B.E
Mechanical Engineering

Curriculum and Syllabus
(Based on Choice Based Credit System)
Effective from the Academic year
2018-2019

Department of Mechanical Engineering
School of Engineering
DEPARTMENT OF MECHANICAL ENGINEERING

Vision of the Department

The Department of Mechanical Engineering envisages to be recognized as a role model in advanced fields of Mechanical Engineering Education and Research and to cater the ever changing industrial demands and social needs.

Mission of the Department

**M1:** Educate, motivate and prepare the students to know the fundamental and technical skills in Mechanical Engineering through effective teaching learning Methodologies.

**M2:** To imbibe professional and ethical standards in the minds of the young engineers by continuous learning and professional activities.

**M3:** To impart the employability skills to the students as industry ready by implant training and industrial visits.

**M4:** To create entrepreneurship skills by industrial collaborations and mentoring.

**M5:** To encourage students to undertake R&D activities for the societal needs with high ethical standards.
PROGRAMME OUTCOMES:

PO 1: Engineering knowledge
Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO 2: Problem analyses
Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 3: Design/development of solutions
Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 4: Conduct investigations of complex problems
Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5: Modern tool usage
Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO 6: The engineer and society
Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO 7: Environment and sustainability
Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8: Ethics
Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9: Individual and team work
Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10: Communication
Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO 11: Project management and finance
Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 12: Life-long learning
Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
Programme Educational Objectives (PEO's)

The Graduates will be Mechanical Engineering related technical and aptitude skills to offer best solution to industrial and societal problems.

PEO 1: To impart fundamentals of Engineering and Technology and applied Mathematics to transform the students as Mechanical Engineers.

PEO 2: To nurture design, analysis and implementation skills to innovate the process or system in Mechanical Engineering with global context.

PEO 3: To imbibe Mechanical Engineering related technical and aptitude skills to offer best solution to industrial and societal problems.

PEO 4: To initiate the entrepreneurial activities and leadership qualities of the students through the effective communication skills.

PEO 5: To develop the awareness among the students about the various social responsibilities related to Engineering ethics and human values with ecological.

Program Specific Outcomes (PSOs)

<table>
<thead>
<tr>
<th>PSO 1</th>
<th>Graduate will be able to acquire core Mechanical Engineering knowledge and able to solve industrial as well as societal problems with ethical and environmental consciousness.</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSO 2</td>
<td>Graduate will be able to build the nation, by imparting technological concepts and tools on emerging fields through the Managerial and entrepreneurs skills.</td>
</tr>
</tbody>
</table>
B.E. - MECHANICAL ENGINEERING
CURRICULUM

TOTAL NUMBER OF CREDITS: 170

<table>
<thead>
<tr>
<th>Category</th>
<th>Code No.</th>
<th>Course</th>
<th>Hours / Week</th>
<th>Credits</th>
<th>Maximum Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lecture</td>
<td>Tutorial</td>
<td>Practical</td>
</tr>
<tr>
<td>SEMESTER I</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Humanities and Social Sciences</td>
<td>18HS101</td>
<td>English</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Basic Science</td>
<td>18BS101</td>
<td>Physics (Introduction to</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Basic Science</td>
<td>18BS102</td>
<td>Mathematics - I (Calculus and</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Engineering Course</td>
<td>18ES101</td>
<td>Basic Electrical Engineering</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Engineering Course</td>
<td>18ES102</td>
<td>Engineering Graphics &amp; Design</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Basic Science Lab</td>
<td>18BL101</td>
<td>Physics Lab</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Engineering Lab</td>
<td>18EL101</td>
<td>Electrical Engineering Lab</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Humanities Lab</td>
<td>18HL101</td>
<td>English Lab</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>12</strong></td>
<td></td>
<td><strong>3</strong></td>
<td><strong>2</strong></td>
<td><strong>12</strong></td>
</tr>
<tr>
<td>SEMESTER II</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basic Science</td>
<td>18BS201</td>
<td>Chemistry</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Basic Science</td>
<td>18BS202</td>
<td>Mathematics - II</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Engineering Course</td>
<td>18ES201</td>
<td>Programming for Problem Solving</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Basic Science Lab</td>
<td>18BL201</td>
<td>Chemistry Lab</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Engineering Lab</td>
<td>18EL201</td>
<td>Programming for problem solving</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Engineering Course</td>
<td>18ES202</td>
<td>Manufacturing Practices Lab</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Mandatory Course</td>
<td>18MC201</td>
<td>Constitution of India</td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>12</strong></td>
<td></td>
<td><strong>2</strong></td>
<td><strong>12</strong></td>
<td><strong>18</strong></td>
</tr>
<tr>
<td>Category</td>
<td>Code No.</td>
<td>Course</td>
<td>Hours / Week</td>
<td>Credits</td>
<td>Maximum Marks</td>
</tr>
<tr>
<td>---------------------------</td>
<td>----------</td>
<td>---------------------------------------</td>
<td>--------------</td>
<td>---------</td>
<td>---------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lecture</td>
<td>Tutorial</td>
<td>Practical</td>
</tr>
<tr>
<td>SEMESTER III</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basic Science</td>
<td>18BS30 1</td>
<td>Mathematics III</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Professional Core</td>
<td>18PCME 301</td>
<td>Engineering Thermodynamics</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Engineering Science</td>
<td>18ES301</td>
<td>Electrical Drives and Control</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Professional Core</td>
<td>18PCME 302</td>
<td>Engineering Mechanics</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Professional Core</td>
<td>18PCME 303</td>
<td>Manufacturing Technology – I</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Professional Core</td>
<td>18PCME 304</td>
<td>Engineering Materials and Metallurgy</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Professional Core</td>
<td>18PLME 301</td>
<td>Computer aided Machine Design Laboratory</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Professional Core</td>
<td>18PLME 302</td>
<td>Manufacturing Technology Laboratory</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Employability Enhancement Courses</td>
<td>18HS30 1</td>
<td>Personality Development I</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Employability Enhancement Courses</td>
<td>18MC30 1</td>
<td>Industrial Safety</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>22</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>SEMESTER IV</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basic Science</td>
<td>18BSME 401</td>
<td>Mathematics IV</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Engineering Science</td>
<td>18ESME 401</td>
<td>Strength of Materials</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Professional Core</td>
<td>18PCME 401</td>
<td>Manufacturing Technology -II</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Professional Core</td>
<td>18PCME 402</td>
<td>Kinematics of Machinery</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Professional Core</td>
<td>18PCME 403</td>
<td>Fluid Mechanics and Engineering</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Humanities and Social Sciences</td>
<td>18MCM E401</td>
<td>Environmental Science and Engineering</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Employability Enhancement Course</td>
<td>18HSME 401</td>
<td>Personality Development II</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Professional Core</td>
<td>18PLME 401</td>
<td>Fluid Mechanics and Strength of Materials lab</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Professional Core</td>
<td>18PLME 402</td>
<td>Kinematics and Dynamics Laboratory</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Humanities and Social Sciences</td>
<td>18MCM E401</td>
<td>Basics Life skills</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>20</td>
<td>1</td>
<td>8</td>
</tr>
</tbody>
</table>
# B.E. - Mechanical Engineering

