Team, published by Jossey-Bass
2. Peter G. Northouse, Leadership, published by SAGE Publications
3. Daniel Goleman, Emotional Intelligence, published by Bantam Books

**E Resources**:

1. NPTEL – Organizational Behavior & Management Courses
2. LinkedIn Learning – Team Leadership & Management Modules
3. Harvard Business Review – Teamwork & Leadership Articles
4. Coursera / edX – Team Management and Leadership Courses

**Mapping of COs with POs & PSO**

| CO | PO | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **1** | **2** | **3** |
| 3SH205OE2.1 | 2 | – | – | – | – | – | – | – | – | – | – | 1 | 2 | 2 |
| 3SH205OE2.2 | – | 2 | 2 | – | – | – | – | 3 | 2 | – | – | 1 | 2 | 3 |
| 3SH205OE2.3 | – | 3 | 3 | – | – | – | – | 2 | – | – | – | – | 2 | 3 |
| 3SH205OE2.4 | – | 2 | 2 | – | – | 2 | 3 | 3 | – | – | – | – | 2 | 3 |
| 3SH205OE2.5 | – | 2 | 2 | – | – | – | – | 2 | – | 2 | – | – | 2 | 3 |
| 3SH205OE2.6 | – | 2 | 2 | – | – | 2 | – | 3 | 2 | – | 2 | 1 | 2 | 3 |
| **3SH205OE2 CO** | 1 | 2 | 2 | - | - | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 3 |

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

| Level: **5** | Course Code: **3ME206PC1** | | Course Category: **PCC** | | |
|---|---|---|---|---|---|
| Course Name | **Thermal Engineering -ILab** | | | | |
| Credits | **01** | Total L:T:P etc. Hours | 0:0:2 **30 Hrs** | Total SL Hours | **--** |
| Total Credit Hours | **30 Hrs** | | | | |
| SEE Marks | **--** | SEE Time | **--** | CIA Marks | **--** |
| EE Marks | **25** | PA Marks | **25** | Total Marks | **50** |

**Course Description:**
Subject Code 3ME206PC1Thermal Engineering -I Lab is a compulsory Program Core Course for Second Year B.Tech. Mechanical Engineering Program.

**Course Objectives:**
The objective of this course is to offers hands-on experiments in thermodynamic systems, steam properties, gas laws, refrigeration, and engines to build skills in measurement, data analysis and performance evaluation.

**Course Outcomes:**
After completing the course students will be able to:

| CO | Course Outcome | Domain Level |
|---|---|---|
| 3ME206PC1.1 | Perform and analyze experiments related to basic thermodynamic systems, processes, and gas laws to develop practical understanding and strengthen fundamental concepts of thermodynamics. | C-3, P-3 |
| 3ME206PC1.2 | Conduct experiments on refrigeration, steam processes, and apply thermodynamic principles to real-life equipment to understand their working and evaluate performance in practical scenarios. | C-3, P-3 |
| 3ME206PC1.3 | Compare and evaluate performance parameters of SI and CI engines through experimentation and data analysis to interpret engine behavior and enhance data-driven decision-making skills. | C-3, P-2, A-4 |

**List of Practical's:**
Minimum eight practical's from the list mentioned below.

1. Study of Thermodynamic System and Processes
2. Study of Zeroth Law and Temperature Measurement Devices
3. Verification of Gas Laws (Boyle's and Charles' Law)
4. Calculation of Gas Constant (R) for Air
5. Study of Steam Formation and Phase Change
6. Measurement of Dryness Fraction using Separating Calorimeter
7. COP Measurement of Refrigeration Test Rig
8. Basic Study of Engine Parameters

9. Study of SI Engine (Petrol Engine)
10. Study of CI Engine (Diesel Engine)

**E-Resources:**

1. https://introphyslab.sites.northeastern.edu/ideal-gas-law-and-absolute-temperature-virtual-lab/?utm_source
2. https://ht-amrt.vlabs.ac.in/?utm_source
3. https://learncheme.com/simulations/thermodynamics/thermo1/?utm_source
4. https://vmtiitg.vlabs.ac.in/Separating_and_Throttling_Calorimeter(procedure).html

**Mapping of CO with POand PSO**

| CO | PO | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **1** | **2** | **3** |
| 3ME206PC1.1 | 3 | 2 | – | 2 | 2 | – | – | 1 | 1 | – | 1 | 3 | - | - |
| 3ME206PC1.2 | 3 | 2 | 1 | 2 | 2 | 1 | – | 1 | 1 | 1 | 1 | 3 | - | - |
| 3ME206PC1.3 | 2 | 3 | 2 | 3 | 2 | 2 | – | 2 | 2 | 1 | 2 | 3 | - | 2 |
| 3ME206PC1 | 3 | 2 | 1 | 2 | 2 | 1 | - | 1 | 1 | 1 | 1 | 3 | - | 1 |

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial

| Level: **5** | Course Code: **3ME207PC1** | | Course Category: **PCC** | | |
|---|---|---|---|---|---|
| Course Name | **Fluid Mechanics - Lab** | | | | |
| Credits | **01** | Total L:T:P etc. Hours | 0:0:2 **30 Hrs** | Total SL Hours | **--** |
| Total Credit Hours | **30 Hrs** | | | | |
| SEE Marks | **--** | SEE Time | **--** | CIA Marks | **--** |
| EE Marks | **25** | PA Marks | **25** | Total Marks | **50** |

**Course Description:**
Subject Code 3ME207PC1 Fluid Mechanics - Lab is a compulsory Program Core Course for Second Year B.Tech. Mechanical Engineering Program.

**Course Objectives:**
The objective of this course is to develop a clear understanding of the fundamental principles of fluid mechanics and to demonstrate the practical application of Bernoulli's equation. The course also aims to provide hands-on learning of the impact of jets on plane, inclined, and curved surfaces.

**Course Outcomes:**
After completing the course students will be able to:

| CO | Course Outcome | Domain Level |
|---|---|---|
| 3ME207PC1.1 | To enable students to comprehend the fundamental physical properties of fluids and apply principles of fluid statics and fluid kinematics to analyze fluid behavior under static and dynamic conditions encountered in engineering applications. | C-4, P-3 |
| 3ME207PC1.2 | To develop students' ability to apply Bernoulli's equation and Reynolds number concepts for analyzing energy conservation in fluid flow and for classifying flow regimes (laminar or turbulent) in practical fluid flow systems. | C-3, P-3 |
| 3ME207PC1.3 | To equip students with analytical skills to estimate energy losses due to friction in pipe flows and to evaluate forces generated by jet impingement, enabling effective analysis and design of hydraulic and mechanical systems. | C-5, P-2 & A-4 |

**List of Practicals:**

Minimum eight practicals from the list mentioned below.

1. Study of manometer.
2. Determination of metacentric height.
3. Verification of Bernoulli's equation.
4. Determination of co-efficient discharge by Venturimeter.
5.Determination of co-efficient discharge by Orificemeter
6. Calculation of Reynolds number for Laminar & Turbulent flow.
7. Determination of co-efficient of friction (Major losses in Pipes) through pipe.
8. Determination of Minor losses in pipe.
9. Determination of Impact of Jet on Plane/Inclined/Curved surfaces.
10. Study of Boundary Layer over a Flat Plate

**E-Resources:**

1.https://fm-nitk.vlabs.ac.in/Target%20Audience.html?utm
2. https://me.iitp.ac.in/Virtual-Fluid-Laboratory/?utm
3.https://eerc03-iiith.vlabs.ac.in/?utm
4.https://www.nptelprep.in/courses/112106311/videos?utm

**Mapping of COs with POs & PSOs**

| CO | PO | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 1 | 2 | 3 |
| 3ME207PC1.1 | 3 | 3 | 2 | 2 | 1 | - | 1 | 2 | 2 | - | 2 | 3 | 1 | - |
| 3ME207PC1.2 | 3 | 3 | 2 | 2 | 1 | - | 1 | 2 | 2 | - | 2 | 3 | 2 | 1 |
| 3ME207PC1.3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 2 | 2 | - | 2 | 3 | 2 | 1 |
| 3ME207PC1CO | 3 | 3 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | - | 2 | 3 | 2 | 1 |

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

| Level: **5** | Course Code: **3ME208PC1** | | Course Category: **PCC** | | |
|---|---|---|---|---|---|
| Course Name | **Strength of Material - Lab** | | | | |
| Credits | **01** | Total L:T:P etc. Hours | 0:0:2 **30 Hrs** | Total SL Hours | **--** |
| Total Credit Hours | **30 Hrs** | | | | |
| SEE Marks | **--** | SEE Time | **--** | CIA Marks | **--** |
| EE Marks | **25** | PA Marks | **25** | Total Marks | **50** |

**Course Description:**
Subject Code 3ME208PC1 Strength of Material - Lab is a compulsory Program Core Course for Second Year B.Tech Mechanical Engineering.

**Course Objectives:**
The objective of this course is to understand the fundamental mechanical properties of materials and their behavior under different types of loading, and to apply these concepts for analyzing stresses, strains, deflection, and failure in structural and machine components.

**Course Outcomes:**
After completing the course students will be able to:

| CO | Course Outcome | Domain Level |
|---|---|---|
| 3ME208PC1 | Explain mechanical properties of materials to understand material behavior through laboratory testing. | C2 |
| 3ME208PC2 | Conduct standard material tests to determine strength and elastic properties experimentally. | C4, P3 |
| 3ME208PC3 | Interpret experimental results to correlate theory with practice while following professional lab practices. | A5, C5 |

**List of Practicals:**
Minimum Eight practicals from the list mentioned below.

1. To study the mechanical properties of engineering materials.
2. To conduct a tension test on metallic specimens for determining yield strength and modulus of elasticity.
3. To perform a compression test on materials to evaluate compressive strength.
4. To determine shear strength of metals.
5. To assess impact strength of metals using Izod/Charpy test.
6. To measure hardness of metals using standard hardness testing methods.
7. To analyze torsional behavior of metallic shafts by torsion testing.
8. To determine deflection of beams under applied loads.
9. To evaluate modulus of rupture for brittle material strength assessment.
10. To examine load–deflection characteristics of springs for stiffness evaluation.

**E-Resources:**

1. Strength of Materials – Prof. S. K. Bhattacharyya, IIT Kharagpur https://nptel.ac.in/courses/105105108
2. Virtual Lab: https://www.vlab.co.in

**Mapping of COs with POs**

| CO | PO | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **1** | **2** | **3** |
| 3ME208PC1.1 | 3 | 2 | 1 | 1 | 1 | - | - | - | 1 | 1 | - | 2 | 2 | - |
| 3ME208PC1.2 | 3 | 3 | 2 | 3 | 2 | - | - | - | 2 | 2 | 1 | 2 | 3 | 2 |
| 3ME208PC1.3 | 2 | 2 | 1 | 2 | 2 | 2 | 1 | 3 | 3 | 3 | 2 | 1 | 2 | 2 |
| 3ME208PC1 | 3 | 2 | 1 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 1 | 2 | 3 | 2 |

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

| Level: **5** | Course Code: **3ME209EM1** | | Course Category: **EEM** | | |
|---|---|---|---|---|---|
| Course Name | **Entrepreneurship in Mechanical Engineering** | | | | |
| Credits | **02** | Total L:T:P etc. Hours | 2:0:0 **30 Hrs** | Total SL Hours | **30 Hrs** |
| Total Credit Hours | **60 Hrs** | | | | |
| SEE Marks | -- | SEE Time | -- | CIA Marks | -- |
| EE Marks | -- | PA Marks | **50** | Total Marks | **50** |

**Course Description:**
Subject Code 3ME209EM1Entrepreneurship in Mechanical Engineering is a compulsory course for Second Year B. Tech in Mechanical Engineering program.

**Course Objectives:**
The objective of the course is to introduce the concept of entrepreneurship in the context of mechanical engineering and develop the ability to identify, plan, and manage engineering-based ventures.

**Course Outcomes:**
After completing the course students will be able to:

| CO | Course Outcome | Domain Level |
|---|---|---|
| 3ME209EM1.1 | Discuss entrepreneurial fundamentals and innovation process in Mechanical Engineering to develop creativity. | C-2 |
| 3ME209EM1.2 | Apply business planning with engineering management skills to understand marketing strategies for engineering products. | C-3 |
| 3ME209EM1.3 | Analyze financial, legal, environmental, and technological trends shaping Mechanical entrepreneurship to do Cost estimation, pricing, and break-even analysis. | C-4 |

**Course Contents:**

| | | |
|---|---|---|
| Unit 1 | **Introduction to Entrepreneurship & Innovation:** Concept and definition of entrepreneurship. Role of entrepreneurs in economic and industrial development. Characteristics and types of entrepreneurs. Creativity, innovation, and idea generation in mechanical engineering. Feasibility analysis and opportunity identification. Case studies of successful mechanical start-ups and innovations. | 10 Hrs |

| | | |
|---|---|---|
| Unit 2 | **Business Planning & Management in Engineering Ventures:** Steps in starting a new enterprise. Project identification and selection process. Preparation of project report/business plan. Feasibility analysis (technical, financial, market). Basics of management: planning, organizing, staffing, directing, and controlling. Leadership, team building, and marketing strategies for engineering products. Intellectual Property Rights (patents, trademarks, designs). | 11 Hrs |
| Unit 3 | **Financial, Legal & Support Systems for Entrepreneurs:** Sources of finance: government, venture capital, angel investors, crowdfunding. Cost estimation, pricing, and break-even analysis. Legal requirements for establishing an enterprise. Government schemes and institutional support (MSME, DIC, Startup India, etc.). Environmental and ethical issues in entrepreneurship. Emerging trends: Industry 4.0, sustainable and green entrepreneurship. | 9 Hrs |

**Text Books:**

1. S.S. Khanka, Entrepreneurship Development, S. Chand & Co.
2. Robert D. Hisrich, Michael P. Peters, and Dean A. Shepherd, Entrepreneurship, McGrawHill.
3. Vasant Desai, Entrepreneurship Development and Project Management, Himalaya Publishing House.

**Reference Books:**

1. Peter F. Drucker, Innovation and Entrepreneurship, The Classic Drucker Collection.
2. Vasant Desai, Small Scale Industries and Entrepreneurship, Himalaya Publishing House.

**E-Resources:**

NPTEL/SWAYAM:

1. https://shorturl.at/nptel-entre
2. https://shorturl.at/swayam-entre

E-Book:

3. https://shorturl.at/ignou-entre
4. https://shorturl.at/epathshala

Central Government Website:

5. https://shorturl.at/startupindia
6. https://shorturl.at/aimindia

**Mapping of COs with POs & PSOs:**

| CO | PO | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 1 | 2 | 3 |
| 3ME209EM1.1 | 3 | - | - | - | - | 3 | 3 | - | - | - | 2 | - | 2 | - |
| 3ME209EM1.2 | 3 | - | - | - | - | 3 | 3 | - | - | - | 2 | - | - | - |
| 3ME209EM1.3 | 3 | - | - | - | - | 3 | 3 | - | - | - | 2 | - | - | - |
| 3ME209EM1 | 3 | - | - | - | - | 3 | 3 | - | - | - | 2 | - | 1 | - |

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

| Level: **5** | Course Code: | **3SH210VE1** | Course Category: | **VEC** |
|---|---|---|---|---|
| Course Name | **Constitutional Values and Fundamental Duties** | | | |
| Credits | **02** | Total L:T:P Hours | 2:0:0 **30 Hrs** | Total SL Hours | **30 Hrs** |
| Total Credit Hours | **60 Hrs** | | | |
| SEE Marks | -- | SEE Time | -- | CIA Marks | -- |
| EE Marks | | PA Marks | **50** | Total Marks | **50** |

**Course Description:**
Subject Code 3SH210VE1 Constitutional Values and Fundamental Duties is a compulsory Values enhancement Course for Second Year B. Tech.