## Curriculum

<table>
<thead>
<tr>
<th>Category</th>
<th>Code No.</th>
<th>Course</th>
<th>Hours /Week</th>
<th>Credits</th>
<th>Maximum Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lecture</td>
<td>Tutorial</td>
<td>Practical</td>
</tr>
<tr>
<td><strong>Semester V</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Professional Core</td>
<td>18PCME 501</td>
<td>Engineering Metrology and Measurements</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Professional Core</td>
<td>18PCME 502</td>
<td>Design of Machine Elements</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Professional Core</td>
<td>18PCME 503</td>
<td>Dynamics of Machinery</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Professional Core</td>
<td>18PCME 504</td>
<td>Applied Hydraulics and Pneumatics</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Open Elective courses</td>
<td>18OEME 5XX</td>
<td>Open Elective courses I</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Professional Elective Courses</td>
<td>18PEME 5XX</td>
<td>Professional Elective I</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Employability Enhancement Courses</td>
<td>18HSME 501</td>
<td>Personality Development III</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Professional Core</td>
<td>18PLME 501</td>
<td>Metrology and Measurements Laboratory</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Professional Core</td>
<td>18PLME 502</td>
<td>Computer Aided Simulation and Analysis Laboratory</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Employability Enhancement Courses</td>
<td>18MCM EP501</td>
<td>Industrial Visit</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>20</td>
<td>1</td>
<td>6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Category</th>
<th>Code No.</th>
<th>Course</th>
<th>Hours /Week</th>
<th>Credits</th>
<th>Maximum Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lecture</td>
<td>Tutorial</td>
<td>Practical</td>
</tr>
<tr>
<td><strong>Semester VI</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Professional Core</td>
<td>18PCME 601</td>
<td>Finite Element Analysis</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Professional Core</td>
<td>18PCME 602</td>
<td>Thermal Engineering</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Professional Core</td>
<td>18PCME 603</td>
<td>Design of Transmission Systems</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Professional Elective courses</td>
<td>18PEME 6XX</td>
<td>Professional Elective courses II</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Professional Elective courses</td>
<td>18PEME 6XX</td>
<td>Professional Elective courses III</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Open Elective courses</td>
<td>18OEME 6XX</td>
<td>Open Elective courses II</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Employability Enhancement Courses</td>
<td>18HSME 601</td>
<td>Personality Development IV</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Professional Core</td>
<td>18PLME 601</td>
<td>Thermal Engineering LAB</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Professional Core</td>
<td>18PLME 602</td>
<td>Advanced Machining laboratory</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Employability Enhancement Courses</td>
<td>18MCM EP601</td>
<td>Internship</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>20</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Category</td>
<td>Code No.</td>
<td>Course</td>
<td>Hours / Week</td>
<td>Credits</td>
<td>Maximum Marks</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>------------</td>
<td>---------------------------------</td>
<td>--------------</td>
<td>---------</td>
<td>---------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lecture</td>
<td>Tutorial</td>
<td>Practical</td>
</tr>
<tr>
<td>SEMESTER VII</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Professional Elective courses</td>
<td>18PEME7XX</td>
<td>Professional Elective courses IV</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>18PEME7XX</td>
<td>Professional Elective courses V</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>18PEME7XX</td>
<td>Professional Elective courses VI</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Open Elective courses</td>
<td>18OEME7XX</td>
<td>Open Elective courses III</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Professional Course</td>
<td>18PLME701</td>
<td>Mechatronics Systems Lab</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Humanities and Social Sciences</td>
<td>18NSS701</td>
<td>NSS</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Employability Enhancement Courses</td>
<td>18PRME701</td>
<td>Project Phase I</td>
<td>0</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>14</strong></td>
<td>0</td>
<td><strong>13</strong></td>
</tr>
<tr>
<td>SEMESTER VIII</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Professional Elective courses</td>
<td>18PEME8X</td>
<td>Professional Elective courses VII</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open Elective courses</td>
<td>18OEME8XX</td>
<td>Open Elective courses IV</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>XX</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open Elective courses</td>
<td>18OEME8XX</td>
<td>Open Elective courses V</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>XX</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employability Enhancement Courses</td>
<td>18PRME80</td>
<td>Project Phase II</td>
<td>0</td>
<td>0</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>9</strong></td>
<td>0</td>
<td><strong>16</strong></td>
</tr>
</tbody>
</table>
## B.E. - MECHANICAL ENGINEERING CURRICULUM

### LIST OF PROFESSIONAL ELECTIVE COURSES

<table>
<thead>
<tr>
<th>Code No.</th>
<th>Course</th>
<th>Hours / Week</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>18DBME31</td>
<td>Special Casting Techniques</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18DBME32</td>
<td>Failure Analysis and Design</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18DBME33</td>
<td>Manufacture and Inspection of Gears</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18DBME34</td>
<td>Refrigeration and Air Conditioning</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18DBME35</td>
<td>Welding Technology</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18DBME43</td>
<td>Heat and Mass Transfer</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18DBME44</td>
<td>Cryogenic Engineering</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18DBME45</td>
<td>Renewable Energy Sources</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18DBME46</td>
<td>Composite Materials and Mechanics</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18DBME51</td>
<td>Automobile Engineering</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18DBME53</td>
<td>Design of Pressure Vessels and Piping</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18DBME54</td>
<td>Vibration and Noise Engineering</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18DBME55</td>
<td>Gas Dynamics and Jet Propulsion</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18DBME56</td>
<td>Design of Jigs, Fixtures and Press Tools</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18DBME61</td>
<td>Industrial Automation, CNC and Robotics</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18DBME62</td>
<td>Unconventional Machining Processes</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18DBME64</td>
<td>Manufacture of Automotive Components</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18DBME65</td>
<td>Design of Heat Exchangers</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18DBME66</td>
<td>Additive Manufacturing</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18DBME71</td>
<td>Rapid Prototyping, Tooling and Manufacture</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18DBME73</td>
<td>Mechatronics</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18DBME74</td>
<td>Computer Integrated Manufacturing</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18DBME75</td>
<td>Power Plant Engineering</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18DBME76</td>
<td>Computational Fluid Dynamics</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18DBME81</td>
<td>Advanced I.C. Engines</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18DBME82</td>
<td>Fundamentals of Nano science</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18DBME83</td>
<td>Product Development and Manufacture</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18DBME84</td>
<td>Non Destructive Testing and Materials</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18DBME85</td>
<td>Industrial Robotics</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18DBME87</td>
<td>Micro Electro Mechanical Systems</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18DBME88</td>
<td>Flexible Manufacturing System</td>
<td>3 0 0 3</td>
<td></td>
</tr>
</tbody>
</table>
# B.E - Mechanical Engineering

## CURRICULUM

### LIST OF OPEN ELECTIVE COURSES

<table>
<thead>
<tr>
<th>Code No.</th>
<th>Course</th>
<th>Hours / Week</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>18GBME51</td>
<td>Principles of Management</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18GBME52</td>
<td>Operations Research</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18GBME53</td>
<td>Human Rights</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18GBME61</td>
<td>Professional Ethics in Engineering</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18GBME62</td>
<td>Quality Control and Reliability Engineering</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18GBME63</td>
<td>Value Analysis and Value Engineering</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18GBME71</td>
<td>Total Quality Management</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18GBME72</td>
<td>Production Planning and Control</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18GBME73</td>
<td>Energy Audit and Energy Conservation Methods</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18GBME74</td>
<td>Quality Control and Reliability Engineering</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18GBME81</td>
<td>Process Planning and Cost Estimation</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18GBME82</td>
<td>Supply Chain Management</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18GBME83</td>
<td>Industrial Marketing and Market Research</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18GBME84</td>
<td>Intellectual Property Rights</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18GBME85</td>
<td>Disaster Management</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18GBME86</td>
<td>Engineering Economics</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18GBME87</td>
<td>Entrepreneurship Development</td>
<td>3 0 0 3</td>
<td></td>
</tr>
</tbody>
</table>

### LIST OF HUMANITIES AND SOCIAL SCIENCES ELECTIVE COURSES

<table>
<thead>
<tr>
<th>Code No.</th>
<th>Course</th>
<th>Hours / Week</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>18HS101</td>
<td>English</td>
<td>2 0 0 2</td>
<td></td>
</tr>
<tr>
<td>18HL101</td>
<td>English Lab</td>
<td>0 0 2 1</td>
<td></td>
</tr>
<tr>
<td>18MC201</td>
<td>Constitution of India</td>
<td>- - - 0</td>
<td></td>
</tr>
<tr>
<td>18NSS255</td>
<td>NSS</td>
<td>2 0 0 2</td>
<td></td>
</tr>
<tr>
<td>18MCE401</td>
<td>Environmental Science and Engineering</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18MCE402</td>
<td>Yoga</td>
<td>0 0 2 1</td>
<td></td>
</tr>
</tbody>
</table>
# B.E. - MECHANICAL ENGINEERING CURRICULUM

## LIST OF BASIC SCIENCE COURSES

<table>
<thead>
<tr>
<th>Code No.</th>
<th>Course</th>
<th>Hours / Week</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>18BS101</td>
<td>Physics (Introduction to Electromagnetic Theory)</td>
<td>3 1 0 4</td>
<td></td>
</tr>
<tr>
<td>18BS102</td>
<td>Mathematics – I (Calculus and Linear Algebra)</td>
<td>3 1 0 4</td>
<td></td>
</tr>
<tr>
<td>18BS201</td>
<td>Chemistry</td>
<td>3 1 0 4</td>
<td></td>
</tr>
<tr>
<td>18BS202</td>
<td>Mathematics – II</td>
<td>3 1 0 4</td>
<td></td>
</tr>
<tr>
<td>18BS302</td>
<td>Mathematics III</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18BS402</td>
<td>Mathematics IV</td>
<td>3 0 0 3</td>
<td></td>
</tr>
</tbody>
</table>

## LIST OF ENGINEERING COURSE

<table>
<thead>
<tr>
<th>Code No.</th>
<th>Course</th>
<th>Hours / Week</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>18ESME101</td>
<td>Basic Electrical Engineering</td>
<td>3 1 0 4</td>
<td></td>
</tr>
<tr>
<td>18ESME102</td>
<td>Engineering Graphics &amp; Design</td>
<td>1 0 4 3</td>
<td></td>
</tr>
<tr>
<td>18ELME101</td>
<td>Electrical Engineering Lab</td>
<td>0 0 2 1</td>
<td></td>
</tr>
<tr>
<td>18ESME201</td>
<td>Programming for Problem Solving</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18ELME201</td>
<td>Programming for problem solving Lab</td>
<td>0 0 4 2</td>
<td></td>
</tr>
<tr>
<td>18ESME202</td>
<td>Manufacturing Practices Lab</td>
<td>1 0 4 3</td>
<td></td>
</tr>
<tr>
<td>18ESME301</td>
<td>Electrical Drives and Control</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>18ESME401</td>
<td>Strength of Materials</td>
<td>3 0 0 3</td>
<td></td>
</tr>
</tbody>
</table>

## LIST OF EMPLOYABILITY ENHANCEMENT COURSES (EEC)

<table>
<thead>
<tr>
<th>Code No.</th>
<th>Course</th>
<th>Hours / Week</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>18SUPD31</td>
<td>Personality Development I</td>
<td>2 0 0 2</td>
<td></td>
</tr>
<tr>
<td>18SUPD41</td>
<td>Personality Development II</td>
<td>2 0 0 2</td>
<td></td>
</tr>
<tr>
<td>18SUPD51</td>
<td>Personality Development III</td>
<td>2 0 0 2</td>
<td></td>
</tr>
<tr>
<td>18SUPD61</td>
<td>Personality Development IV</td>
<td>2 0 0 2</td>
<td></td>
</tr>
<tr>
<td>18ECME301</td>
<td>Industrial Safety</td>
<td>2 0 0 2</td>
<td></td>
</tr>
<tr>
<td>18ECME501</td>
<td>Industrial Visit</td>
<td>0 0 0 0</td>
<td></td>
</tr>
<tr>
<td>18ECME601</td>
<td>Internship</td>
<td>0 0 2 1</td>
<td></td>
</tr>
<tr>
<td>18PRME701</td>
<td>Project Phase I</td>
<td>0 0 16 5</td>
<td></td>
</tr>
<tr>
<td>18PRME801</td>
<td>Project Phase II</td>
<td>0 0 16 8</td>
<td></td>
</tr>
<tr>
<td>Course Code</td>
<td>Definitions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------</td>
<td>-------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>Lecture</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>Tutorial</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>Practical</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Credits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BSC</td>
<td>Basic Science Courses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ESC</td>
<td>Engineering Science Courses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HSMC</td>
<td>Humanities and Social Sciences including Management courses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PCC</td>
<td>Professional core courses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PEC</td>
<td>Professional Elective courses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OEC</td>
<td>Open Elective courses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LC</td>
<td>Laboratory course</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MC</td>
<td>Mandatory courses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PROJ</td>
<td>Project</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CA</td>
<td>Continuous Assessment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SEE</td>
<td>Semester End Examination</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### B.E. - MECHANICAL ENGINEERING

### SUMMARY OF CURRICULUM COMPONENTS

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Subject Area</th>
<th>Credits Per Semester</th>
<th>Credits Total</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>I II III IV V VI VII VIII</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Humanities and Social Sciences Courses</td>
<td>3 - - 4 - - 2 - -</td>
<td>9</td>
<td>5.3</td>
</tr>
<tr>
<td>2</td>
<td>Basic Science Courses</td>
<td>10 10 3 3 - - - -</td>
<td>26</td>
<td>15.3</td>
</tr>
<tr>
<td>3</td>
<td>Engineering Courses</td>
<td>8 8 3 3 - - - -</td>
<td>22</td>
<td>13.0</td>
</tr>
<tr>
<td>4</td>
<td>Employability Enhancement Courses</td>
<td>- - 4 2 2 3 5 8</td>
<td>24</td>
<td>14.0</td>
</tr>
<tr>
<td>5</td>
<td>Professional Elective Courses</td>
<td>- - - - 3 6 9 3</td>
<td>21</td>
<td>12.4</td>
</tr>
<tr>
<td>6</td>
<td>Open Elective Courses</td>
<td>- - - - 3 3 3 6</td>
<td>15</td>
<td>9.0</td>
</tr>
<tr>
<td>7</td>
<td>Professional Core Courses</td>
<td>- - 14 12 15 11 1 -</td>
<td>53</td>
<td>31.0</td>
</tr>
<tr>
<td>8</td>
<td>Mandatory Courses</td>
<td>- - - - - - - -</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>21 18 24 24 23 23 20 17</td>
<td>170</td>
<td></td>
</tr>
</tbody>
</table>
COURSE OBJECTIVE:

- To acquire ability to speak effectively in real life situations.
- To write letters and reports effectively in formal and business situations.
- To develop listening skills for academic and professional purposes.
- To gain effective speaking and listening skills in communication.
- To develop the soft skills and interpersonal skills to excel in their career.
- To enhance the performance of students at Placement Interviews, Group Discussions and other recruitment procedures.

UNIT I  VOCABULARY BUILDING
General Vocabulary – Nouns- Compound nouns, Word borrowing & Word making, Foreign machinery in English, Dictionary and Thesaurus usages, Synonyms, Antonyms, Prefixes and Suffixes, Homonyms, Homographs and Homophones, Changing words from one form to another, Acronyms and Abbreviations.

UNIT II  BASIC WRITING
Sentences structures – Kinds of sentences, Types of sentences, Clauses and Phrases, Punctuations, Word Links and Connectives, Summarizing, Precise writing, Paragraph Writing.

UNIT III  IDENTIFYING COMMON ERRORS IN ENGLISH
Articles, Prepositions, Subject-verb Agreement, Pronouns - Relative pronouns, Demonstrative pronouns, Misplaced Modifiers, Redundancies, Clichés, Infinitives& Gerund

UNIT IV  NATURE AND STYLE OF SENSIBLE WRITING
Describing people, place and situations, Process description, Definitions, Numerical Expressions, Information Transfer- Flow chart Bar chart and Pie chart, Checklists, Writing introduction and conclusion.