**Course Objectives:**
The objective of the course is to introduce the Indian Constitution, its historical background, fundamental values, rights, and duties.

**Course Outcomes:**
After completing the course students will be able to:

| CO | Course Outcome | Domain Level |
|---|---|---|
| 3SH210VE1.1 | Explain the historical background, making, and significance of the Indian Constitution to Understand the Constitution, Preamble, and core values. | C2 |
| 3SH210VE1.2 | Interpret Fundamental Rights and Duties (Articles 12–35, 51A) to evaluate their implications through case studies in professional and civic life. | C3 |
| 3SH210VE1.3 | Apply constitutional principles to engineering ethics, sustainability concerns (Articles 48A, 51A(g)), and demonstrate social commitment, innovation, and inclusive growth as nation builders. | C3 |

**Course Contents:**

| | | |
|---|---|---|
| Unit 1 | **Introduction to the Constitution and Fundamental Values**:<br>Overview of the Indian Constitution – Historical background and making of the Constitution; Meaning of Constitution; Preamble – Meaning and significance. Core Constitutional Values – Justice (Social, Economic, Political); Liberty (thought, expression, belief, faith, worship); Equality (status and opportunity); Fraternity (dignity and unity of the nation). Relevance of constitutional values for professionals and citizens. | 10 Hrs |

| | | |
|---|---|---|
| Unit 2 | **Fundamental Rights and Duties**:<br>Fundamental Rights (Articles 12–35) – Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies. Fundamental Duties (Article 51-A) – Importance and implications; Role of youth and professionals in upholding duties. Case studies highlighting real-life significance of rights and duties. | 10 Hrs |
| Unit 3 | **Application of Constitutional Values in Engineering and Public Life**:<br>Ethical Responsibilities and Constitutional Alignment – Engineering ethics and public interest; Environment and sustainability as constitutional concern (Articles 48A, 51A(g)); Engineers as nation builders – Social commitment, innovation, and inclusive growth. | 10 Hrs |

**Text Books:**


1. Basu D. D., Introduction to the Constitution of India, LexisNexis Publication, New Delhi (Twenty-Third Edition).
2. Jain M. P., Constitution of India, LexisNexis Publication, New Delhi (Eighth Edition).
3. Laxmikanth M., Indian Polity, McGraw Hill Education, New Delhi (Sixth Edition).
4. Austin Granville, The Indian Constitution: Cornerstone of a Nation, Oxford University Press, New Delhi.
5. Shukla V. N., Constitution of India, Eastern Book Company, Lucknow (Twelfth Edition).
6. Government of India, Constitution of India (Bare Act), Government of India Publication, New Delhi.


**Reference Books:**


1. Subhash Kashyap, Our Constitution, National Book Trust, New Delhi.
2. Durga Das Basu, Shorter Constitution of India, LexisNexis Publication.
3. P. M. Bakshi, The Constitution of India, Universal Law Publishing.
4. J. N. Pandey, Constitutional Law of India, Central Law Agency.
5. Seervai H. M., Constitutional Law of India, N. M. Tripathi Pvt. Ltd. (Vols. I–III).
6. B. Shiva Rao, The Framing of India's Constitution: A Study, Indian Institute of Public Administration.
7. D. C. Wadhwa, Political Science and Constitutional Law, Eastern Book Company.
8. Madhav Khosla, The Indian Constitution: Oxford India Short Introductions, Oxford University Press.

**E Resources**:

1. NPTEL course on Constitutional Studies, Prof. Sudhir Krishnaswamy, National Law School of India University
2. Constitutional Values and Fundamental Duties (University of Delhi – aligned with NEP 2020, available via NPTEL/DU open learning) https://kmc.du.ac.in/kmcouter/collnews/download/40727448169063791359.pdf/LinkedContents/pdf/All/All

**Mapping of COs with POs & PSOs**

| CO | PO | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 1 | 2 | 3 |
| 3SH210VE1.1 | 3 | 2 | - | 1 | - | - | - | - | - | - | - | 1 | 2 | 1 |
| 3SH210VE1.2 | - | 3 | 2 | 2 | - | 2 | 3 | 3 | - | - | - | 1 | 2 | 1 |
| 3SH210VE1.3 | - | - | 3 | 3 | - | 2 | 3 | 2 | - | 2 | - | 1 | 2 | 2 |
| 3SH210VE1CO | 1 | 2 | 2 | 2 | - | 2 | 2 | 2 | - | 1 | - | 1 | 2 | 2 |

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

| Level: | **5** | Course Code: | **3ME400FP1** | Course Category: | **FP** |
|---|---|---|---|---|---|
| Course Name | **Field Project** | | | | |
| Credits | **02** | Total L:T:P Hours | 0:0:4 **60 Hrs** | Total SL Hours | **--** |
| Total Credit Hours | **60 Hrs** | | | | |
| SEE Marks | **--** | SEE Time | **--** | CIA Marks | **--** |
| EE Marks | **25** | PA Marks | **25** | Total Marks | **50** |

**Course Description:**
Subject Code 3ME400FP1Field Projectis a compulsory Experiential Learning Course for Second Year B. Tech Mechanical Engineering

**Course Objectives:**
The objective of this course is to provide students real-world exposure to industrial, community, or field environments relevant to mechanical engineering. Also to develop problem-solving, teamwork, and communication skills through hands-on project work.

**Course Outcomes:**
After completing the course students will be able to:

| CO | Course Outcome | Domain Level |
|---|---|---|
| 3ME400FP1.1 | Conduct field visits, collect relevant data, and analyze engineering problems to identify and define real-world problems related to mechanical or allied systems. | C-4, P-3 |
| 3ME400FP1.2 | Develop feasible technical solutions or improvement strategies for identified problems andPrepare a project report with proper documentation, analysis, and presentation. | C-5, C-6, P-4 |
| 3ME400FP1.3 | Demonstrate teamwork, professional ethics, and communication during project execution. | A-3 |

**Course Contents:**

| Module | Description | Hours |
|---|---|---|
| Module 1 | Orientation & Sensitization | 4 |
| Module 2 | Field Visit & Problem Identification | 24 |
| Module 3 | Problem–Solution Design & Implementation | 20 |
| Module 4 | Documentation, Presentation & Reflection | 12 |

**Note:**

1. Students must collaborate within their assigned practical batches. Each batch should be further divided into subgroups, with five students per subgroup, in accordance with the prescribed guidelines.
2. **Projects (Must select from the guidelines provided)**

1. Study of manufacturing processes in a local industry
2. Maintenance practices and condition monitoring
3. Energy audit and efficiency improvement in machines
4. Design and fabrication of simple mechanical systems (e.g., pedal pump, hydraulic jack, or solar dryer)
5. Reverse engineering and 3D modeling of mechanical parts
6. Lean manufacturing or productivity improvement study

**3. Suggested Mechanical Project Themes**

1. Development of low-cost agricultural implements
2. Water conservation or irrigation system design
3. Waste management or recycling system for local area
4. Design of ergonomic devices for physically challenged persons
5. Energy conservation awareness campaigns or devices
6. Renewable energy-based mechanical applications.

**4. Documentation /Project Report Format:**

The Documentation /Project Report shall contain the following sections:

1. Title Page
2. Certificate & Declaration
3. Abstract
4. Introduction (Community + Mechanical relevance)
5. Objectives
6. Literature Survey
7. Methodology (Survey + Technical)
8. Problem Identification
9. Proposed E&TC Solution
10. Implementation / Simulation
11. Results & Analysis
12. Community Feedback & Social Impact
13. Conclusion & Future Scope
14. References
15. Appendices (Photos, questionnaires, certification letter issued by the Gram Panchayat office)

**Course Plan:**

| Lecture No. | Module Title | Topic | Hours |
|---|---|---|---|
| 1 | **Module1: Orientation & Sensitization** | NEP 2020: Community Engagement & Role of Engineers, Ethics, Social Responsibility & SDGs for Civil Engineers, Overview of Rural & Urban Communication Infrastructure, Identification of Community Institutions (GP, School, Self Help Group (SHG), Health Centre), Field Safety, Team Formation, Area & Theme Allocation, Reorganization | 4 |
| 2 | **Module 2: Field Visits & Problem Identification** | Pre-Visit Study, Permissions &Planning | 24 |
| 3 | | Conduct field visits and survey to understand the working process of each elements. | |
| 4 | | Field Data Collection & Technical Observation | |
| 5 | | Problem Identification or scope for improvement | |
| 6 | **Module3: Engineering Problem–Solution Design & Implementation-** | Literature review & relevant data collection | 20 |
| 7 | | Analysis of Collected Field Data and Identification of Problems | |
| 8 | | Preparation alternative feasible solutions | |
| 9 | | Design and Develop solution, its cost estimation | |
| 10 | | Experimentation & analysis of solution | |
| 11 | | Evaluation of Feasibility and Expected Community Benefits | |
| 12 | | Implementation of solution | |
| 13 | **Module4: Documentation, Presentation & Reflection** | Data Analysis & Graphical Representation, Writing Methodology & Analysis Sections, Results, Discussion & Conclusion | 12 |
| 14 | | Project Report Structure & Guidelines, Report Finalization, Presentation Preparation | |
| 15 | | Evaluation and Viva | |

**Mapping of COs with POs & PSOs**

| CO | PO | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 1 | 2 | 3 |
| 3CE400FP1.1 | 3 | 3 | 2 | 3 | 2 | 1 | 1 | 2 | 2 | 2 | 3 | 2 | 2 | - |
| 3CE400FP1.2 | 3 | 2 | 3 | 3 | 3 | 1 | 2 | 1 | 2 | 3 | 3 | 1 | 2 | - |
| 3CE400FP1.3 | 1 | 1 | 2 | 1 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| 3CE400FP1CO | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 |

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

| Level: **5** | Course Code: **3AL001NC1** | | Course Category: **NC** | | |
|---|---|---|---|---|---|
| Course Name | **Disaster Management and Preparedness** | | | | |
| Credits | -- | Total L:T:P Hours | 2:0:0 **30 Hrs** | Total SL Hours | -- |
| Total Credit Hours | -- | | | | |
| SEE Marks | -- | SEE Time | -- | CIA Marks | -- |
| EE Marks | -- | PA Marks | -- | Total Marks | -- |

**Course Description:**
Subject Code 3CE001NC1 Disaster Management and Preparedness is a Compulsory Non-Credit course for Second Year B. Tech all disciplines.

**Course Objectives:**
The objective of this course is to provide students with a comprehensive understanding of disasters, their types, impacts, the complete disaster management cycle, and the roles of various agencies in Disaster Risk Reduction.

**Course Outcomes:**
After completing the course students will be able to:

| CO | Course Outcome | Domain Level |
|---|---|---|
| 3CE001NC1.1 | Identify the concepts of disaster, hazard, vulnerability and risk, and classify disasters to understand the basic nature, causes and profiles of disasters in India. | C-2 |
| 3CE001NC1.2 | Analyze the disaster management cycle for risk assessment, mitigation, preparedness, response, recovery, and international disaster management frameworks. | C-4 |
| 3CE001NC1.3 | Apply disaster management practices, including stakeholder roles, national policies, engineers' responsibilities, and preparedness measures for effective disaster risk reduction. | C-3 |

**Course Contents:**

| | | |
|---|---|---|
| Unit 1 | **Introduction to Disaster Management:**<br>Concepts and definitions – disaster, hazard, vulnerability, risk, severity, frequency, exposure, capacity, and impact; classification of disasters- Natural disasters: earthquakes, tsunami, landslides, mining, Hydro-Meteorological Disasters: floods, draught, cyclones, coastal erosion. Biological Disaster: epidemics, pest attacks, forest fire, Manmade disasters: Industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, vulnerability profile of India, ecological fragility; principles of disaster prevention and mitigation | 10 hrs |

| | | |
|---|---|---|
| Unit 2 | **Disaster Management Cycle and Framework:** Pre-Disaster – Risk Assessment and Analysis, Risk Mapping, zonation and Microzonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development. Awareness During Disaster – Evacuation, Disaster Communication, Search and Rescue, Emergency Operation Centre, Incident Command System, Relief and Rehabilitation. Post-disaster – Damage and Needs Assessment, Restoration of Critical Infrastructure, Early Recovery, Reconstruction and Redevelopment; IDNDR, Yokohama Strategy, Hyogo Framework of Action Phases of disaster management; vulnerability and capacity assessment, post-disaster environmental response | 12 hrs |
| Unit 3 | **Disaster Management practices:** Roles and responsibilities of government, community, local bodies, NGOs, and other stakeholders, National Policy on Disaster Management Act 2005 Mega Disasters of India and Lessons Learnt, Disaster Management practices at working and residential places. Key responsibility of engineers in disaster reduction techniques, medical preparedness aspect of disaster. | 8 hrs |

**Textbooks:**


1. Sharma, S. C. (2022). Disaster Management, Khanna Publication.
2. Subramanian, R. (2024). Disaster Management. Vikas Publication.


**Reference Books:**


1. Gaur, R. C. (2018). Environmental Engineering and Disaster Management. New Age International.
2. Pradeep Sahni, 2024, Disaster Risk Reduction in South Asia, Prentice Hall.
3. Mondal, D. (2022). Disaster Management. New Delhi: CBS Publishers & Distributors
4. Manual on natural disaster management in India, M C Gupta, NIDM, New Delhi
5. An overview on natural & man-made disasters and their reduction, R K Bhandani, CSIR, New Delhi
6. Natural Disaster Management Policy ,2009,GOI
7. H.N. Shrivastava& G.D. Gupta, Management of Natural Disasters in developing Countries, Daya Publishers , Delhi
8. S.L. Goyal, Encyclopedia of disaster Management, Vol I,II& III Disaster Managemnt Policy and administration, Deep & Deep, New Delhi,2006
9. Coppola D P, Introduction to International Disaster Management, Elsevier Science (B/H), London, 2007
10. Disaster Mitigation in Asia & Pacific, Asian Development Bank

**Course Assignments**

Internal Assessment at Institute level will be based on following assignments:

1) Study of Recent Disasters (at local, state and national level)
2) Preparation of Disaster Risk Management Plan of and Area or Sector
3) A Case study on Disaster Management

**E Recourses:**

1. https://onlinecourses.swayam2.ac.in/ntr25_ed61/preview

**Mapping of COs with POs & PSOs**

| CO | PO | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 1 | 2 | 3 |
| 3CE001NC1.1 | 3 | 2 | - | - | - | 3 | 2 | - | - | - | 3 | - | - | - |
| 3CE001NC1.2 | 3 | 3 | - | - | - | 3 | 3 | - | - | - | 3 | 2 | 2 | - |
| 3CE001NC1.3 | 3 | 3 | - | - | - | 3 | 3 | - | - | 3 | 3 | 1 | 2 | 2 |
| 3CE001NC1.CO | 3 | 3 | - | - | - | 3 | 3 | - | - | 1 | 3 | 1 | 2 | 1 |

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

| Level: **5** | Course Code: 3ME211DH1 | | Course Category: **DH** | | |
|---|---|---|---|---|---|
| Course Name | **Principles of Robotics** | | | | |
| Credits | **03** | Total L:T:P etc. Hours | 3:0:0 **45 Hrs** | Total SL Hours | **45 Hrs** |
| Total Credit Hours | **90 Hrs** | | | | |
| SEE Marks | **60** | SEE Time | **3 Hrs** | CIA Marks | **40** |
| EE Marks | **--** | PA Marks | **--** | Total Marks | **100** |

**Course Description:**
Subject Code 3ME211DH1Principles of Robotics is a for Double Minor / Double Minor / Course offered as Honours by department of Mechanical Engineering for Second Year B.Tech., for all Discipline.