UNIT V  WRITING PRACTICES

TOTAL: 50 Hours

COURSE OUTCOMES:

After successful completion of the Technical English course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Improve the language proficiency of a technical under-graduate in English with emphasis on General Vocabulary, Dictionary and Thesaurus usages, Synonyms, Antonyms</td>
<td>K6</td>
</tr>
<tr>
<td>CO2</td>
<td>Develop sentences, Clauses and Phrases, Punctuations</td>
<td>K6</td>
</tr>
<tr>
<td>CO3</td>
<td>Acquire the ability to write Articles, Prepositions, Subject-verb Agreement, Pronouns</td>
<td>K5</td>
</tr>
<tr>
<td>CO4</td>
<td>Provide learning environment to practice Information Transfer- Flow chart Bar chart and Pie chart, Checklists, Writing introduction and conclusion.</td>
<td>K6</td>
</tr>
</tbody>
</table>
TEXT BOOKS:


REFERENCE BOOKS:


COURSE OBJECTIVE:

➢ To learn the basics of Ultrasonic, Lasers, Fiber optics and applications, Quantum physics and crystal physics etc., and to apply these fundamental principles to solve practical problems related to materials used for engineering applications.

UNIT I   Electrostatics in vacuum
Coulomb's inverse square law, Super position principle – Gauss theorem and its application (intensity at a point due to charged sphere and cylinder), Laplace's and Poisson's equations for electrostatic potential- uniqueness theorem, potential difference – equipotential surface-potential at a point due to a point charge.

UNIT II   Electrostatics in a linear dielectric medium
Electric dipole- potential energy of a dipole – Electric field due to an electric dipole (axial point and equatorial line)- dielectric- dielectric constant- Electric susceptibility - Types of polarization- point charge at centre of dielectric sphere in uniform magnetic field- Lorentz method- Clausius Mosotti equation.

UNIT III  Magneto-statics in a linear magnetic medium
Bio-Savart law - magnetic induction at a point due to a straight conductor carrying current – magnetic field at centre of a circular coil carrying current- Ampere’s circuital law-Field along the axis of a circular coil and solenoid. Intensity of magnetisation - Magnetic susceptibility - Magnetic permeability - Classification of magnetic material - Domain theory of ferromagnetism – BH curve.

UNIT IV   Faraday's law and Maxwell's equation
Faraday's law - Differential form of Faraday's law – Self and mutual inductance- Self-inductance of a long solenoid- Experimental determination of self-inductance (Rayleigh’s method) and mutual inductance- Continuity equation for current densities; Modifying equation for the curl of magnetic field to satisfy continuity equation– Displacement current - Maxwell’s equations and their derivation – Physical significance of Maxwell's equation.

UNIT V   Electromagnetic waves
The wave equation - Plane electromagnetic waves in vacuum, their transverse nature - Relation between electric and magnetic fields of an electromagnetic wave -Energy carried by electromagnetic waves–Hertz experiment: production and detection of electromagnetic wave - Reflection and transmission of electromagnetic waves at normal incidence.

TOTAL: 45 Hours
COURSE OUTCOMES:
After successful completion of the physics course, the student will be able to

<table>
<thead>
<tr>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1 Apply the fundamental principles to solve practical problems related to materials used for engineering applications and Formulate general mechanics parameters and distinguish between central and non-central forces.</td>
<td>K3</td>
</tr>
<tr>
<td>CO2 Learn the basics of Electrostatics in a linear dielectric medium</td>
<td>K2</td>
</tr>
<tr>
<td>CO3 Explain types of waves and interference of light and Derive thermodynamic parameters and apply fundamental laws to solve thermodynamic problems</td>
<td>K2</td>
</tr>
<tr>
<td>CO4 Differentiate between the terms atomic number, atomic mass, isotopes, etc. and apply various rules such as rules, octet rules, and Bohr’s energy levels. Know about Faraday’s law and Maxwell’s equation</td>
<td>K4</td>
</tr>
<tr>
<td>CO5 Categorize The wave equation - Plane electromagnetic waves in vacuum, their transverse nature - Relation between electric and magnetic fields of an electromagnetic wave depletion and acid rain.</td>
<td>K4</td>
</tr>
</tbody>
</table>

TEXT / REFERENCE BOOKS:
1. David Griffiths, Introduction to Electrodynamics
2. Halliday and Resnick, Physics
3. W. Saslow, Electricity, magnetism and light
COURSE OBJECTIVE:

- The objective of this course is to familiarize the prospective engineers with techniques in calculus and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

UNIT I Calculus 12
Evolutes and involutes - Evaluation of definite and improper integrals - Beta and Gamma functions and their properties.

UNIT II Calculus 12
Rolle’s Theorem, Mean value theorems, Taylor’s and Maclaurin theorems with remainders-indeterminate forms and L'Hospital’s rule.

UNIT III Sequences and series 12
Convergence of sequence and series, tests for convergence- Power series, Taylor's series, series for exponential, trigonometric and logarithm functions.

UNIT IV Multivariable Calculus (Differentiation) 12
Limit, continuity and partial derivatives, directional derivatives, total derivative- Tangent plane and normal line- Maxima, minima and saddle points- Method of Lagrange multipliers.

UNIT V Matrices 12
Introduction to matrix and rank of a matrix-System of linear equations- Symmetric, skew-symmetric and orthogonal matrices-Eigenvalues and eigenvectors- Diagonalization of matrices-Cayley-Hamilton Theorem, and Orthogonal transformation.

TOTAL: 60 Hours

COURSE OUTCOMES:

After successful completion of the Mathematics – I course, the student will be able to

CO COURSE OUTCOME STATEMENTS KNOWLEDGE LEVEL

CO1 To introduce the idea of applying definite and improper integrals - Beta and Gamma functions and their properties. K3

CO2 To introduce the fallouts of Rolle’s Theorem that is fundamental to application of analysis to Engineering problems. K5

CO3 To develop the tool of power series Convergence of sequence and series, tests for convergence-.Power series, Taylor’s series, series for exponential, trigonometric and logarithm functions. K5

CO4 To familiarize the student with functions of Limit, continuity and partial derivatives, directional derivatives, total derivative K4
To develop the essential tool of matrices in engineering.

**TEXT BOOKS:**

**REFERENCE BOOKS:**
COURSE OBJECTIVE:

- To provide exposure to the students of basic electrical engineering.

UNIT I  
DC Circuits  

UNIT II  
AC Circuits  
Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT III  
Transformers  

UNIT IV  
Electrical Machines & Power Converters  

UNIT V  
Electrical Installations  
Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

TOTAL: 60 Hours

COURSE OUTCOMES:

After successful completion of the Basic Electrical Engineering course, the student will be able to:

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Explain the basics of DC electrical circuits and measurements.</td>
<td>K5</td>
</tr>
<tr>
<td>CO2</td>
<td>Understand the Ohm's and Kirchhoff's Laws</td>
<td>K2</td>
</tr>
<tr>
<td>CO3</td>
<td>Explain the basics of semiconductor devices and applications</td>
<td>K5</td>
</tr>
<tr>
<td>CO4</td>
<td>Understand the principle and develop design of construction of single phase motors and three phase induction motors.</td>
<td>K6</td>
</tr>
<tr>
<td>CO5</td>
<td>Explain the Three phase balanced circuits, voltage and current relations in star and delta connections.</td>
<td>K5</td>
</tr>
</tbody>
</table>
TEXT / REFERENCES:
COURSE OBJECTIVE:

- To develop in students, graphic skills for communication of concepts, ideas and design of engineering products.
- To expose them to existing national standards related to technical drawings.

CONCEPTS AND CONVENTIONS (Not for Examination)
Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I  INTRODUCTION TO ENGINEERING DRAWING AND PLANE CURVES  12

UNIT II  PROJECTION OF POINTS, LINES AND PLANE SURFACES  12
Projection of points and straight lines located in the first quadrant – Determination of true lengths and true inclinations – Projection of polygonal surface and circular lamina inclined to both reference planes - Auxiliary Planes.

UNIT III  PROJECTION OF SOLIDS  12
Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method - Auxiliary Views.

UNIT IV  SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES  12
Sectioning of above solids in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other – Obtaining true shape of section - Auxiliary Views. Development of lateral surfaces of simple and truncated solids – Prisms, pyramids, cylinders and cones – Development of lateral surfaces of solids with cylindrical cutouts, perpendicular to the axis.

UNIT V  ORTHOGRAPHIC PROJECTION AND ISOMETRIC PROJECTION  12

TOTAL: 60 Hours
COURSE OUTCOMES:
After successful completion of the Engineering Graphics course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Understand the theory of projection and plane curves</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Improve their visualization skills so that they can apply these skills in developing</td>
<td>K6</td>
</tr>
<tr>
<td></td>
<td>points, lines and plane surfaces</td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>Able to prepare the simple projection of solids</td>
<td>K2</td>
</tr>
<tr>
<td>CO4</td>
<td>Understand the various concepts section of solids and development of surfaces.</td>
<td>K2</td>
</tr>
<tr>
<td>CO5</td>
<td>Impart the knowledge for understanding and drawing of orthographic projection and isometric</td>
<td>K2</td>
</tr>
<tr>
<td></td>
<td>projection and isometric projection depletion and acid rain.</td>
<td></td>
</tr>
</tbody>
</table>

TEXT BOOKS:

REFERENCES:

Publication of Bureau of Indian Standards:

Special points applicable to University Examinations on Engineering Graphics:
1. There will be five questions, each of either-or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. Whenever the total number of candidates in a college exceeds 150, the University Examination in that college will be conducted in two sessions (FN and AN on the same day) for 50 percent of student (approx) at a time.
COURSE OBJECTIVE:
➢ To study and understand the basic physics concepts and study the young's modulus of the uniform and non uniform bending of the materials.

LIST OF EXPERIMENTS

1. Deflection magnetometer – Tan A position
2. Deflection magnetometer – Tan B position
3. Copper voltameter - Determination of BH
4. Carey Foster Bridge – Determination of specific resistance of unknown coil
5. Potentiometer – EMF of thermocouple
6. Potentiometer - Calibration of Ammeter
7. Potentiometer - Calibration of Low range voltmeter
8. Potentiometer - Calibration of High range voltmeter
9. Deflection magnetometer - Field along the axis of a circular coil- Determination of BH
10. Ballistic Galvanometer – Internal resistance of a cell

TOTAL: 45 Hours

COURSE OUTCOMES:
After successful completion of the Engineering Physics Laboratory course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Ability to Design and Conduct experiments Deflection magnetometer – Tan A and B position</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Copper voltameter - Determination of BH and specific resistance of unknown coil</td>
<td>K6</td>
</tr>
<tr>
<td>CO3</td>
<td>Potentiometer EMF of thermocouple</td>
<td>K2</td>
</tr>
<tr>
<td>CO4</td>
<td>Understand Potentiometer - Calibration of Low range voltmeter Calibration of High range voltmeter</td>
<td>K2</td>
</tr>
<tr>
<td>CO5</td>
<td>Understand Deflection magnetometer, Field along the axis of a circular coil-Determination of BH Ballistic Galvanometer and Internal resistance of a cell</td>
<td>K2</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVE:
- To provide exposure to the students with hands on experience on various basic engineering practices in Electrical Engineering.

List of Laboratory Experiments/Demonstrations:
3. Resonance in R-L-C circuits.
4. Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
5. Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents).
6. Load Characteristics of a DC Motor
7. Torque - Slip Characteristic of an Induction motor
8. Three phase induction motors - Direction reversal by change of phase-sequence of connections.
9. Demonstration of DC-DC converter.
10. Demonstration of DC-AC converter.
11. Demonstration of AC-DC converter.

TOTAL: 30 Hours

COURSE OUTCOMES:
After successful completion of the Electrical Engineering Laboratory course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Measure of instruments, voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors</td>
<td>K3</td>
</tr>
<tr>
<td>CO2</td>
<td>Discover transformer measurement of primary and secondary voltages and currents, and power</td>
<td>K4</td>
</tr>
<tr>
<td>CO3</td>
<td>Measure performance characteristics of DC generators and three-phase induction motors</td>
<td>K4</td>
</tr>
<tr>
<td>CO4</td>
<td>Perform three phase induction motors</td>
<td>K3</td>
</tr>
<tr>
<td>CO5</td>
<td>Design the experiments for of DC-DC converter</td>
<td>K3</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVE:
 To gain effective speaking and listening skills in communication.
 To develop the soft skills and interpersonal skills to excel in their job.
 To enhance the performance of students at Placement Interviews, Group Discussions and other recruitment exercises.

ORAL COMMUNICATION
(This unit involves interactive practice sessions in Language Lab)
Listening comprehensions, Pronunciation, Phonology, Intonation, Stress and Rhythm, Situational Dialogues, Communication in workplace, Interviews, Seminar, Formal Presentations, Group Discussions, Debates, JAM sessions

TOTAL: 40 Hours

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

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Improve the listening capability</td>
<td>K6</td>
</tr>
<tr>
<td>CO2</td>
<td>Get the writing capability through the practices.</td>
<td>K3</td>
</tr>
<tr>
<td>CO3</td>
<td>Use strong vocabulary and fluency like foreigners.</td>
<td>K3</td>
</tr>
<tr>
<td>CO4</td>
<td>Prepare their own resume in professional method.</td>
<td>K3</td>
</tr>
<tr>
<td>CO5</td>
<td>Understand the Structure of presentation and the tools available in the point presentation.</td>
<td>K2</td>
</tr>
</tbody>
</table>

TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVE:

➢ To learn about the molecular orbitals, ionic interactions and periodic properties.
➢ Rationalise periodic properties such as ionization potential, electro negativity, oxidation states and electro negativity.
➢ List major chemical reactions that are used in the synthesis of molecules.

UNIT I  Atomic and molecular structure, Intermolecular forces and potential energy surfaces

UNIT II  Spectroscopic techniques and applications

UNIT III  Use of free energy in chemical equilibria

UNIT IV  Periodic Properties
Variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries.

UNIT V  Organic reactions and synthesis of a drug molecule
Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

Total: 60 Hours
**COURSE OUTCOMES:**

After successful completion of the Engineering Chemistry course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Analyze microscopic chemistry in terms of atomic and molecular orbital's and intermolecular forces.</td>
<td>K4</td>
</tr>
<tr>
<td>CO2</td>
<td>Rationalise Spectroscopic techniques and applications.</td>
<td>K3</td>
</tr>
<tr>
<td>CO3</td>
<td>Function of Thermodynamic energy, entropy and free energy. Estimations of entropy and free energy</td>
<td>K4</td>
</tr>
<tr>
<td>CO4</td>
<td>Understand Variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies</td>
<td>K2</td>
</tr>
<tr>
<td>CO5</td>
<td>Able to understand Organic reactions and synthesis of a drug molecule</td>
<td>K2</td>
</tr>
</tbody>
</table>

**TEXT BOOKS:**


**REFERENCE BOOKS:**

COURSE OBJECTIVE:

- The objective of this course is to familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations and complex variables. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

UNIT I  Multivariable Calculus (Integration)  12
Multiple Integration: Double integrals (Cartesian)-change of order of integration in double integrals-Change of variables(Cartesian to polar)- Triple integrals(Cartesian)-orthogonal curvilinear coordinates- Green ,Gauss and Stokes theorems (statement only)-Simple problems.

UNIT II  First order ordinary differential equations  12
Exact, linear and Bernoulli’s equations, Euler’s equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut’s type.

UNIT III  Ordinary differential equations of higher orders  12
Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials.

UNIT IV  Complex Variable–Differentiation  12
Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.

UNIT V  Complex Variable–Integration  12
Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof)-Taylor's series, zeros of analytic functions, singularities, Laurent’s series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine.