**Course Objectives:**
The objective of the course is to introduce the fundamental concepts, terminology, and classifications of robots and robotic systems to develop an understanding of the kinematic and dynamic modeling of robotic manipulators.

| CO | Course Outcome | Domain Level |
|---|---|---|
| 3ME211DH1.1 | Explain the fundamentals, classification, and historical evolution of robotics along with various robot configurations and their performance parameters | C-2 |
| 3ME211DH1.2 | Identify and describe the structural elements of robots, including links, joints, end-effectors, actuators, and drive mechanisms used for different applications. | C-2 |
| 3ME211DH1.3 | Demonstrate understanding of various types of sensors, feedback devices, and signal conditioning techniques used for robot perception and control. | C-3 |
| 3ME211DH1.4 | Illustrate basic concepts of robot motion, degrees of freedom, workspace, trajectory planning, and simple motion control strategies for how to plan and control trajectories for precise and efficient task execution. | C-3 |
| 3ME211DH1.5 | Develop simple robot programs for basic industrial tasks such as pick-and-place, assembly, and welding using standard programming approaches and simulation tools.To gain practical skills in programming robots for common industrial tasks | C-4 |

| | | |
|---|---|---|
| 3ME211DH1.6 | Analyze different industrial and service applications of robotics and discuss emerging trends such as AI, IoT, collaborative robots, and ethical issues in robotic automation. | C-5 |

**Course Contents:**

| | | |
|---|---|---|
| Unit 1 | **Introduction to Robotics:** Definition and scope of robotics, History and evolution of robots, Basic components of a robot – structure, actuators, sensors, controller, power supply, Types of robots and their configurations (Cartesian, cylindrical, SCARA, articulated), Robot specifications and performance parameters, Areas of application – manufacturing, service, agriculture, medical, and defense | 8 Hrs |
| Unit 2 | **Robot Structure and Components:** Links and joints – revolute, prismatic, and other types, End effectors – grippers, tools, and their selection, Common materials used for robot construction, Drives and power transmission systems – belt, gear, and chain drives, Overview of actuators and basic working principles – electric, pneumatic, and hydraulic systems | 8 Hrs |
| Unit 3 | **Sensors and Feedback Devices:** Role of sensors in robotics, Internal sensors: position, speed, and current sensors, External sensors: proximity, force, temperature, and vision sensors, Simple signal conditioning and data acquisition, Feedback systems and introduction to closed-loop control | 7 Hrs |
| Unit 4 | **Basics of Robot Motion and Control:** Concept of degrees of freedom, Robot motion terminology: workspace, path, and trajectory, Simple joint and Cartesian motion, Introduction to kinematics (concept only, without derivation) Basic motion control strategies – open-loop and closed-loop, Introduction to path control and trajectory planning (conceptual overview) | 7 Hrs |
| Unit 5 | **Robot Programming and Simulation:** Introduction to robot programming – online and offline methods, Simple programming examples for pick-and-place, assembly, and welding tasks, Overview of standard robot programming languages | 7 Hrs |

| | | |
|---|---|---|
| Unit 6 | **Robotics Applications and Future Trends:** Industrial applications – material handling, welding, assembly, and inspection, Robots in healthcare, defense, agriculture, and domestic service, Introduction to collaborative robots (cobots), Mobile robots and autonomous vehicles – basic concepts, Emerging trends: AI in robotics, Industry 4.0, IoT and robotic automation, Ethical and social issues in robotics | 8 Hrs |

**Text Books:**

1. S. K. Saha, Introduction to Robotics, Tata McGraw-Hill.
2. Mikell P. Groover, Industrial Robotics: Technology, Programming, and Applications, McGraw-Hill.
3. John J. Craig, Introduction to Robotics: Mechanics and Control, Pearson Education.

**Reference Books:**

1. Mikell P. Groover, Industrial Robotics: Technology, Programming, and Applications, McGraw-Hill.
2. Robert J. Schilling, Fundamentals of Robotics: Analysis and Control, PHI.
3. Peter Corke, Robotics, Vision and Control, Springer.

**E-Resources:**

6. https://github.com/correll/Introduction-to-Autonomous-Robots
7. https://ocw.mit.edu/courses/mechanical-engineering/2-12-introduction-to-robotics-fall-2005

**Course Outcomes:**

After completing the course students will be able to:

**Mapping of COs with POs**

| CO | PO | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 1 | 2 | 3 |
| 3ME211DH1.1 | 3 | 2 | 1 | - | - | - | - | - | - | - | 1 | 1 | - | - |
| 3ME211DH1.2 | 3 | 2 | 2 | 1 | 1 | - | - | - | - | - | 1 | 1 | 1 | - |
| 3ME211DH1.3 | 2 | 2 | 2 | 2 | 3 | - | - | - | - | - | 1 | - | 1 | 1 |
| 3ME211DH1.4 | 2 | 3 | 2 | 3 | - | - | - | - | - | - | 1 | - | 1 | - |
| 3ME211DH1.5 | 2 | 3 | 3 | 2 | 3 | - | 2 | 2 | 2 | 2 | 1 | - | 1 | - |
| 3ME211DH1.6 | 2 | 2 | 2 | - | 3 | 3 | 2 | 3 | 2 | 2 | 1 | - | 1 | - |
| 3ME211DH1 | 3 | 3 | 2 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 1 | 1 | 1 | 1 |

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

| Level: **5** | Course Code: 3ME211DH2 | | Course Category: **DH** | | |
|---|---|---|---|---|---|
| Course Name | **Energy Resource, Environment and Economics** | | | | |
| Credits | **03** | Total L:T:P etc. Hours | 3:0:0 **45 Hrs** | Total SL Hours | **45 Hrs** |
| Total Credit Hours | **90 Hrs** | | | | |
| SEE Marks | **60** | SEE Time | **3 Hrs** | CIA Marks | **40** |
| EE Marks | **--** | PA Marks | **--** | Total Marks | **100** |

**Course Description:**
Subject Code 3ME211DH2EnergyResource, Environment and Economics is a for Double Minor / Double Minor / Course offered as Honours by department of Mechanical Engineering for Second Year B.Tech., for all Discipline.

**Course Objectives:**
The objective of the course is to understand various conventional and renewable energy resources, their technologies, and patterns of energy utilization and apply economic principles to evaluate energy systems, including cost analysis, feasibility, and energy policy considerations.

| CO | Course Outcome | Domain Level |
|---|---|---|
| 3ME211DH2.1 | Explain the classification of energy resources, energy systems, energy demand–supply dynamics, and energy planning concepts. | C-2 |
| 3ME211DH2.2 | Describe the working principles, advantages, limitations, and challenges of conventional energy systems such as thermal, hydro, and nuclear power plants. | C-2 |
| 3ME211DH2.3 | Analyze renewable and emerging energy technologies for sustainable energy applications. | C-4 |
| 3ME211DH2.4 | Evaluate environmental impacts of energy systems using sustainability concepts and life-cycle assessment (LCA). | C-5 |
| 3ME211DH2.5 | Apply engineering economic principles to perform cost analysis, life-cycle costing, and economic comparison of energy projects. | C-3 |
| 3ME211DH2.6 | Assess energy policies, management strategies, and future energy transitions for sustainable development. | C-5 |

**Course Contents:**

| | | |
|---|---|---|
| Unit 1 | **Introduction to Energy Systems and Resources:** Classification of energy resources: Conventional & non-conventional Global and national energy scenario & consumption patterns. Primary, secondary, commercial, and non-commercial energy. Energy units, conversions, and energy chains. Basics of energy demand–supply and sector-wise distribution. Energy planning and integrated resource planning. | 8 Hrs |
| Unit 2 | **Conventional Energy Resources:** Coal, petroleum, and natural gas: origin, extraction, utilization. Thermal power plants: working principles, efficiency, emissions. Hydropower: site selection, types, advantages and limitations. Nuclear energy: fission, fusion, reactors, safety, waste disposal. Issues with fossil fuels: depletion, pollution, energy security. | 8 Hrs |
| Unit 3 | **Renewable and Emerging Energy Resources:** Solar energy: photovoltaic and thermal systems, applications. Wind energy: site selection, turbine basics, performance. Biomass and biofuels: conversion technologies and applications. Geothermal, tidal, wave and ocean thermal energy. Hydrogen economy and fuel cells – potential and challenges. Hybrid and integrated renewable systems. | 7 Hrs |
| Unit 4 | **Energy, Environment, and Sustainability:** Environmental impacts of energy production and consumption. Air, water, and soil pollution from energy systems. Climate change, greenhouse gases, and global warming. Life-cycle assessment (LCA) of energy systems. Sustainable energy development and low-carbon technologies. Environmental regulations, policies, and international agreements (e.g., COP, Kyoto, Paris). | 7 Hrs |
| Unit 5 | **Energy Economics and Costing:** Basics of engineering economics applied to energy systems. Time value of money, cost–benefit analysis, payback period. Life-cycle cost (LCC) and levelized cost of energy (LCOE). Fuel cost, operation & maintenance cost estimation. Externalities and social cost of energy. Economic comparison of conventional vs renewable projects. | 7 Hrs |
| Unit 6 | **Energy Planning, Policy, and Future Trends:** National and international energy policies and strategies. Energy pricing, subsidies, taxation, and incentives. Energy audits and management for industries and buildings. Demand-side management (DSM) and integrated energy planning. Smart grids, distributed generation, and prosumer models. Future energy transitions and sustainable development goals (SDGs). | 8 Hrs |

**Text Books:**

1. Subhes C. Bhattacharyya, Energy Economics: Concepts, Issues, Markets and Governance, Springer London.
2. Tom Tietenberg & Lynne Lewis, Environmental and Natural Resource Economics, 12th Edition, Routledge, 2024.
3. Peter M. Schwarz, Energy Economics, 2nd Edition, Routledge (Taylor & Francis Group), published 2022/2023.

**Reference Books:**

1. Narendra N. Dalei & Anshuman Gupta, Economics and Policy of Energy and Environmental Sustainability, 1st Edition, Springer Singapore, 2022.
2. Jonathan M. Harris & Brian Roach, Environmental and Natural Resource Economics, 6th Edition, Routledge, 2026.
3. Tom Tietenberg & Lynne Lewis, Natural Resource Economics, 2nd Edition, Routledge, 2025.

**E-Resources:**

1. https://archive.nptel.ac.in/courses/109/101/109101171/.
2. https://www.nptelprep.in/courses/109101171/materials

**Course Outcomes:**

After completing the course students will be able to:

**Mapping of COs with POs**

| CO | PO | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 1 | 2 | 3 |
| 3ME211DH2.1 | 3 | 2 | - | - | - | 1 | 2 | - | - | - | 1 | 1 | - | - |
| 3ME211DH2.2 | 3 | 2 | 1 | - | - | 1 | 2 | - | - | - | 1 | 1 | 1 | - |
| 3ME211DH2.3 | 3 | 3 | 2 | - | 2 | 2 | 3 | - | - | - | 1 | - | 1 | - |
| 3ME211DH2.4 | 2 | 2 | 1 | - | 2 | 2 | 3 | - | - | - | 1 | - | 1 | - |
| 3ME211DH2.5 | 2 | 2 | 2 | - | - | 1 | 2 | 2 | - | 3 | 1 | - | 1 | - |
| 3ME211DH2.6 | 2 | 2 | 1 | - | - | 2 | 2 | 3 | - | 2 | 1 | - | 1 | - |
| 3ME211DH2 | 2 | 2 | 1 | - | 1 | 2 | 2 | 1 | - | 1 | 1 | 1 | 1 | - |

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

| Level: **5** | Course Code: **4ME212PC1** | | Course Category: **PCC** | | |
|---|---|---|---|---|---|
| Course Name | **Manufacturing Processes** | | | | |
| Credits | **03** | Total L:T:P etc. Hours | 3:0:0 **45 Hrs** | Total SL Hours | **45 Hrs** |
| Total Credit Hours | **90 Hrs** | | | | |
| SEE Marks | **60** | SEE Time | **3 Hrs** | CIA Marks | **40** |
| EE Marks | **--** | PA Marks | **--** | Total Marks | **100** |

**Course Description:**
Subject Code 4ME212PC1Manufacturing Processesis a Program Core Course offered to Second Year B.Tech Mechanical Engineering Program.

**Course Objectives:**
The objective of the course is to introduce fundamental manufacturing concepts and to impart knowledge of materials and various manufacturing processes.