TOTAL:  60 Hours
**COURSE OUTCOMES:**

After successful completion of the Mathematics – II course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Introduce the idea of evaluating integral calculus to improper integrals</td>
<td>K5</td>
</tr>
<tr>
<td>CO2</td>
<td>Understanding of Differential equations in engineering</td>
<td>K2</td>
</tr>
<tr>
<td>CO3</td>
<td>Develop the ordinary differential equation for learning advanced Engineering Mathematics</td>
<td>K6</td>
</tr>
<tr>
<td>CO4</td>
<td>Familiarize the student with functions of several variables that is essential in most branches of engineering.</td>
<td>K4</td>
</tr>
<tr>
<td>CO5</td>
<td>Develop the essential tool of complex variable (Integration) in engineering.</td>
<td>K6</td>
</tr>
</tbody>
</table>

**TEXT / REFERENCE BOOKS:**

COURSE OBJECTIVE:
- To understand the basic concepts of programming – Flow chart, Pseudo code.
- To learn the fundamentals of C programming - declarations, operators, expressions and control statements.
- To learn the manipulation of strings, functions, pointers and file operations.
- To understand the concepts of arrays, basic sorting and searching algorithms.
- To find the order of time complexity of basic algorithms.

UNIT I Introduction to Programming
Introduction to Programming (Flow chart/pseudo code, compilation etc.), Variables (including data types) -Arithmetic expressions and precedence, Conditional Branching and Loops -Writing and evaluation of conditional statements and consequent branching - Iteration and loops.

UNIT II Arrays and Basic Algorithms
Arrays (1-D, 2-D), Character arrays and Strings, Searching, Basic Sorting Algorithms, Finding roots of equations, Notion of order of time complexity through example programs.

UNIT III Function and Pointers
Functions (including using built in libraries), Parameter passing in functions, call by value, passing arrays to functions: idea of call by reference, Recursion with example programs such as Finding Factorial, Fibonacci series, etc. Pointers - Defining pointers, Use of Pointers in self-referential structures.

UNIT IV Structures and Unions

UNIT V String Functions and Files
Strings - library string functions, pointers in strings, pointers and function arguments, Files - file Operations, processing a file, Preprocessor directives, use of type def, Command line arguments, Enumerated data types.

TOTAL: 45 Hours

COURSE OUTCOME:
After successful completion of the Programming for Problem Solving course, the student will be able to

CO COURSE OUTCOME STATEMENTS KNOWLEDGE LEVEL
CO1 Understand the principles of algorithm, flowchart and pseudo code K2
CO2 Find the order of time Arrays and Basic Algorithms. K1
CO3 Write programs involving control instructions, arrays, structures and unions. K2
CO4 Use string manipulations, and to write Structures and Unions K4
CO5 Explain file operations in ‘C’ programming. K5


TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVE:

- The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering.
- The students will learn to:
  - Estimate rate constants of reactions from concentration of reactants/products as a function of time.
  - Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc.
  - Synthesize a small drug molecule and analyse a salt sample.

Choice of 10-12 experiments from the following

1. Determination of surface tension and viscosity
2. Thin layer chromatography
3. Ion exchange column for removal of hardness of water
4. Determination of chloride content of water
5. Colligative properties using freezing point depression
6. Determination of the rate constant of a reaction
7. Determination of cell constant and conductance of solutions
8. Potentiometry - determination of redox potentials and emfs
9. Synthesis of a polymer/drug
10. Saponification/acid value of an oil
11. Chemical analysis of a salt
12. Lattice structures and packing of spheres
13. Models of potential energy surfaces
14. Chemical oscillations- Iodine clock reaction
15. Determination of the partition coefficient of a substance between two immiscible liquids.
16. Adsorption of acetic acid by charcoal
17. Use of the capillary viscosimeters to demonstrate the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of engineering.

TOTAL: 45 Hours

LABORATORY OUTCOME:

After successful completion of the chemistry lab course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Understand to Find of surface tension and viscosity of hardness of water</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Students understand chromatography and find chloride content of water</td>
<td>K2</td>
</tr>
<tr>
<td>CO3</td>
<td>Students will know to estimate the rate constants of reactions, freezing point depression and partial coefficient of immiscible liquids.</td>
<td>K4</td>
</tr>
<tr>
<td>CO4</td>
<td>Students to Synthesize a small drug molecule and analyze a salt sample.</td>
<td>K4</td>
</tr>
</tbody>
</table>
Determine viscosity and partition coefficient of a substance.

**TEXT BOOKS:**

**REFERENCE BOOKS:**
COURSE OBJECTIVE:
➢ To design and develop C Programs for various applications

LIST OF EXPERIMENTS:
1. Familiarization with programming environment
2. Simple computational problems using arithmetic expressions
3. Problems involving if-then-else structures
4. Iterative problems
5. 1D Array manipulation
6. Matrix problems
7. String operations
8. Simple functions
9. Solving Numerical methods problems
10. Recursive functions
11. Pointers and structures
12. File operations

TOTAL: 45 Hours

COURSE OUTCOME:
After successful completion of the programming for problem solving lab course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Familiarize with the Programming Environment</td>
<td>K1</td>
</tr>
<tr>
<td>CO2</td>
<td>Develop programs using various control instructions and operator precedence in C Programming.</td>
<td>K6</td>
</tr>
<tr>
<td>CO3</td>
<td>Implement string manipulations, arrays and functions for various applications in C.</td>
<td>K3</td>
</tr>
<tr>
<td>CO4</td>
<td>Analyze the use of structures, unions and pointers in C.</td>
<td>K4</td>
</tr>
<tr>
<td>CO5</td>
<td>Handle various file operations in C.</td>
<td>K3</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVE:
- To study bench fitting drawings for making male and female fittings as per the given dimensions and Tolerances.
- To study Arc welding drawings for making common weld joints as per the given dimensions.
- To study sheet metal development drawings for making common metal parts/components as per the given dimensions.

Part A: Workshop/Manufacturing Practices [L : 1; T:0; P : 0 (1 credit)]

Detailed contents:
1. Manufacturing Methods - casting, forming, machining, joining, advanced manufacturing methods (3 lectures)
2. CNC machining, Additive manufacturing (1 lecture)
3. Fitting operations & power tools (1 lecture)
4. Electrical & Electronics (1 lecture)
5. Carpentry (1 lecture)
6. Plastic moulding, glass cutting (1 lecture)
7. Metal casting (1 lecture)
8. Welding (arc welding & gas welding), brazing (1 lecture)

Lectures & videos: (10 hours)

Part B: Workshop Practice: [L : 0; T:0 ; P : 4 (2 credits)]
1. Machine shop (10 hours)
   - To make Facing and plain turning, step turning, drilling in the lathe

2. Fitting shop (8 hours)
   - To make square, V joint in bench fitting as per the given dimension and tolerances

3. Carpentry (6 hours)
   - To make half lap joint, dovetail, TEE Lap joint

4. Electrical & Electronics (8 hours)
   i. To make fluorescent lamp wiring.
   ii. To make stair case wiring.
   iii. To make residential wiring.
   iv. To measure Peak-peak, rms, period, frequency using CRO.
   v. To solder components devices and circuits by using general purpose PCB.

5. Welding shop (8 hours (Arc welding 4 hrs + gas welding 4 hrs))
   - To make single, butt, lap and T fillet joint by arc welding with the back hand and fore hand welding techniques as per the given dimensions.
6. Plumbing Works  
- Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
- Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.

7. Sheet Metal Work  
- To make simple Dust pan, Rectangular trays in sheet metal with the jigs as per the given dimensions.

TOTAL:  60 Hours

COURSE OUTCOMES:
After successful completion of the Engineering Practices Laboratory course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Familiarity with different types of woods used and tools used in wood Working technology</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Developments of sheet metal jobs from GI sheets, knowledge of basic concepts of soldering</td>
<td>K3</td>
</tr>
<tr>
<td>CO3</td>
<td>Familiarity with different types of tools used in fitting technology.</td>
<td>K2</td>
</tr>
<tr>
<td>CO4</td>
<td>Utilize the hands-on experience in basic appliances of Electrical &amp; Electronics</td>
<td>K3</td>
</tr>
<tr>
<td>CO5</td>
<td>Basic Engineering Practices such as welding in single, butt, lap and T fillet joint by arc welding</td>
<td>K3</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVE:
- The purpose of the course is to acquaint the students with basic principles of the Constitution of India and its working.

UNIT I  NATURE, OBJECT AND SCOPE OF THE CONSTITUTION  6

UNIT II  FUNDAMENTAL RIGHTS  6

UNIT III  DIRECTIVE PRINCIPLES OF STATE POLICY AND FUNDAMENTAL DUTIES  6

UNIT IV  FEDERAL STRUCTURE  6
Federal Structure – Distribution of Legislative and Financial Powers between the Union and the States – Parliamentary Form of Government in India – Constituent Powers and Status of the President of India.

UNIT V  AMENDMENT AND EMERGENCY PROVISIONS  6

TOTAL: 30 Hours

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

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Understand the historical perspective of the Constitution of India and Meaning of the constitution law</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Know the Fundamental Rights and Fundamental Duties and its legal status</td>
<td>K2</td>
</tr>
<tr>
<td>CO3</td>
<td>Understand the Federal structure and distribution of legislative and financial powers between the Union and the States</td>
<td>K2</td>
</tr>
<tr>
<td>CO4</td>
<td>To Know the Parliamentary Form of Government in India; The constitution powers and status of the President of India</td>
<td>K2</td>
</tr>
<tr>
<td>CO5</td>
<td>Understand the Emergency Provisions of National Emergency, President Rule, and Financial Emergency</td>
<td>K2</td>
</tr>
</tbody>
</table>

REFERENCE BOOKS:
1. V.N. Shukla, Constitutional Law of India
2. D.D. Basu, Commentary on the Constitution of India
3. J.N. Pandey, Constitution of India
4. V.D. Mahajan, Constitutional Law of India.
COURSE OBJECTIVE:
➢ To understand Fourier series representation of periodic signals. The analysis of signal is far more convenient in the frequency domain.

UNIT I  FOURIER SERIES  12
Dirichlet’s conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Parseval’s identity – Harmonic Analysis.

UNIT II  FOURIER TRANSFORM  12

UNIT III  PARTIAL DIFFERENTIAL EQUATIONS  12
Formation of partial differential equations - singular integrals- Solutions of standard types of first order partial differential equations – Lagrange’s linear equation - Linear partial differential equations of second and higher order with constant coefficients of homogeneous functions.

UNIT IV  APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS  12
Classification PDE-Method of separation of variables – One dimensional wave and heat equation – Steady state solution of two-dimensional heat equation (square plate only).

UNIT V  Z-TRANSFORM AND DIFFERENCE EQUATIONS  12

TOTAL: 60 Hours

COURSE OUTCOME:
After successful completion of the Mathematics - III course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Construct the Fourier series to solve the initial and boundary value problems</td>
<td>K3</td>
</tr>
<tr>
<td>CO2</td>
<td>Formulate Fourier Sine and Cosine transforms</td>
<td>K6</td>
</tr>
<tr>
<td>CO3</td>
<td>Evaluate the partial difference equations.</td>
<td>K5</td>
</tr>
<tr>
<td>CO4</td>
<td>solve one dimensional and two-dimensional wave equation – One dimensional equation of heat conduction</td>
<td>K6</td>
</tr>
<tr>
<td>CO5</td>
<td>Analyze the Elementary properties Z-transform and difference equations</td>
<td>K4</td>
</tr>
</tbody>
</table>
TEXT BOOKS:

REFERENCE BOOKS:
COURSE OBJECTIVE:
- To familiarize the students to understand the fundamentals of thermodynamics and to perform thermal analysis on their behavior and performance. (Use of Standard and approved Steam Table, Mollier Chart, Compressibility Chart and Psychrometric Chart permitted)

UNIT I BASIC CONCEPT AND FIRST LAW
Basic concepts - concept of continuum, macroscopic approach, thermodynamic systems - closed, open and isolated. Property, state, path and process, quasi-static process, work, modes of work, Zeroth law of thermodynamics – concept of temperature and heat, Concept of ideal and real gases, First law of thermodynamics – application to closed and open systems, internal energy, specific heat capacities, enthalpy, steady flow process with reference to various thermal equipments.

UNIT II SECOND LAW AND ENTROPY
Second law of thermodynamics – Kelvin’s and Clausius statements of second law, Reversibility and irreversibility. Carnot theorem, Carnot cycle, reversed carnot cycle, efficiency, COP, Thermodynamic temperature scale, Clausius inequality, concept of entropy, entropy of ideal gas, principle of increase of entropy.

UNIT III THERMODYNAMIC AVAILABILITY

UNIT IV PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE

UNIT V PSYCHROMETRY
*(Use of standard thermodynamic tables, Mollier diagram, Psychrometric chart and refrigerant property tables are permitted)*

TOTAL: 45 Hours
COURSE OUTCOME:
After successful completion of the Engineering Thermodynamics course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Understand the fundamentals of the first and second laws of thermodynamics and their application.</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Solving the problems in Carnot cycle, Clausius equality.</td>
<td>K6</td>
</tr>
<tr>
<td>CO3</td>
<td>Formulate the steady flow energy equation in non-flow processes and apply it to solve the problems in steady flow processes.</td>
<td>K6</td>
</tr>
<tr>
<td>CO4</td>
<td>Analyzing the properties of pure substance and calculation of work done and heat transfer in steam power cycles.</td>
<td>K4</td>
</tr>
<tr>
<td>CO5</td>
<td>Evaluate the property calculations of air vapour mixtures.</td>
<td>K5</td>
</tr>
</tbody>
</table>

TEXT BOOKS:

REFERENCES:
1. Yunus A angel and Michael Boleo, Thermodynamics an Engineering Approach.
COURSE OBJECTIVE:

➢ To understand the basic concepts of different types of electrical machines and their performance.
➢ To study the different methods of starting D.C motors and induction motors.
➢ To study the conventional and solid-state drives.

UNIT I INTRODUCTION 9
Fundamentals of electric drives – advances of electric drive-characteristics of loads – different types of mechanical loads – choice of an electric drive – control circuit components: Fuses, switches, circuit breakers, contactors, Relay – control transformers.

UNIT II SPEED CONTROL OF DC MACHINES 9

UNIT III SPEED CONTROL OF AC MACHINES 9
Induction motor – Speed torque Characteristics – pole changing, stator frequency variation - slip-ring induction motor – stator voltage variation - Rotor resistance variation, slip power recovery – basic inverter circuits- variable voltage frequency control.

UNIT IV MOTOR STARTERS AND CONTROLLERS 9

UNIT V HEATING AND POWER RATING OF DRIVE MOTORS 9
Load diagram, over load capacity, insulating materials, heating and cooling of motors, service condition of electric drive – continuous, intermittent and short time – industrial application.

TOTAL: 45 Hours

COURSE OUTCOMES:
After successful completion of the Electrical Drives and Control course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Understand the various electrical drives and their controls.</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Create the thyristor bridge rectifier circuits- chopper circuits for DC motor.</td>
<td>K6</td>
</tr>
<tr>
<td>CO3</td>
<td>Understand the speed control of ac machines</td>
<td>K2</td>
</tr>
<tr>
<td>CO4</td>
<td>Discuss the DC motor starters and controllers.</td>
<td>K6</td>
</tr>
<tr>
<td>CO5</td>
<td>Explain the heating and power rating of drive motors in industrial application</td>
<td>K5</td>
</tr>
</tbody>
</table>
TEXT BOOKS:

REFERENCE BOOKS:
COURSE OBJECTIVE:

At the end of this course the student should be able to understand the vectorial and scalar representation of forces and moments, static equilibrium of particles and rigid bodies both in two dimensions and also in three dimensions. Further, he should understand the principle of work and energy. He should be able to comprehend the effect of friction on equilibrium. He should be able to understand the laws of motion, the kinematics of motion and the interrelationship. He should also be able to write the dynamic equilibrium equation. All these should be achieved both conceptually and through solved examples.