**Course Outcomes:**
After completing the course students will be able to:

| CO | Course Outcome | Domain Level |
|---|---|---|
| 4ME212PC1.1 | Describe the principles and operations of casting processes, including pattern making, moulding, melting furnaces, and defect analysis for understanding the principles and operational steps of casting. | C-2 |
| 4ME212PC1.2 | Explain the principles, operations, and applications of various welding and joining processes along with their defects and inspection methodsfor understanding the principles, operations, applications, of various welding and joining processes. | C-2 |
| 4ME212PC1.3 | Understand the principles and applications of hot and cold working processes and various metal forming operations for understanding various metal forming operations used in manufacturing. | C-2 |
| 4ME212PC1.4 | Identify the mechanics of metal cutting, tool geometry, and lathe operations involved in various machining processes for understanding mechanics of metal cutting & tool geometry. | C-2 |
| 4ME212PC1.5 | Discuss the construction, working, and applications of drilling, milling, grinding, and finishing processes used in manufacturing for understanding the construction and working principles of different machines. | C-2 |

| | | |
|---|---|---|
| 4ME212PC1.6 | Understand the principles, processes, and applications of additive manufacturing technologies such as FDM, SLA, and SLS for understanding the principles and applications of additive manufacturing. | C-2 |

**Course Contents:**

| | | |
|---|---|---|
| Unit 1 | **Introduction to Casting processes:**<br>Introduction to pattern making, types of patterns, pattern materials, pattern allowances, core print, core box, moulding sands & their properties, types of moulding, gating system. Melting furnaces, cupola, electric arc furnace, induction furnace. Casting processes & their principle of operation, permanent mould casting, die casting, centrifugal casting, investment casting. Casting defects. | 7 Hrs |
| Unit 2 | **Joining processes:**<br>Mechanical joining processes, Mechanical fastening, riveting, soldering, brazing.<br>Different types of welding processes, principle and working: Weldability, Arc welding, Submerged arc welding, Resistance welding Forge welding, Plasma arc, Heat generation of resistance welding processes such as spot welding, projection welding, butt welding.<br>Gas welding principle and working: Oxy-acetylene welding, Tungsten Inert Gas (TIG) & Metal Inert Gas (MIG) welding.<br>Special Welding Processes: Friction welding, Ultrasonic welding, Electron Beam, Laser Beam welding, Thermit welding and welding defects. | 8 Hrs |
| Unit 3 | **Mechanical Working of Metals:**<br>Principle of hot and cold working process and its types, Extrusion, piercing, pipe and tube production, manufacture of seamless pipe. Shearing operations, tube drawing, wire drawing, spinning, embossing and coining, squeezing and bending operations, rotary swaging, forging and drawing, rolling and types of rolling mills. | 7 Hrs |
| Unit 4 | **Theory of metal cutting:**<br>Mechanics of metal cutting, chip formation process, tool material, classification of tools, Single point cutting tool geometry, tool life, tool failure, Construction and working principle and accessories of lathe machine, lathe operations like- turning, facing, thread cutting, knurling, taper turning and its methods. Introduction to CNC lathe machine. | 7 Hrs |

| | | |
|---|---|---|
| Unit 5 | **Milling, Drilling & Grinding:**<br>Milling machines: types of milling, types of milling cutters, types of indexing. Introduction to CNC milling machine.<br>Construction & working of drilling machine, types of drilling machine. Introduction to boring, broaching and reaming operations. Grinding operation and wheel selection.<br>Honing, lapping, super finishing, buffing & burnishing processes. | 9 Hrs |
| Unit 6 | **Additive Manufacturing:**<br>Introduction to Additive Manufacturing: Concept of Rapid Prototyping, Definition and concept of Additive Manufacturing (AM), Comparison between additive, subtractive, and formative manufacturing, Advantages, limitations, and applications of AM.<br>Classification and Overview of AM Processes, Additive Manufacturing Process Steps.<br>Principle, working, materials used, advantages, and limitations of Fused Deposition Modeling (FDM), Stereolithography (SLA), Selective Laser Sintering (SLS). | 7 Hrs |

**Textbooks:**


1. Chapman W. A., Workshop Technology, Vol. II, III and I, Edward Arnold Pub. Ltd. London.
2. Hajra Chaudhary S. K., Elements of workshop technology Vol. I & II, Media Prom & pub, Mumbai.
3. P. N. Rao, Manufacturing technology Vol. II McGraw Hill 1998


**Reference books:**


1. Workshop Technology, O.P Khanna, Dhanpatrai& sons.
2. Workshop Technology Vol. II, B. S. Raghuvanshi.


**E-Resources:**

1. https://link.springer.com/book/10.1007/978-3-030-21066-3
2. https://www.sciencedirect.com/book/9780080523958/manufacturing-engineers-reference-book?utm_source=chatgpt.com
3. https://openlibrary.org/subjects/manufacturing_processes?utm_source=chatgpt.com
4. https://welib.org/md5/83c3bfdbf1e9a60ce30a7c8f8cdca36e?utm_source=chatgpt.com
5. https://www.kopykitab.com/Manufacturing-Processes-Second-Edition-Vol-I-by-PUBLIC-DOMAIN?utm_source=chatgpt.com

**Mapping of COs with POs**

| CO | PO | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **1** | **2** | **3** |
| 4ME212PC1.1 | 3 | 2 | 2 | 1 | 2 | - | - | - | 1 | 1 | - | 2 | 1 | - |
| 4ME212PC1.2 | 3 | 2 | 2 | 2 | 1 | - | - | - | - | 1 | - | 2 | 2 | - |
| 4ME212PC1.3 | 3 | 2 | 2 | 1 | 1 | - | - | - | 1 | 1 | - | 2 | 1 | - |
| 4ME212PC1.4 | 3 | 2 | 2 | 1 | 1 | - | - | - | 1 | - | - | 2 | 1 | - |
| 4ME212PC1.5 | 3 | 2 | 2 | 1 | 1 | - | - | - | 1 | 1 | - | 2 | 1 | - |
| 4ME212PC1.6 | 3 | 2 | 3 | 2 | 3 | - | 1 | - | 1 | 1 | - | 3 | 2 | 1 |

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

| Level: **5** | Course Code: **4ME213PC1** | | Course Category: **PCC** | | |
|---|---|---|---|---|---|
| Course Name | **Material Science and Nano Technology** | | | | |
| Credits | **02** | Total L:T:P etc. Hours | 2:0:0 **30 Hrs** | Total SL Hours | **30 Hrs** |
| Total Credit Hours | **60 Hrs** | | | | |
| SEE Marks | **60** | SEE Time | **3 Hrs** | CIA Marks | **40** |
| EE Marks | **--** | PA Marks | **--** | Total Marks | **100** |

**Course Description:**
Subject Code 4ME213PC1Material Science and Nano Technology is a compulsory Program Core Course for Second Year B.Tech. Mechanical Engineering Program.

**Course Objectives:**
The objective of this course is to provide students with a comprehensive understanding of the structure, properties, and behavior of various engineering materials, and to introduce the fundamental concepts of nano-materials and nano-technology.

**Course Outcomes:**
After completing the course students will be able to:

| CO | Course Outcome | Domain Level |
|---|---|---|
| 4ME213PC1.1 | Explain the basic principles of process, physical, and mechanical metallurgy, and relate the structure and composition of metals and alloys to understand their properties using phase relationships and the lever rule. | **C2** |
| 4ME213PC1.2 | Interpret binary phase diagrams and the iron–carbon equilibrium diagram, identify critical temperatures and invariant reactions, and explain the advantages and applications of composite materials for effective material selection. | **C4** |
| 4ME213PC1.3 | Explain the purpose of alloying, classify alloy steels, and assess the effect of alloying elements on steel properties and to understand their engineering applications | **C2** |
| 4ME213PC1.4 | Compare the constitution, properties, and applications of cast irons and common non-ferrous alloys such as brass, bronze, and aluminium alloys for appropriate material selection. | **C2** |

| | | |
|---|---|---|
| 4ME213PC1.5 | Explain metal-working processes including hot and cold working, work hardening, strain ageing, recovery, recrystallization, and grain growth, and assess their impact on microstructure and mechanical properties. | **C3** |
| 4ME213PC1.6 | Describe the applications of powder metallurgy and explain the fundamentals, properties, applications, and environmental and health aspects of nanotechnology and nanomaterials. | **C2** |

**Course Contents:**

| | | |
|---|---|---|
| Unit 1 | **Introduction to Metallurgy:**<br>Introduction to metallurgy: Basic concept of process metallurgy, physical metallurgy, and mechanical metallurgy, Classification of materials & their application, Structure of metals and alloys, formation of Alloys, Solid solutions, types and their formation, Lever rule for phase mixtures. | 5 Hrs |
| Unit 2 | **Study of Binary Phase Diagrams, Iron–Carbon System and Introduction to Composite Materials:**<br>Study of binary equilibrium diagram and invariant reactions, Construction and study of Iron-carbon Equilibrium Diagram, Critical temperatures, Introduction to composite materials, advantages and applications. | 5 Hrs |
| Unit 3 | **Alloy Steels:**<br>Purpose of alloying, Classification of alloy steels, classification of alloying elements, Alloying elements and their effect on properties of steels, properties and applications of OHNS steels, Hadfield's Manganese steels, High speed steels,Ferritic, Austenitic and Martensitic stainless steels. | 5 Hrs |
| Unit 4 | **Cast iron and Non-Ferrous Metals& Alloys:**<br>Constitution and properties of White, Gray, Nodular and Malleable cast irons; and their applications.<br>Non-ferrous metals and alloys: Properties, Composition and applications of Cartridge Brass, Admiralty Brass, Muntz Metal, Phosphor Bronze, Aluminium Bronze, Aluminium Alloy -Duralumin. Season Cracking. | 5 Hrs |
| Unit 5 | **Mechanical working of Metals and Powder Metallurgy:**<br>Hot and cold working, Relative advantages and disadvantages, Work hardening, Strain Ageing; Recovery, Recrystallization and grain growth.<br>**Powder Metallurgy:** Concept, Advantages, limitations and applications of Powder Metallurgy. | 5 Hrs |

| | | |
|---|---|---|
| Unit 6 | **Introduction to Nanotechnology:** Definition, scope, and importance of nanotechnology. Environmental and health issues in nanotechnology. Introduction, Properties, Applications of Nano materials. Future Perspectives of Nanomaterials. | 5 Hrs |

**Text Books:**


1. Sidney H Avner, Introduction to physical metallurgy, TATA Mc-Graw hill
2. R.K.Rajput, Engineering materials & metallurgy, S Chand Publication.
3. V.D. Kodgire, Material Science & Metallurgy, Everest Publication House.
4. C. N. R. Rao, Achim Müller, A. K. Cheetham, The Chemistry of Nanomaterials: Synthesis, Properties and Applications, Publisher: Wiley-VCH
5. T. Pradeep, *A Textbook of Nanoscience and Nanotechnology*, McGraw Hill.


**Reference Books:**


1. G. E. Dieter, Mechanical Metallurgy, G. E. Dieter, Mc- Graw Hill International, London 3rd Edn. 1999
2. Clarke and Varney, Physical metallurgy for engineers, Second Edn.,1987.
3. A.K Sinha, Power metallurgy, Dhanpat Rai & Sons.
4. Y Lakhtin, Engineering physical Metallurgy, Mir Publications. Second Ed. 1999
5. C. Daniel Yesudian,Materials Science and Metallurgy.Scitech Publication (India) Pvt. Ltd.
6. Dinesh C. Agrawal, Introduction to Nanomaterials, Oxford University Press


**E-Resources:**

1. http://www.digimat.in/nptel/courses/video/113104068/L26.htmlto L60.html
2. http://kcl.digimat.in/nptel/courses/video/112104195/lec12.pdf
3. https://www.coursera.org/specializations/materials-science-for-technological-application
4. http://kcl.digimat.in/nptel/courses/video/112107145/lec1.pdf
5. https://www.coursera.org/learn/introduction-to-materials-science
6. https://www.coursera.org/learn/nanotechnology

**Mapping of COs with POs**

| CO | PO | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **1** | **2** | **3** |
| 4ME213PC1.1 | 3 | 2 | 1 | - | - | - | - | - | - | 1 | - | 1 | 2 | 1 |
| 4ME213PC1.2 | 3 | 3 | 2 | 1 | - | - | - | - | - | 1 | - | 1 | 3 | 1 |
| 4ME213PC1.3 | 3 | 2 | 2 | - | - | - | - | - | - | 1 | - | 1 | 3 | 1 |
| 4ME213PC1.4 | 3 | 2 | 2 | - | - | - | - | - | - | 1 | - | 1 | 3 | 1 |
| 4ME213PC1.5 | 3 | 3 | 3 | 2 | 1 | - | - | - | - | - | - | 1 | 3 | 1 |
| 4ME213PC1.6 | 3 | 2 | 1 | - | - | 2 | - | - | - | - | - | 1 | 2 | 3 |
| 4ME213PC1 | 3 | 2 | 2 | 2 | 2 | 1 | - | - | - | 1 | - | 1 | 3 | 2 |

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

| Level: **5** | Course Code: **4ME214PC1** | | Course Category: **PCC** | | |
|---|---|---|---|---|---|
| Course Name | **Hydraulic and Pneumatic Systems** | | | | |
| Credits | **02** | Total L:T:P etc. Hours | 2:0:0 **30 Hrs** | Total SL Hours | **30 Hrs** |
| Total Credit Hours | **60 Hrs** | | | | |
| SEE Marks | **60** | SEE Time | **3 Hrs** | CIA Marks | **40** |
| EE Marks | **--** | PA Marks | **--** | Total Marks | **100** |

**Course Description:**
Subject Code4ME214PC1Hydraulic and Pneumatic Systems is a compulsory Program Core Course for Second Year B.Tech. Mechanical Engineering Program.

**Course Objectives:**
The objective of this course is to provide fundamental knowledge of hydroelectric power plants and hydraulic machines—including turbines and pumps—along with an understanding of their working principles, performance characteristics, and the behaviour of compressible fluid flow.

**Course Outcomes:**
After completing the course students will be able to:

| CO | Course Outcome | Domain Level |
|---|---|---|
| 4ME214PC1.1 | To enable students to understand the working principles, classification, and basic operation of prime movers and hydraulic turbines used for energy conversion in mechanical systems. | C-2 |
| 4ME214PC1.2 | To develop students' ability to analyze, design, and evaluate the performance characteristics of hydraulic turbines for efficient power generation and engineering applications. | C-4 |
| 4ME214PC1.3 | To help students understand the operating principles, classification, and applications of water lifting devices used in hydraulic and irrigation systems. | C-2 |
| 4ME214PC1.4 | To equip students with the capability to analyze, select, and apply centrifugal and reciprocating pumps for suitable industrial, municipal, and mechanical engineering applications. | C-4 |
| 4ME214PC1.5 | To enable students to understand and apply basic principles of compressible fluid flow, including flow through nozzles and pipes, relevant to pneumatic and gas flow systems. | C-3 |

| | | |
|---|---|---|
| 4ME214PC1.6 | To develop students' ability to integrate hydraulics and pneumatics concepts in problem-solving, design, and mini-projects addressing real-world mechanical engineering challenges. | C-6 |

**Course Contents:**

| | | |
|---|---|---|
| Unit 1 | **Hydraulic Turbines**:<br>Basic classification of Turbines, Theory of impulse and reaction turbines, Pelton wheel Turbinetheir construction, classification, analysis, characteristics. | 5 Hrs |
| Unit 2 | **Reaction Turbines**:<br>Theory of Francis and Kaplan turbines, their construction, classification, analysis, characteristics and governing, draft tube . | 5 Hrs |
| Unit 3 | **Axial flow pump**:<br>Basic theory, construction, & operation.<br>**Other water lifting devices**:<br>(a) Air lift pump. (b) Jet Pump. (c) Hydraulic Ram.<br>**Computational Fluid Dynamics (CFD):**<br>Introduction to CFD: Necessity, limitations, philosophy behind CFD, applications | 5 Hrs |
| Unit 4 | **Pumps**:<br>Centrifugal pumps Basic Theory, classification, construction, operation, characteristics, multistage, NPSH and cavitations in pumps, Reciprocating pump theory, Slip, Indicator diagram, Effect of acceleration, air vessels. Comparison of centrifugal and reciprocating pumps, performance characteristics | 5 Hrs |
| Unit 5 | **Hydraulics**:<br>Hydraulic accumulator, Hydraulic intensifier, Hydraulic Press, hydraulic crane, hydraulic lift, hydraulic coupling, hydraulic torque converter. | 5 Hrs |
| Unit 6 | **Introduction to Pneumatics**:<br>Definition of pneumatics, Comparison of pneumatic, hydraulic, and electric systems. Air Treatment Units-Air filtration, Air dryers, Air lubrication, Air Regulation, FRL unit symbol and working. | 5 Hrs |

**Text Books:**

1. CSP Ojha, R. Berndtsson, Fluid mechanics and machinery, Oxford University.
2. R.K.Bansal, Fluid mechanics and fluid machines, Laxmi publications.

**Reference Books:**

1. Jagdish Lal, Hydraulic machines, Metropolitan Book Co. Pvt. Ltd
2. Dr. Modi & Seth, Hydraulics and Fluid Mechanics, Standard house book.
3 Sen gupta, Computational fluid dynamics, Pearson Publishers.
4 Sameer sheikh, Iliyas Khan, Treaties on Hydraulics, Pneumatics, R.K. Publication.

**E-Resources:**

1. https://www.nptelprep.in/courses/112106300?utm
2. https://link.springer.com/book/10.1007/978-981-19-0855-2?utm
3. https://hydraulicsonline.com/technical-knowledge-hub/ebooks/?utm
4. https://onlinecourses.nptel.ac.in/noc25_me58/preview?utm
5. https://swayam.gov.in/nc_details/NPTEL?utm

**Mapping of COs with POs & PSOs**

| CO | PO | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 1 | 2 | 3 |
| 4ME214PC1.1 | 3 | 2 | 1 | - | - | 1 | - | - | - | - | - | 1 | - | - |
| 4ME214PC1.2 | 3 | 3 | 3 | 2 | 2 | 1 | - | - | - | - | - | 3 | 3 | - |
| 4ME214PC1.3 | 2 | 2 | 1 | - | 1 | 1 | - | - | - | - | - | 1 | - | - |
| 4ME214PC1.4 | 3 | 3 | 2 | 1 | 2 | 1 | - | - | - | - | - | 2 | 3 | - |
| 4ME214PC1.5 | 3 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | 2 | - | - |
| 4ME214PC1.6 | 3 | 2 | 3 | 2 | 3 | 1 | - | - | - | - | - | 3 | 3 | 3 |
| 4ME214PC1 | 3 | 3 | 2 | 1 | 2 | 1 | - | - | - | - | - | 2 | 2 | 1 |

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

| Level: **5** | Course Code: **4ME215MD1** | | Course Category: **MDM** | | |
|---|---|---|---|---|---|
| Course Name | **Green Power Technologies** | | | | |
| Credits | **02** | Total L:T:P etc. Hours | 2:0:0 **30Hrs** | Total SL Hours | **30Hrs** |
| Total Credit Hours | **60Hrs** | | | | |
| SEE Marks | **30** | SEE Time | **3Hrs** | CIA Marks | **20** |
| EE Marks | **--** | PA Marks | **--** | Total Marks | **50** |

**Course Description:**
Subject Code 4ME215MD1 Green Power Technologies is a Multidisciplinary Minor offered by Second Year B.Tech Mechanical Engineering program.

**Course Objectives:**
The objective of this course is to develop understanding of renewable and green energy systems, evaluate performance of different energy conversion technologies, and apply sustainable engineering principles for real-world applications and carbon-neutral solutions.
.

**Course Outcomes:**
After completing the course students will be able to:

| CO | Course Outcome | Domain Level |
|---|---|---|
| 4ME215MD1.1 | Explain green and renewable energy technologies to understand working principles of solar, wind, and biomass systems. | C2 |
| 4ME215MD1.2 | Evaluate renewable and emerging energy technologies to assess performance, efficiency, and environmental impact. | C4 |
| 4ME215MD1.3 | Apply energy storage and sustainability concepts to design efficient and eco-friendly power solutions. | C3 |

**Course Contents:**

| | | |
|---|---|---|
| Unit 1 | **Introduction to Green and Renewable Energy Technologies:** Concept of green power; global and Indian energy scenarios; classification and significance of renewable energy sources. Solar thermal and photovoltaic energy; collectors, characteristics, applications. Basics of wind energy and turbine performance. | 10 Hrs |
| Unit 2 | **Bioenergy, Waste-to-Energy, and Emerging Technologies:** Biomass, biogas, biodiesel production. Waste-to-energy methods: pyrolysis, gasification, incineration. Basics of geothermal, hydrogen energy, fuel cells, and ocean energy. | 10 Hrs |

| | | |
|---|---|---|
| Unit 3 | **Energy Storage, Smart Grids, and Sustainable Power Systems:** Batteries, thermal storage, pumped hydro. Smart grids, demand-side management, microgrids, EV integration. Environmental and economic assessment of renewable energy. | 10 Hrs |

**Text Books:**


7. Chetan Singh Solanki, Solar Photovoltaics: Fundamentals, Technologies and Applications, PHI Learning.
8. S. P. Sukhatme, Solar Energy: Principles of Thermal Collection and Storage, Tata McGraw Hill
9. B. H. Khan, Non-Conventional Energy Resources, Tata McGraw Hill


**Reference Books:**


1. Godfrey Boyle, Renewable Energy: Power for a Sustainable Future, Oxford University Press
2. S. N. Bhadra, D. Kastha, S. Banerjee, Wind Electric Systems, Oxford University Press
3. G. D. Rai, Non-Conventional Energy Sources, Khanna Publishers
4. Duffie&Beckman, Solar Engineering of Thermal Processes, Wiley
5. Ibrahim Dincer, Green Energy and Technology, Springer


**E-Resources:**

1. Renewable Energy Engineering: Solar, Wind and Biomass Energy Systems NPTEL, IIT: https://nptel.ac.in/courses/103103206?utm_source=chatgpt.com
2. IEI- International Energy Agency: https://www.iea.org
3. Ministry of New and Renewable Energy: https://mnre.gov.in

**Mapping of COs with POs**

| CO | PO | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **1** | **2** | **3** |
| 4ME215MD1.1 | 3 | 2 | 2 | 1 | - | - | 2 | 1 | - | 1 | - | 3 | 2 | 1 |
| 4ME215MD1.2 | 3 | 3 | 3 | 2 | 1 | 1 | 2 | 1 | - | 1 | - | 3 | 2 | 2 |
| 4ME215MD1.3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 1 | 2 | 1 | 2 | 3 | 3 |
| 4ME215MD1 | 3 | 3 | 3 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 3 | 3 | 2 |

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

| Level: **5** | Course Code: | | **4SH216OE1** | Course Category: | **OE** |
|---|---|---|---|---|---|
| Course Name | **Quantitative and Logical Reasoning** | | | | |
| Credits | **03** | Total L:T:P Hours | 3:0:0 **45 Hrs** | Total SL Hours | **45 Hrs** |
| Total Credit Hours | **90 Hrs** | | | | |
| SEE Marks | **60** | SEE Time | **3 Hrs** | CIA Marks | **40** |
| EE Marks | **--** | PA Marks | **--** | Total Marks | **100** |

**Course Description:**
Subject Code 4SH216OE1Quantitative and Logical Reasoning is a compulsory Open Elective Course for Second Year B. Tech All Branch Students.

**Course Objectives:**
The Objective of the Course is to develop quantitative aptitude, logical reasoning, problem-solving efficiency, and decision-making skills for placements, competitive exams, and real-life applications

**Course Outcomes:**
After completing the course students will be able to:

| CO | Course Outcome | Domain Level |
|---|---|---|
| 4SH216OE1.1 | Apply arithmetic and numerical techniques to solve quantitative problems accurately. | C-3 |
| 4SH216OE1.2 | Solve algebraic and equation-based problems using simplification and approximation methods to improve problem-solving efficiency. | C-3 |
| 4SH216OE1.3 | Analyze logical reasoning problems using structured and critical thinking approaches to improve decision-making skills. | C-4 |
| 4SH216OE1.4 | Interpret and analyze data using graphical and tabular methods for decision making for strategic planning. | C-4 |
| 4SH216OE1.5 | Solve complex logical puzzles and advanced reasoning problems efficiently for competitive examination success. | C-3 |
| 4SH216OE1.6 | Demonstrate effective aptitude test strategies integrating quantitative and logical reasoning skills for career advancement opportunities. | C-3 |

**Course Contents:**

| | | |
|---|---|---|
| Unit 1 | **Number System & Arithmetic Foundations:** Number system fundamentals; LCM and HCF applications; divisibility rules; percentage calculations; ratio and proportion; averages; profit and loss; simple and compound interest; speed mathematics and shortcut techniques. | 7Hrs |
| Unit 2 | **Algebra, Equations & Simplification Techniques:** Linear and quadratic equations; algebraic expressions; | 7 Hrs |

| | | |
|---|---|---|
| | simplification and approximation; indices and surds; inequalities; time and work; pipes and cisterns; time, speed and distance; mixtures and alligation. | |
| Unit 3 | **Logical Reasoning: Analytical & Critical Thinking:** Coding–decoding; blood relations; direction sense; series and pattern recognition; analogies; ranking and ordering; syllogisms; statement and assumption; statement and conclusion; cause–effect reasoning. | 7 Hrs |
| Unit 4 | **Data Interpretation & Analytical Aptitude:** Tables; pie charts; line graphs; bar graphs; caselets; data sufficiency; DI shortcut techniques; approximation in data interpretation; comparative and predictive data analysis. | 8Hrs |
| Unit 5 | **Advanced Logical Reasoning & Puzzle Solving:**Seating arrangements (linear, circular, and complex); floor-based puzzles; scheduling puzzles; selection-based puzzles; Venn diagrams; logical grouping; critical reasoning frameworks | 8 Hrs |
| Unit 6 | **Placement Aptitude Mastery & Test Strategies:** Integrated quantitative and logical reasoning practice; decision-making and elimination strategies; speed improvement techniques; mock placement aptitude patterns (TCS, Infosys, Wipro, Accenture, Capgemini); common error analysis; test-taking strategies; aptitude and reasoning simulations. | 8 Hrs |

**Text Books:**

1. R. S. Aggarwal, Quantitative Aptitude for Competitive Examinations, S. Chand Publishing
2. Arun Sharma, Logical Reasoning and Data Interpretation, McGraw Hill

**Reference Books:**

1Arun Sharma, How to Prepare for Quantitative Aptitude,published by McGraw Hill Education.
2. R.S. Aggarwal, A Modern Approach to Logical Reasoning, published by S. Chand Publishing
3. M.K. Pandey, Analytical Reasoning, published by BSC Publishing Co. Pvt. Ltd.
4. Rajesh Verma, Fast Track Objective Arithmetic, published by Arihant Publications

**E Resources**:

1. NPTEL – Quantitative Aptitude & Logical Reasoning Courses
2. IndiaBIX – Quantitative and Logical Reasoning Practice
3. CareerRide – Aptitude Preparation Modules
4. PrepInsta / HackerEarth – Placement Aptitude Practice Platforms

**Mapping of COs with POs & PSO**

| CO | PO | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **1** | **2** | **3** |
| 4SH216OE1.1 | 3 | 3 | 2 | – | – | – | – | – | – | – | – | 1 | 2 | 1 |
| 4SH216OE1.2 | 3 | 3 | 2 | – | – | – | – | – | – | – | – | 1 | 2 | 1 |
| 4SH216OE1.3 | – | 3 | 3 | – | – | – | – | – | – | – | – | 1 | 2 | 2 |
| 4SH216OE1.4 | – | 3 | 2 | – | – | – | – | – | – | – | – | 1 | 3 | 2 |
| 4SH216OE1.5 | – | 3 | 3 | – | – | – | – | – | – | – | – | 2 | 2 | 2 |
| 4SH216OE1.6 | – | 3 | 2 | – | – | – | – | – | – | 2 | 3 | 1 | 2 | 2 |
| **4SH216OE1 CO** | 1 | 3 | 3 | – | – | – | – | – | – | 1 | 1 | 1 | 2 | 2 |

Correlation levels-1: Slight (Low),2: Moderate (Medium), 3: Substantial(High)

| Level: | **5** | Course Code: | **4SH216OE2** | Course Category: | **OE** |
|---|---|---|---|---|---|
| Course Name | **Critical Thinking & Decision Making** | | | | |
| Credits | **03** | Total L:T:P Hours | 3:0:0 **45 Hrs** | Total SL Hours | **45 Hrs** |
| Total Credit Hours | **90 Hrs** | | | | |
| SEE Marks | **60** | SEE Time | **3 Hrs** | CIA Marks | **40** |
| EE Marks | **--** | PA Marks | **--** | Total Marks | **100** |

**Course Description:**
Subject Code 4SH216OE2 Critical Thinking & Decision Making is a compulsory Open Elective Course for Second Year B. Tech All Branch Students.

**Course Objectives:**
The objective of this course is to develop critical thinking and decision-making competencies by strengthening analytical reasoning and structured problem-solving skills applicable to professional and real-world situations.

**Course Outcomes:**
After completing the course students will be able to:

| CO | Course Outcome | Domain Level |
|---|---|---|
| 4SH216OE2.1 | Apply critical thinking frameworks to analyze problems systematically. | C-3 |
| 4SH216OE2.2 | Evaluate information, assumptions, and arguments for logical consistency and validity. | C-5 |
| 4SH216OE2.3 | Analyze complex situations and identify feasible alternatives for decision making. | C-4 |
| 4SH216OE2.4 | Design rational and ethical decision-making strategies under uncertainty to ensure sustainable organizational outcomes. | C-6<br>A-3 |
| 4SH216OE2.5 | Apply quantitative and qualitative tools to support decision-making processes. | C-3 |
| 4SH216OE2.6 | Demonstrate effective decision making in simulated professional and team-based scenarios to resolve workplace challenges effectively | C-3<br>P-3<br>A-3 |

**Course Contents:**

| | | |
|---|---|---|
| Unit 1 | **Foundations of Critical Thinking:**<br>Concept of critical thinking; elements of reasoning; logical vs illogical thinking; assumptions and inferences; inductive and deductive reasoning; common cognitive biases; barriers to critical thinking. | 7Hrs |
| Unit 2 | **Analytical Reasoning & Problem Framing:**<br>Problem identification and structuring; root cause analysis; | 7 Hrs |

| | | |
|---|---|---|
| | issue trees; questioning techniques; systems thinking; analytical reasoning models. | |
| Unit 3 | **Decision Making Models & Techniques:** Rational decision-making model; intuitive decision making; bounded rationality; decision trees; cost–benefit analysis; risk and uncertainty; heuristics. | 7 Hrs |
| Unit 4 | **Data-Driven & Ethical Decision Making:** Use of data in decision making; qualitative vs. quantitative data; basic decision matrices; ethical frameworks; professional ethics; social and environmental considerations in decisions. | 8Hrs |
| Unit 5 | **Creativity, Innovation & Strategic Thinking:** Creative thinking techniques; lateral thinking; design thinking approach; scenario planning; strategic decision making; innovation in problem solving. | 8 Hrs |
| Unit 6 | **Applied Decision Making & Case Analysis:** Case studies from industry and management; individual and group decision simulations; conflict resolution through decision frameworks; decision-making under pressure; reflection and feedback | 8 Hrs |

**Text Books:**

1.Alec Fisher, Critical Thinking, published by Cambridge University Press.

2. John Adair, Decision Making and Problem Solving, published by Kogan Page.

**Reference Books:**

1Daniel Kahneman, Thinking, Fast and Slow published by Farrar, Straus and Giroux.

2. Rolf Dobelli, The Art of Thinking Clearly,published by Sceptre.

3. John S. Hammond, Ralph L. Keeney, Howard Raiffa, Smart Choices, published by Harvard Business School Press.

4. Ken Watanabe, Problem Solving 101, published by Portfolio.

**E Resources**:

1. NPTEL – Critical Thinking &Decision Making Courses
2. Coursera – Critical Thinking and Decision-Making Modules
3. Harvard Business Review – Decision Making Articles
4. MIT OpenCourseWare – Decision Analysis

**Mapping of COs with POs & PSO**

| CO | PO | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 1 | 2 | 3 |
| 4SH216OE2.1 | 2 | 3 | 2 | – | – | – | – | – | – | – | – | 1 | 2 | 2 |
| 4SH216OE2.2 | – | 3 | 3 | – | – | – | – | – | – | – | – | 1 | 2 | 2 |
| 4SH216OE2.3 | – | 3 | 2 | – | – | – | – | – | – | – | – | 1 | 2 | 2 |
| 4SH216OE2.4 | – | 3 | 3 | – | – | 2 | 3 | – | – | – | – | - | 3 | 2 |
| 4SH216OE2.5 | – | 2 | 2 | – | 2 | – | – | – | – | – | – | 2 | 3 | 2 |
| 4SH216OE2.6 | – | 2 | 2 | – | – | 2 | – | 2 | 2 | – | 2 | 1 | 2 | 2 |
| 4SH216OE2. CO | 1 | 3 | 3 | - | 1 | 1 | 1 | 1 | 1 | - | 1 | 1 | 3 | 2 |

Correlation levels-1: Slight (Low),2: Moderate (Medium), 3: Substantial(High)

| Level: **5** | Course Code: **4ME217PC1** | | Course Category: **PCC** | | |
|---|---|---|---|---|---|
| Course Name | **Material Science & Nano Technology – Lab** | | | | |
| Credits | **01** | Total L:T:P etc. Hours | 0:0:2 **30 Hrs** | Total SL Hours | **--** |
| Total Credit Hours | **30 Hrs** | | | | |
| SEE Marks | **--** | SEE Time | **--** | CIA Marks | **--** |
| EE Marks | **25** | PA Marks | **25** | Total Marks | **50** |

**Course Description:**
Subject Code 4ME217PC1Material Science & Nano Technology - Lab is a compulsory Engineering Science Course for Second Year B. Tech. Mechanical Engineering.

**Course Objectives:**

To provide a practical understanding of the structure, properties, and behavior of engineering materials, and to develop skills in using metallurgical and material characterization equipment such as microscopes, while correlating theoretical material science concepts with experimental observations.

**Course Outcomes:**
After completing the course students will be able to:

| CO | Course Outcome | Domain Level |
|---|---|---|
| 4ME217PC1.1 | Demonstrate proficiency in using metallurgical microscope, and differentiate the microstructures of steels, cast irons, and non-ferrous alloys to interpret their material behavior. | C-4, P-3, A-3 |
| 4ME217PC1.2 | Interpret the iron–carbon equilibrium diagram, analyse the effects of mechanical working and microstructural phenomena like recovery, recrystallization, and grain growth in metals. | C3, P4, A3 |
| 4ME217PC1.3 | Describe the fundamentals of nanotechnology and classify nanomaterials based on properties and applications as well as study of Nanomaterials, classification, properties, and applications | C-2, P-1, A-2 |

**List of Practical's:**
Minimum Eight practical's from the list mentioned below.
1. Study of metallurgical microscope.
2. Study of Iron carbon Equilibrium diagram &its invariant reactions.
3. Study of effect of alloying elements on the properties of steels.
4. Study of micro structures of plain carbon steels and alloy steels.

5. Study of micro structures of various cast irons.
6. Study of micro structures of non-ferrous metals (brasses, bronzes)
7. Investigation of Mechanical Working Processes and their effects on metal 8. Study of Recovery, Recrystallization, and Grain Growth in Metals.
9. Study of Nanotechnology, its applications and benefits.
10. Study of Nanomaterials, classification, properties and its applications.

**E-Resources:**

1. http://www.digimat.in/nptel/courses/video/113104068/L26.html
2. https://www.coursera.org/specializations/materials-science-for-technological-application
3. http://kcl.digimat.in/nptel/courses/video/112104219/L01.html
4. http://kcl.digimat.in/nptel/courses/video/112104219/L01.html
5. https://msvs-dei.vlabs.ac.in/QuenchingSimulation.php?
6. http://kcl.digimat.in/nptel/courses/video/112107145/L01.html

**Mapping of COs with POs**

| CO | PO | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **1** | **2** | **3** |
| 4ME217PC1.1 | 3 | 2 | 1 | 3 | 3 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 1 |
| 4ME217PC1.2 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 3 | 3 | 1 |
| 4ME217PC1.3 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | 1 | 2 | 3 |
| 4ME217PC1 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 2 |

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

| Level: **5** | Course Code: **4ME218PC1** | | Course Category: **PCC** | | |
|---|---|---|---|---|---|
| Course Name | **Hydraulic and Pneumatic Systems- Lab** | | | | |
| Credits | **01** | Total L:T:P etc. Hours | 2:0:0 **30 Hrs** | Total SL Hours | **--** |
| Total Credit Hours | **30 Hrs** | | | | |
| SEE Marks | **--** | SEE Time | **--** | CIA Marks | **--** |
| EE Marks | **25** | PA Marks | **25** | Total Marks | **50** |

**Course Description:**
Subject Code 4ME218PC1Hydraulic and Pneumatic Systems - Labis a compulsory Program Core Course for Second Year B.Tech. Mechanical Engineering Program.

**Course Objectives:**
The objective of this Course is to understand the fundamental concepts of hydraulic machines, apply them in practical engineering scenarios, and recognize the importance of specialized water-lifting devices.

**Course Outcomes:**
After completing the course students will be able to:

| CO | Course Outcome | Domain Level |
|---|---|---|
| 4ME218PC1.1 | Demonstrate the basic concepts of prime movers and turbines to develop a strong understanding of energy conversion in mechanical systems. | C-3, P-3 |
| 4ME218PC1.2 | Apply the knowledge of centrifugal and reciprocating pumps for selecting and implementing appropriate solutions in industrial and engineering applications. | C-3, P-3 |
| 4ME218PC1.3 | Apply hydraulic and pneumatic principles to design and develop practical projects and problem-solving solutions in mechanical engineering contexts | C-3, P-2 & A-4 |

**List of Practicals:**
At least Eight Practicals from the below list.
1.Study of Pelton wheel
2.Study of Francis Turbine
3.Study of Kaplan Turbine
4.Study of centrifugal pump
5.Study of reciprocating pump
6.Study of axial flow pump
7.Study of multistage pump
8.Study of special pumps (air lift pump/ jet pump)
9.Trial on pneumatic system

10.Case study onComputational Fluid Dynamics (CFD)

**E-Resources:**

1. https://archive.nptel.ac.in/courses/112/106/112106300/?utm
2. https://www.g-wonlinetextbooks.com/fluid-power-lab-manual-2020/?utm
3. https://www.onlinetutorials.org/teaching-academics/introduction-of-hydraulics-and-pneumatics/?utm
4. https://docslib.org/doc/1908894/lecture-1-introduction-to-hydraulics-and-pneumatics?utm

**Mapping of COs with POs & PSOs**

| CO | PO | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **1** | **2** | **3** |
| 4ME218PC1.1 | 3 | 2 | 2 | 1 | 2 | 2 | 1 | 3 | 2 | 1 | 2 | 1 | - | - |
| 4ME218PC1.2 | 3 | 2 | 3 | 1 | 2 | 2 | 1 | 3 | 2 | 1 | 2 | 2 | 3 | - |
| 4ME218PC1.3 | 2 | 2 | 3 | 2 | 2 | 2 | 1 | 3 | 3 | 1 | 2 | 2 | 3 | 3 |
| 4ME218PC1 | 3 | 2 | 3 | 2 | 2 | 2 | 1 | 3 | 2 | 1 | 2 | 2 | 2 | 1 |

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

| Level: **5** | Course Code: **4ME219VS1** | | Course Category: **VSC** | | |
|---|---|---|---|---|---|
| Course Name | **Manufacturing Processes - Lab** | | | | |
| Credits | **02** | Total L:T:P etc. Hours | 0:0:4 **60 Hrs** | Total SL Hours | **--** |
| Total Credit Hours | **60 Hrs** | | | | |
| SEE Marks | **--** | SEE Time | **--** | CIA Marks | **--** |
| EE Marks | **--** | PA Marks | **50** | Total Marks | **50** |

**Course Description:**
Subject Code 4ME219VS1 Manufacturing Processes Lab is a Vocational Skill Course. (VSC)offered to Second Year B.Tech Mechanical Engineering Program.

**Course Objectives:**
The objective of this course is to develop practical skills and understanding of various manufacturing processes including casting, welding, machining, and additive manufacturing.

**Course Outcomes:**
After completing the course students will be able to:

| CO | Course Outcome | Domain Level |
|---|---|---|
| 4ME219VS1.1 | Demonstrate and perform the basic casting processes including pattern making and mould preparation, for understanding and practically apply the fundamentals of casting by creating patterns and preparing moulds. | C-3<br>P-4 |
| 4ME219VS1.2 | Demonstrate and perform various welding operations such as arc, gas, and TIG welding with an understanding of their applications, for developing hands-on skills in arc, gas, and TIG welding and understand their appropriate applications in fabrication and joining processes. | C-3<br>P-4 |
| 4ME219VS1.3 | Demonstrate and perform basic machine tools like lathe and milling machines and demonstrate modern manufacturing techniques such as 3D printing, for applying and understanding conventional machining operations on lathe and milling machines. | C-3<br>P-4 |

**List of Practicals:**

Minimum Ten Practicals from the list mentioned below.

11. Study of Various Casting Techniques.
12. Preparation of a single piece wooden pattern by teak wood.
13. Preparation of the mould cavity in the mould box using split pattern.
14. Study of different types of welding processes.
15. Preparation of a welding job by using arc welding and gas welding.
16. Preparation of a welding job by using TIG welding.
17. Demonstration of MIG welding machine.
18. Preparation of one job on Lathe Machine consisting of facing, turning, taper turning, knurling & threading operations.
19. Preparation of a spur gear on milling machine
20. Demonstration of Shaper machine.
21. Demonstration of verticalmilling machine.
22. Study and demonstration of 3D Printing.

**E-Resources:**

1. https://www.vlab.co.in/broad-area-mechanical-engineering
2. dei.vlabs.ac.in/exp/design-manufacture-wooden-pattern-given-casting
3. https://mp-dei.vlabs.ac.in/exp/study-observe-stages-casting-sand-casting-process
4. https://mm-coep.vlabs.ac.in/exp/welding-ndyag-laser
5. https://osme.co.in/wp-content/uploads/2023/09/FOUNDRY-ENGINEERING-LAB-MANUAL.pdf

6. **Mapping of COs with POs**

| CO | PO | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **1** | **2** | **3** |
| 4ME219VS1.1 | 3 | 2 | 1 | - | 1 | - | - | - | - | - | 2 | 2 | 1 | 2 |
| 4ME219VS1.2 | 3 | 2 | - | - | 1 | 1 | - | - | 2 | 1 | 2 | 2 | 2 | 2 |
| 4ME219VS1.3 | 3 | 2 | 2 | 1 | 3 | - | - | - | 2 | 1 | 2 | 3 | 2 | 1 |
| 4ME219VS1CO | 3 | 2 | 1 | - | 2 | - | - | - | 1 | 1 | 2 | 2 | 2 | 2 |

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

| Level: **5** | Course Code: | **4SH220AE1** | Course Category: | **AEC** |
|---|---|---|---|---|
| Course Name | **Technical Writing** | | | |
| Credits | **02** | Total L:T:P Hours | 1:0:2 **45 Hrs** | Total SL Hours | **15 Hrs** |
| Total Credit Hours | **60 Hrs** | | | | |
| SEE Marks | -- | SEE Time | -- | CIA Marks | -- |
| EE Marks | -- | PA Marks | **50** | Total Marks | **50** |

**Course Description:**
Subject Code 4SH220AE1 Technical Writing is common Ability Enhancement Course for Second Year B. Tech.

**Course Objectives:**
The objective of the course is to enhance students' ability to write effective technical documents, professional correspondence, and research-oriented content with clarity, accuracy, and ethical standards.

**Course Outcomes:**
After completing the course students will be able to:

| CO | Course Outcome | Domain Level |
|---|---|---|
| 4SH220AE1.1 | Apply principles of technical writing in engineering documents. | C-3<br>P-2<br>A-2 |
| 4SH220AE1.2 | Apply technical writing skills to prepare professional documents. | C-4<br>P-2<br>A-2 |
| 4SH220AE1.3 | Create ethical, well-structured technical and research documents using IEEE referencing for professional and academic communication. | C-3<br>P-3<br>A-3 |

**Course Contents:**

| | | |
|---|---|---|
| Unit 1 | **Fundamentals of Technical Writing:**<br>Nature and importance of technical communication, characteristics of technical writing, audience analysis, technical vocabulary, grammar and style, clarity and conciseness, paragraph structure, coherence, technical descriptions, instructions and manuals. | 7 Hrs |
| Unit 2 | **Professional and Research Writing:**<br>Technical reports and documentation, structure of reports, abstracts and summaries, research papers, project proposals, resumes and cover letters, business emails, documentation ethics, plagiarism, referencing styles (IEEE), editing and proofreading. | 8 Hrs |

**List of Practicals:**

Minimum eight practicals from the list mentioned below.
1.Analysis of Technical Communication to Identify the nature, purpose of given technical documents and evaluate their effectiveness.

2. Editing technical text for clarity and brevity
3. Technical description of an engineering device/system
4. Writing step-by-step technical instructions
5. Preparation of structured technical reports
6. Resume and cover letter drafting
7. Technical report writing based on laboratory work, case study, or project work
8. Abstract and executive summary writing for technical documents
9. Referencing and citation using IEEE format
10. Editing, proofreading, and plagiarism check of technical documents

**Text Books:**


1. Rizvi A. M. & Patnaik P., Effective Technical Communication, McGraw Hill Education (India), New Delhi (Second Edition).
2. Verma S., Technical Communication for Engineers, Vikas Publishing House Pvt. Ltd., New Delhi (First Edition).
3. Misra P. & Tyagi K., Advanced Technical Communication, PHI Learning Pvt. Ltd., New Delhi (Second Edition).


**Reference Books:**


1. Chauhan G. S., Kashiramka S. &Thimmesha L., Technical Communication, Cengage Learning India Pvt. Ltd., New Delhi (First Edition).
2. Alred G. J., Brusaw C. T. &Oliu B., Handbook of Technical Communication, Oxford University Press, New Delhi (Second Edition).
3. IEEE Editorial Style Manual, IEEE Standards Association, IEEE, USA (Latest Edition).
4. Joseph G. & Joseph B., Grammar and Usage for Technical Communication, Cambridge University Press India, Delhi (First Edition).


**E Resources**:

1. NPTEL–SWAYAM, IIT Roorkee,Technical Communication for Engineers.
2. https://owl.purdue.edu
3. https://ieeeauthorcenter.ieee.org

**Mapping of COs with POs & PSOs:**

| CO | PO | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 1 | 2 | 3 |
| 4SH220AE1.1 | - | - | - | - | - | - | - | - | | 3 | - | | | |
| 4SH220AE1.2 | - | - | - | - | - | - | - | - | 3 | 3 | - | | | |
| 4SH220AE1.3 | - | - | - | - | - | - | - | 3 | | 3 | 3 | | | |
| 4SH220AE1 CO | - | - | - | - | - | - | - | 1 | 1 | 3 | 1 | | | |

Correlation levels-1: Slight (Low),2: Moderate (Medium), 3: Substantial(High)

| Level: **5** | Course Code: | 4SH221EM1 | Course Category: | **EEM** |
|---|---|---|---|---|
| Course Name | **Fundamentals of Book Keeping and Accounting** | | | |
| Credits | **02** | Total L:T:P Hours | 1:0:2 **45 Hrs** | Total SL Hours **15 Hrs** |
| Total Credit Hours | **60 Hrs** | | | |
| SEE Marks | **--** | SEE Time | **--** | CIA Marks **--** |
| EE Marks | **--** | PA Marks | **50** | Total Marks **50** |

**Course Description:**

Subject Code 4SH221EM1 Fundamentals of Book Keeping and Accounting is an Ability Enhancement Course for Second Year B. Tech students that introduce basic accounting principles, bookkeeping processes, and financial statements for business applications.

**Course Objectives:**

The objective of the course is to develop students' skills in recording and analyzing financial transactions and to enable effective use of accounting information for decision-making.

**Course Outcomes:**

After completing the course students will be able to:

| CO | Course Outcome | Domain Level |
|---|---|---|
| 4SH221EM1.1 | Apply basic principles of bookkeeping and accounting for recording and maintaining financial transactions accurately. | C-3<br>P-2<br>A-2 |
| 4SH221EM1.2 | Analyze financial statements such as income statement, balance sheet, and cash flow statement for supporting financial understanding and business decision-making. | C-4<br>P-2<br>A-2 |
| 4SH221EM1.3 | Apply accounting tools and techniques for evaluating financial performance and improving business efficiency. | C-3<br>P-3<br>A-3 |

**Course Contents:**

| | | |
|---|---|---|
| **Unit 1** | **Foundation of Book keeping and Accounting**<br>Definition, objectives, and importance of accounting, Difference between accounting and bookkeeping, accounting equation, double entry system, Debit vs credit, accrual vs cash accounting, Terminology- depreciation, armotisation, CapEx vs OpEx.<br>Source of Document (invoice, receipt, Purchase Order), Work Flow (Journal, posting to the ledger), Preparing trial balance, Software Integration- A brief overview of ERP (SAP/ oracle and tools like a tally/ quick book). | 8 Hrs |

| | | |
|---|---|---|
| **Unit 2** | **Financial Statements & Decision Making**<br>Income Statement, Balance Sheet, Cash flow Statement. Ratio Analysis (Current Ratio, Debt to equity, ROI), Cost Accounting (Fixed vs Variable, Break-even), Taxation Basics (Corporate IT) | 7 Hrs |

**List of Practicals:**

Minimum eight practicals from the list mentioned below.

1. Categories a list of items (Laptop, Office Rent Deposit, Cash, Bank Loan, Software Licenses) into Assets, Liabilities, or Equity.
2. Use the Double-Entry System to record buying raw materials, paying technician wages, and receiving a client advance.
3. Identify discrepancies like uncashed cheques, bank charges, or direct deposits from clients.
4. Compare the Straight-Line Method vs. the Written Down Value (WDV) method (as per Indian Income Tax rules).
5. Distinguish between Direct Costs (raw materials, factory power) and Indirect Costs (office salary, marketing).
6. Analyze the Annual Report of an Indian tech giant (e.g., L&T or Tata Motors).
7. Calculate the Current Ratio (liquidity), Debt-to-Equity (solvency), and Return on Investment (ROI).
8. Input Fixed Costs (Rent, Machinery) and Variable Costs (Material per unit) into a spreadsheet to find the Break-Even Point.
9. Value the remaining stock after several purchases and sales using the First-In, First-Out (FIFO) method.
10. Enter 5 basic transactions into a trial version of Tally Prime or a cloud-based tool like Zoho Books.

**Text Books:**


1. S.N. Maheshwari S.K. Maheshwari & S.K. Maheshwari., Financial Accounting, Vikas Publishing House (Eleventh Edition)
2. N. Ramachandran, Ramkumar Kakani., Financial Accounting for Management, McGraw Hill Education (Sixth Edition)


**Reference Books:**


1. R. L. Gupta & U. K. Gupta., Financial Accounting, Sultan Chand & Sons, (Ninth revised Edition)
2. Dr. Santanu Chakrabarty & Dr. Nilanjan Singha Roy., Accounting & Finance for engineering, Lawpoint Publications (Second Edition)
3. Bhushan Kumar Goyal., Accounting for Everyone, Taxmann Publications Pvt. Ltd (First Edition)

**E Resources**:

1. SWAYAM, Financial Accounting / Business Accounting
2. National Digital Library of India, https://ndl.iitkgp.ac.in
3. Tally Education, https://tallyeducation.com

**Mapping of COs with POs & PSOs:**

| CO | PO | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 1 | 2 | 3 |
| 4SH221EM1.1 | 2 | 2 | - | - | - | - | - | - | - | - | - | | | |
| 4SH221EM1.2 | 3 | 3 | - | - | - | - | - | - | - | 3 | - | | | |
| 4SH221EM1.3 | 2 | 3 | - | - | 3 | - | - | - | - | 3 | - | | | |

Correlation levels-1: Slight (Low),2: Moderate (Medium), 3: Substantial(High)

| Level: **5** | Course Code: **4CE222VE1** | | Course Category: **VEC** | | |
|---|---|---|---|---|---|
| Course Name | **Environmental Science** | | | | |
| Credits | **02** | Total L:T:P Hours | 2:0:0 **30 Hrs** | Total SL Hours | **30 Hrs** |
| Total Credit Hours | **60 Hrs** | | | | |
| SEE Marks | **30** | SEE Time | **2 Hrs** | CIA Marks | **20** |
| EE Marks | **--** | PA Marks | **--** | Total Marks | **50** |

**Course Description:**
Subject Code 4CE222VE1 Environmental Science is a Value Education course for Second Year B. Tech Civil Engineering.

**Course Objectives:**
The objective of this course is to develop understanding of environmental systems, natural resource management, ecological balance, and sustainable development practices to promote awareness and responsibility toward environmental protection and societal well-being.

**Course Outcomes:**
After completing the course students will be able to:

| CO | Course Outcome | Domain Level |
|---|---|---|
| 4CE222VE1.1 | Analyze renewable and non-renewable natural resources and associated problems to promote sustainable utilization for future generations. | C-4 |
| 4CE222VE1.2 | Analyze food chains, webs, and ecological pyramids to evaluate ecological interactions and succession processes. | C-4 |
| 4CE222VE1.3 | Examine shift from unsustainable to sustainable development to promote responsible resource planning for society. | C-3 |

**Course Contents:**

| | | |
|---|---|---|
| Unit 1 | **Renewable and non-renewable resources**: Environmental Science, Definition, scope and importance, Need for public awareness, Renewable and non-renewable resources, Natural resources and associated problems. Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable life styles. | 10 hrs |
| Unit 2 | **Ecosystem:** Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: Forest | 10 hrs |

| | | |
|---|---|---|
| | ecosystem, Grassland ecosystem, Desert ecosystem. | |
| Unit 3 | **Social Issues & Environment:** From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issues and possible solutions, Environment Protection Act. Air (Prevention and Control of Pollution) Act., Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, public awareness. | 10 hrs |

**Text Books:**

1. Suresh K. Dhameja, Environmental Studies, Katson Books
2. Benny Joseph, Environmental Studies, McGraw Hill Education

**Reference Books:**

1. Gilbert M. Masters & Wendell Ela, Introduction to Environmental Engineering and Science, Pearson Education
2. William Cunningham & Mary Cunningham, Environmental Science, McGraw Hill

**E Resources:**

1. https://www.vlab.co.in/broad-area-civil-engineering

**Mapping of COs with POs**

| CO | PO | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 1 | 2 | 3 |
| 4CE222VE1.1 | 3 | 2 | - | - | - | 2 | 2 | - | - | - | - | - | - | - |
| 4CE222VE1.2 | 3 | 2 | - | - | - | 3 | 2 | - | - | - | - | - | 1 | - |
| 4CE222VE1.3 | 3 | 2 | - | - | - | 3 | 3 | - | - | - | - | - | 1 | - |
| 4CE222VE1.CO | 3 | 2 | - | - | - | 3 | 3 | - | - | - | - | - | 1 | - |

Correlation levels-1: Slight (Low),2: Moderate (Medium), 3: Substantial(High)

| Level: **5** | Course Code: **4ME223DH1** | | Course Category: **DH** | | |
|---|---|---|---|---|---|
| Course Name | **Robotics and Automation** | | | | |
| Credits | **04** | Total L:T:P etc. Hours | 4:0:0 **60 Hrs** | Total SL Hours | **30 Hrs** |
| Total Credit Hours | **120 Hrs** | | | | |
| SEE Marks | **60** | SEE Time | **3 Hrs** | CIA Marks | **40** |
| EE Marks | **--** | PA Marks | **--** | Total Marks | **100** |

**Course Description:**
Subject Code 4ME223DH1 Robotics and Automation is a for Double Minor / Double Minor / Course offered as Honours by department of Mechanical Engineering for Second Year B.Tech., for all Discipline.

**Course Objectives:**
The objective of this course is to provide foundational knowledge of robotics and automation, including structure, actuation, sensing, and modern advancements such as AI, IoT, and autonomous systems.

**Course Outcomes:**
After completing the course students will be able to:

| CO | Course Outcome | Domain Level |
|---|---|---|
| 4ME223DH1.1 | Explain the fundamentals, configurations, and components of robotics and automation systems. To understand the fundamentals, configurations, and components of robotics and automation systems | C-2 |
| 4ME223DH1.2 | Describe the structure of robots including joints, links, end effectors, drive systems, and transmission mechanisms used in robotic actuation. To build a strong foundation for understanding how robotic and automation systems | C-2 |
| 4ME223DH1.3 | Discuss the classification, working principles, and roles of internal/external sensors, signal conditioning, and basic feedback control systems used in robotics. To enable accurate sensing, monitoring, and control of robotic operations | C-2 |
| 4ME223DH1.4 | Analyze kinematic relationships and motion control principles in robotic manipulators. To achieve precise positioning, motion planning, and control of robots. | C-4 |

| | | |
|---|---|---|
| 4ME223DH1.5 | Analyze degrees of freedom, workspace, kinematics, differential motion, and basic dynamics of robotic manipulators. To evaluate robot motion capability, performance, and dynamic behavior. | C-4 |
| 4ME223DH1.6 | Evaluate current and emerging trends in robotics, automation, and Industry 4.0 technologies. To prepare for modern industrial applications and future advancements in intelligent automation. | C-5 |

**Course Contents:**

| | | |
|---|---|---|
| Unit 1 | **Introduction to Robotics and Automation**<br>Definition, scope, and evolution of robotics and automation<br>Classification and anatomy of robots (Cartesian, cylindrical, SCARA, articulated, delta), Components of a robotic system: mechanical structure, actuators, sensors, controller, power supply, Performance parameters and specifications. Applications in manufacturing, service, medical, agriculture, and defense | 5 Hrs |
| Unit 2 | **Robot Structure, Drives, and Actuators**:<br>Joints and links: types and configuration, End effectors – types of grippers and selection criteria, Drives: electrical, pneumatic, and hydraulic systems, Transmission systems: gears, belts, chains, lead screws. | 5 Hrs |
| Unit 3 | **Sensors and Control Systems:**<br>Sensor classification and working principles: proximity, force, torque, temperature, vision, and tactile sensors, Internal sensors: position, velocity, acceleration, current, Signal conditioning and data acquisition. Open-loop and closed-loop control systems, Basic feedback control concepts used in robotics. | 5 Hrs |
| Unit 4 | **Kinematics and Dynamics of Robots**:<br>Degrees of freedom, workspace, path, and trajectory, Forward and inverse kinematics, Differential motion and velocity relationships. Dynamics of robotic manipulators – basic concept. | 5 Hrs |
| Unit 5 | **Industrial Automation and Programming:**<br>Introduction to automation systems and levels of automation, Programmable Logic Controllers (PLC): structure, I/O modules, ladder logic programming, Sensors and actuators in automation systems. Robot programming methods – online/offline programming, Simple programs for pick-and-place. | 5 Hrs |

| | | |
|---|---|---|
| Unit 6 | **Emerging Trends and Applications:** Collaborative robots (Cobots) and mobile robots, Artificial Intelligence and Machine Learning in robotics. Integration of IoT, Cloud, and Industry 4.0 in automation. Human-robot interaction, ethics, and safety in robotics. | 5 Hrs |

**Text Books:**

1. S. K. Saha, Introduction to Robotics, McGraw Hillpublication.
2. Saeed B. Niku, Introduction to Robotics: Analysis, Control, Applications, Wiley publication.
3. Deb, S.R. – Robotics Technology and Flexible Automation, McGraw Hillpublication.

**Reference Books:**

1. Spong & Vidyasagar – Robot Dynamics and Control, Wiley publication.
2. Bolton, W. – Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, Pearson publication.
3. Alessandro De Luca et al., Springer Handbook of Robotics, Springer publication.

**E-Resources:**

1. https://tinyurl.com/mit-robotics-ocw
2. https://tinyurl.com/nptel-robotics-preview
3. https://tinyurl.com/elements-robotics-freebook

**Mapping of COs with POs & PSOS**

| CO | PO | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 1 | 2 | 3 |
| 4ME223DH1.1 | 3 | - | - | - | - | - | - | - | 1 | - | - | 1 | - | - |
| 4ME223DH1.2 | 3 | 1 | - | - | - | - | - | - | 1 | 1 | - | 1 | 1 | - |
| 4ME223DH1.3 | 3 | - | - | - | 1 | - | - | - | 1 | 1 | - | - | 1 | 1 |
| 4ME223DH1.4 | 3 | 2 | 2 | 1 | 2 | - | - | - | 1 | 1 | - | - | 1 | - |
| 4ME223DH1.5 | 3 | 2 | 2 | 1 | 2 | - | - | - | - | - | 1 | - | 1 | - |
| 4ME223DH1.6 | 2 | 1 | 2 | 1 | 2 | - | - | - | 1 | - | 1 | - | 1 | - |
| 4ME223DH1 | 3 | 2 | 2 | 1 | 2 | - | - | - | 1 | 1 | 1 | 1 | 1 | 1 |

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

| Level: **5** | Course Code: **4ME223DH2** | | Course Category: **DH** | | |
|---|---|---|---|---|---|
| Course Name | **Fuels and Combustion** | | | | |
| Credits | **04** | Total L:T:P etc. Hours | 4:0:0 **60 Hrs** | Total SL Hours | **30 Hrs** |
| Total Credit Hours | **120 Hrs** | | | | |
| SEE Marks | **60** | SEE Time | **3 Hrs** | CIA Marks | **40** |
| EE Marks | **--** | PA Marks | **--** | Total Marks | **100** |

**Course Description:**
Subject Code 4ME223DH2Fuels and Combustion is a for Double Minor / Double Minor / Course offered as Honours by department of Mechanical Engineering for Second Year B.Tech., for all Discipline.

**Course Objectives:**
The objective of this course is to analyze combustion processes using stoichiometry, thermochemistry, and efficiency calculations for practical engineering applications and to evaluate combustion equipment, emission control techniques, and energy optimization methods for safe, efficient, and environmentally responsible fuel utilization.

**Course Outcomes:**
After completing the course students will be able to:

| CO | Course Outcome | Domain Level |
|---|---|---|
| 4ME223DH2.1 | Explain the classification, origin, and properties of solid, liquid, gaseous, and alternative fuels and their importance in energy systems. | C-2 |
| 4ME223DH2.2 | Describe coal carbonization, petroleum refining, and production, handling, and safety measures for different fuels. | C-2 |
| 4ME223DH2.3 | Analyze gaseous and alternative fuels, comparing energy content, storage, handling, and environmental impact. | C-4 |
| 4ME223DH2.4 | Apply combustion stoichiometry and thermochemistry principles to calculate air–fuel ratio, adiabatic flame temperature, flue gas composition, and combustion efficiency. | C-3 |
| 4ME223DH2.5 | Understand combustion equipment and furnace design, types of burners, and industrial applications including boilers, turbines, and IC engines. | C-2 |
| 4ME223DH2.6 | Evaluate combustion emissions, control techniques, waste heat recovery, and strategies for efficient and environmentally sustainable fuel utilization. | C-5 |

**Course Contents:**

| | | |
|---|---|---|
| Unit 1 | **Introduction to Fuels and Combustion:** Classification of fuels: Solid, liquid, and gaseous fuels. Origin and characteristics of fuels. Importance of fuels in energy systems and power generation. Fundamental definitions: calorific value, ignition temperature, flash & fire point. Combustion basics: definition, types (complete & incomplete), stages of combustion. | 10 Hrs |
| Unit 2 | **Solid and Liquid Fuels**: Solid fuels: Coal – types, properties, grading, analysis (proximate & ultimate). Carbonization and coke production. Liquid fuels: Petroleum refining, types of liquid fuels (diesel, kerosene, fuel oils). Properties and applications of liquid fuels. Fuel handling, storage, and safety measures. | 10 Hrs |
| Unit 3 | **Gaseous and Alternative Fuels:** Gaseous fuels: Producer gas, water gas, coal gas, natural gas, LPG, CNG. Manufacture, properties, and applications. Alternative fuels: Biofuels, hydrogen, alcohols, synthetic fuels. Comparative analysis: energy content, storage, handling, environmental impact. | 10 Hrs |
| Unit 4 | **Combustion Stoichiometry and Thermochemistry**: Stoichiometric air-fuel ratio, excess air, equivalence ratio. Mass and energy balance for combustion systems. Adiabatic flame temperature, flue gas analysis. Determination of combustion efficiency. Problems on combustion calculations. | 10 Hrs |
| Unit 5 | **Combustion Equipment and Furnaces:** Principles of burner and furnace design. Types of burners (pressure jet, rotary cup, gas burners). Solid fuel combustion systems: grate, fluidized bed combustion. Furnaces: design considerations, heat losses, efficiency. Industrial applications: boilers, gas turbines, IC engines. | 10 Hrs |
| Unit 6 | **Emissions, Control, and Energy Utilization:** Combustion emissions: CO, $NO_x$, $SO_x$, particulates. Environmental impact and emission standards. Combustion control techniques: flue gas recirculation, staged combustion. Waste heat recovery and energy optimization. Case studies in industrial combustion systems. | 10 Hrs |

**Text Books:**

1. Samir Sarkar, Fuel and Combustion, PHI Learning Pvt. Ltd.
2. Ganesan V., Fuels and Combustion, McGraw-Hill Education.
3. Gary L. Borman & Kenneth W. Ragland, Combustion Engineering, McGraw Hill publication.

**Reference Books:**

1. D.P. Mishra,Engineering Combustion, PHI Learning.
2. Stephen R. Turns, Introduction to Combustion: Concepts and Applications,

McGraw-Hill Education
3. Harald G. Weller, Alternative Fuels and Advanced Combustion Techniques, Springer.

**E-Resources:**

4. https://nptel.ac.in/courses/112/105/112105285/
5. https://nptel.ac.in/courses/108/106/108106130/
6. https://www.coursera.org/learn/combustion

**Mapping of COs with POs**

| CO | PO | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 1 | 2 | 3 |
| 4ME223DH2.1 | 3 | - | - | - | - | - | - | - | 1 | - | - | 1 | - | - |
| 4ME223DH2.2 | 3 | 1 | - | - | - | - | - | - | 1 | 1 | - | 1 | 1 | - |
| 4ME223DH2.3 | 3 | - | - | - | 1 | - | - | - | 1 | 1 | - | - | 1 | - |
| 4ME223DH2.4 | 3 | 2 | 2 | 1 | 2 | - | - | - | 1 | 1 | - | - | 1 | - |
| 4ME223DH2.5 | 3 | 2 | 2 | 1 | 2 | - | - | - | - | - | 1 | - | 1 | - |
| 4ME223DH2.6 | 2 | 1 | 2 | 1 | 2 | - | - | - | 1 | - | 1 | - | 1 | - |
| 4ME223DH2 | 3 | 2 | 2 | 1 | 2 | - | - | - | 1 | 1 | 1 | 1 | 1 | - |

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

| Level: **5** | Course Code: **5ME224EC1** | | Course Category: **EC** | | |
|---|---|---|---|---|---|
| Course Name | **Lathe Machine** | | | | |
| Credits | **4** | Total L:T:P etc. Hours | 2:0:4 **90 Hrs** | Total SL Hours | **30Hrs** |
| Total Credit Hours | **120 Hrs** | | | | |
| SEE Marks | **30** | SEE Time | **2 Hrs** | CIA Marks | **20** |
| EE Marks | **25** | PA Marks | **25** | Total Marks | **100** |

**Course Description:**
Subject Code 5ME224EC1Hands on Training on Lathe Machine is an exit course(L-5) for second year B.Tech in Mechanical Engineering program.

**Course Objectives:**
To provide students with foundational knowledge and hands-on experience on Lathe Machine to develop skills in performing various machining operations

**Course Outcomes:**
After completing the course students will be able to:

| CO | Course Outcome | Domain Level |
|---|---|---|
| 5ME224EC1.1 | Interpret the fundamentals of Lathe machine to perform the jobs. | C-2 |
| 5ME224EC1.2 | Perform basic Lathe operations to fabricate the jobs. | P-4 |
| 5ME224EC1.3 | Analyze Common lathe problems, causes, and remedies to do maintenance of Lathe machine. | C-4 |

**Course Contents:**

| | | |
|---|---|---|
| Unit 1 | **Introduction and Lathe Fundamentals:** Introduction to machine tools – classification and application. Purpose, working principle, and components of lathe machine. Types of lathes – engine, bench, turret, capstan, and CNC lathe. Lathe specifications and main parts: bed, headstock, tailstock, carriage, feed mechanism. Lathe accessories: chuck, faceplate, mandrel, centers, collets, and tool post. Cutting tool materials and geometry of single-point cutting tool. Safety precautions while operating lathe machines. | 9 Hrs |

| | | |
|---|---|---|
| Unit 2 | **Lathe Operations and Machining Parameters:** Basic operations: facing, straight turning, step turning, taper turning, and parting-off. Advanced operations: thread cutting, knurling, drilling, boring, and grooving. Cutting parameters: cutting speed, feed, and depth of cut – calculation and selection. Surface finish and accuracy considerations. Tool setting and alignment procedure. Measurement and inspection of machined parts using precision instruments (vernier caliper, micrometer, etc.) | 12 Hrs |
| Unit 3 | **Maintenance, Troubleshooting, and CNC Concepts:** Common lathe problems, causes, and remedies. Lubrication and preventive maintenance of lathe machines. Cutting fluid types and applications. Introduction to CNC lathe – basic features and comparison with conventional lathe. Introduction to part programming (G-codes and M-codes). Safety, ergonomics, and environmental considerations in machining | 9 Hrs |

**List of Practicals:**

Minimum Ten practicals from the list mentioned below.

1. Study of lathe machine parts, specifications, and accessories.
2. Demonstration of lathe operations and safety procedures.
3. Tool grinding and setting of single-point cutting tool.
4. Facing operation on mild steel workpiece.
5. Straight turning and step turning operations.
6. Taper turning using compound rest and tailstock offset methods.
7. External Thread cutting on lathe.
8. Knurling and parting-off operations.
9. Drilling and boring operations using lathe.
10. Measurement and inspection of machined components using precision tools.
11. Study and demonstration of CNC lathe.
12. Study of various G & M codes and sample part program on CNC lathe.

**Text Books:**

1. B.S. Raghuwanshi, Workshop Technology Vol. II(Machine Tools)**,** Dhanpat Rai Publications.
2. S. K. Hajra Choudhury, Elements of Workshop Technology Vol. II(Machine Tools), Media Promoters and Publishers Pvt. Ltd.
3. P. N. Rao, Manufacturing Technology: Vol. II(Metal cutting and Machine tools), McGraw Hill.

**Reference Books:**

1. R.K. Jain, Production Technology, Khanna Publishers
2. S. Kalpakjian& S.R. Schmid, Manufacturing Processes for Engineering Materials, Pearson

**E-Resources:**

1. https://virtlabs.tech/metal-cutting/
2. https://www.teksure.in/virtual_CNC_lathe_simulator.php

**Mapping of COs with POs and PSOs:**

| CO | PO | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 1 | 2 | 3 |
| 5ME224EC1.1 | 3 | - | - | - | - | - | 2 | - | - | - | 2 | - | - | - |
| 5ME224EC1.2 | 3 | - | - | - | 3 | - | 2 | - | - | - | 2 | - | 2 | 2 |
| 5ME224EC1.3 | 3 | 3 | 2 | - | 2 | - | 2 | - | - | - | 2 | - | - | - |
| 5ME224EC1 | 3 | 1 | 1 | - | 2 | - | 2 | - | - | - | 2 | - | 1 | 1 |

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

| Level: **5** | Course Code: **5ME225EC1** | | Course Category: **EC** | | |
|---|---|---|---|---|---|
| Course Name | **Casting Process** | | | | |
| Credits | **4** | Total L:T:P etc. Hours | 2:0:4 **90 Hrs** | Total SL Hours | **30 Hrs** |
| Total Credit Hours | **120 Hrs** | | | | |
| SEE Marks | **30** | SEE Time | **2 Hrs** | CIA Marks | **20** |
| EE Marks | **25** | PA Marks | **25** | Total Marks | **100** |

**Course Description:**
Subject Code 5ME225EC1Hands on Training on Casting Process is an exit course (L-5) for second year B.Tech in Mechanical Engineering program.

**Course Objectives:**
The objective of this course is to provide fundamental knowledge of operations involved in metal casting and develop hands-on skills in producing simple cast components.

**Course Outcomes:**
After completing the course students will be able to:

| CO | Course Outcome | Domain Level |
|---|---|---|
| 5ME225EC1.1 | Interpret the basic principles of metal casting process to build a strong foundation in the fundamentals of Foundry. | C-2 |
| 5ME225EC1.2 | Demonstrate knowledge of moulding materials, Core making and melting processes to perform moulding and casting operations. | C-3, P-4 |
| 5ME225EC1.3 | Identify and analyze casting defects to perform inspection of castings using various testing methods. | C-4 |

**Course Contents:**

| | | |
|---|---|---|
| Unit 1 | **Introduction to Casting Process:**<br>Overview of manufacturing processes and role of casting in industry. Basic principles of metal casting and solidification. Types of casting processes (sand casting, die casting, investment casting, etc.). Foundry layout and equipment. Pattern making: types of patterns, pattern allowances, materials used, and core boxes. Foundry tools and their uses. Safety precautions in foundry. | 9 Hrs |

| | | |
|---|---|---|
| Unit 2 | **Moulding, Core Making, and Melting:** Moulding materials: types of sand, sand properties, and additives. Sand testing: grain fineness, permeability, strength tests. Types of moulds and cores. Moulding methods: hand moulding, machine moulding. Melting furnaces – Cupola, crucible, induction, and electric arc furnaces. Pouring techniques and gating system design (sprue, runner, riser). | 12 Hrs |
| Unit 3 | **Defects, Inspection, and Modern Casting Techniques:** Casting defects – causes, identification, and remedies. Inspection and testing of castings (visual, dimensional, and NDT methods). Fettling and finishing operations. Modern casting processes – centrifugal, investment, shell moulding, and continuous casting. Quality control and environmental aspects in foundry. | 9 Hrs |

**List of Practicals:**

Minimum ten practicals from the list mentioned below.

1. Study of foundry tools, equipment, and layout.
2. Study and demonstration of different types of patterns and pattern materials.
3. To make a single piece wooden pattern by teak wood.
4. Study and demonstration of different types of moulding sand.
5. Study of various testing methods for moulding sand.
6. Making a single-piece pattern mould.
7. Making a split-pattern mould with core setting.
8. Preparation of a core using core box and core baking.
9. Study of gating and riser systems and their design parameters.
10. Demonstration of metal melting and pouring into prepared moulds.
11. Shakeout, fettling, and inspection of a casting.
12. Identification and analysis of common casting defects in sample castings.

**Text Books:**

1. B. S. Raghuwanshi, Workshop Technology: Vol.-I(Manufacturing Processes)**,** Dhanpat Rai Publications.
2. S. K. Hajra Choudhury, Elements of Workshop Technology: Vol.-I (Manufacturing Processes), Media Promoters and Publishers Pvt. Ltd.
3. P. N. Rao, Manufacturing Technology: Vol.-I(Foundry, Forming and Welding), McGraw Hill.

**Reference Books:**

3. R.K. Jain, Production Technology, Khanna Publishers.
4. S. Kalpakjian& S.R. Schmid, Manufacturing Processes for Engineering Materials, Pearson.

**E-Resources:**

1. https://onlinecourses.nptel.ac.in/noc24_me84/preview
2. https://onlinecourses.nptel.ac.in/noc24_me16/preview

**Mapping of COs with POs**

| CO | PO | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 1 | 2 | 3 |
| 5ME225EC1.1 | 3 | - | - | - | - | 2 | - | - | - | - | 2 | - | - | - |
| 5ME225EC1.2 | 3 | - | - | - | 3 | 2 | 2 | 2 | - | - | 2 | 2 | 2 | - |
| 5ME225EC1.3 | 3 | 3 | - | - | 2 | - | - | - | - | - | 2 | - | - | - |
| 5ME225EC1 | 3 | 1 | - | - | 2 | 1 | 1 | 1 | - | - | 2 | 1 | 1 | - |

Correlation levels- 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)