UNIT I  BASICS AND STATICS OF PARTICLES  12

UNIT II  EQUILIBRIUM OF RIGID BODIES  12

UNIT III  PROPERTIES OF SURFACES AND SOLIDS  12

UNIT IV  DYNAMICS OF PARTICLES  12

UNIT V  FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS  12

TOTAL: 60 Hours
COURSE OUTCOMES:
After successful completion of the Engineering Mechanics course, the students have the ability to:

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Solve engineering problems dealing with force, displacement, velocity and acceleration.</td>
<td>K6</td>
</tr>
<tr>
<td>CO2</td>
<td>Evaluate problems on equilibrium of rigid bodies</td>
<td>K5</td>
</tr>
<tr>
<td>CO3</td>
<td>Determine the areas and volumes of surface and solids</td>
<td>K5</td>
</tr>
<tr>
<td>CO4</td>
<td>Explain dynamics of particles and their relationships between motions</td>
<td>K5</td>
</tr>
<tr>
<td>CO5</td>
<td>Analyze friction and elements of rigid body dynamics</td>
<td>K4</td>
</tr>
</tbody>
</table>

TEXT BOOKS:

REFERENCE BOOKS:
COURSE OBJECTIVE:
➢ To introduce the concepts of basic manufacturing processes and fabrication techniques, such as metal casting, metal joining, metal forming and manufacture of plastic components.

UNIT I  METAL CASTING PROCESSES  12

UNIT II  METAL JOINING PROCESSES  12

UNIT III  BULK DEFORMATION PROCESSES  12

UNIT IV  SHEET METAL PROCESSES  12

UNIT V  MANUFACTURING OF PLASTIC COMPONENTS  12

TOTAL: 60 Hours
**COURSE OUTCOMES:**
After successful completion of the Production Technology course, the student will be able to

<table>
<thead>
<tr>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1 Understand the concept and basic mechanics of metal cutting process</td>
<td>K2</td>
</tr>
<tr>
<td>CO2 Construct and working principle of center lathe and special purpose lathe</td>
<td>K6</td>
</tr>
<tr>
<td>CO3 Develop knowledge about reciprocating machine tools and milling machines for various machining operations</td>
<td>K3</td>
</tr>
<tr>
<td>CO4 Create the constructive knowledge in surface finishing process</td>
<td>K6</td>
</tr>
<tr>
<td>CO5 Understand the concept and working principle of various sawing machines, broaching and various gear cutting machines</td>
<td>K2</td>
</tr>
</tbody>
</table>

**TEXT BOOKS:**

**REFERENCE BOOKS:**
18PCME304  ENGINEERING MATERIALS AND METALLURGY  L  T  P  C
3  0  0  3

COURSE OBJECTIVE:
- To impart knowledge on the structure, properties, treatment, testing and applications of metals and non-metallic materials so as to identify and select suitable materials for various engineering applications.

UNIT I  ALLOYS AND PHASE DIAGRAMS  8

UNIT II  HEAT TREATMENT  10

UNIT III  FERROUS AND NON-FERROUS METALS  9

UNIT IV  NON-METALLIC MATERIALS  9
Polymers – types of polymer, commodity and engineering polymers – Properties and applications of various thermosetting and thermoplastic polymers (PP, PS, PVC, PMMA, PET, PC, PA, ABS, PI, PAI, PPO, PPS, PEEK, PTFE, Polymers – Urea and Phenol formaldehydes)-Engineering Ceramics – Properties and applications of Al2O3, SiC, Si3N4, PSZ and SIALON – Composites-Classifications- Metal Matrix and FRP - Applications of Composites.

UNIT V  MECHANICAL PROPERTIES AND DEFORMATION MECHANISMS  9

TOTAL: 45 Hours
COURSE OUTCOMES:
After successful completion of the Engineering Materials and Metallurgy course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Understand constitutions of alloys and its metallurgical studies.</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Classify types of heat treatment process and tests.</td>
<td>K2</td>
</tr>
<tr>
<td>CO3</td>
<td>Compare various types of ferrous and non-ferrous metals.</td>
<td>K4</td>
</tr>
<tr>
<td>CO4</td>
<td>Improve knowledge about non-metallic materials and composites.</td>
<td>K6</td>
</tr>
<tr>
<td>CO5</td>
<td>Understand the various testing methods</td>
<td>K2</td>
</tr>
</tbody>
</table>

TEXT BOOKS:

REFERENCE BOOKS:
COURSE OBJECTIVE:
- To develop skill to use software to create 2D and 3D models.

INTRODUCTION
Introduction to machine components and interpret drawings of machine components so as to prepare assembly drawing either manually and using standard CAD packages.

DRAWING STANDARDS

2-D DRAWINGS

CAD PRACTICE (USING APPLICATION PACKAGES)
Drawing, Editing, Dimensioning, Plotting Commands, Layering Concepts, Hatching, Detailing, Assembly, Basic principles of GD&T (geometric dimensioning & tolerancing).

ASSEMBLY DRAWING (MANUAL & USING APPLICATION PACKAGES)
Making free hand sketches of typical subassemblies-Plummer block, Screw jack, Lathe Tailstock, Universal Joint-Machine Vice-Stuffing Box-safety Valves-rolling element bearings, keyed joints, cotter joints, C clamp.

TOTAL: 45 Hours

COURSE OUTCOMES:
After successful completion of the Computer aided Machine Design Laboratory course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Discuss the code of practices and standard for engineering drawing</td>
<td>K6</td>
</tr>
<tr>
<td>CO2</td>
<td>Construct both 2-D of any components using Auto CAD software.</td>
<td>K6</td>
</tr>
<tr>
<td>CO3</td>
<td>Construct assemblies such as vice, screw jack and tailstock of the lathe, etc. from the concepts learned using drafting software and create the different wireframe primitives using parametric representations</td>
<td>K6</td>
</tr>
<tr>
<td>CO4</td>
<td>Apply geometric transformations on the created wireframe, surface and solid models.</td>
<td>K3</td>
</tr>
<tr>
<td>CO5</td>
<td>Understand the contemporary computer design tools for aerospace and mechanical engineers. Evaluate the validity of the sketch for later operations.</td>
<td>K2</td>
</tr>
</tbody>
</table>
TEXT BOOKS:

REFERENCE BOOKS:
COURSE OBJECTIVE:
➢ To Study and practice the various operations that can be performed in lathe, shaper, drilling, milling machines etc. and to equip with the practical knowledge required in the core industries.

LIST OF EXPERIMENTS
1. Assembly of core and cavity
2. Assembly of die and punch
3. Machining an internal keyway using slotting machine
4. Shaping round to square
5. Surface grinding
6. Keyway milling
7. Drilling and tapping
8. Turning and cylindrical grinding

TOTAL: 45 Hours

LIST OF EQUIPMENT
1. Center lathe - 14 Nos.
2. Capstan lathe - 01 No.
3. Turret lathe - 01 No.
4. Pillar type drilling machine - 01 No.
5. Radial drilling machine - 01 No.
6. Shaper - 02 Nos.
7. Surface grinding machine - 01 No.
11. Slotting machine - 01 No.

COURSE OUTCOMES:
After successful completion of the Manufacturing Technology Laboratory course, the student will be able to

CO1 Understanding the Mechanics of metal cutting & Machining Operations K2
CO2 Understand the concept of shaper machines and its functions and Study the drilling operations performed in different types of drilling machine and its applications. K2
CO3 Improve the knowledge of various milling machines and operations K6
CO4 Study and construction details of different types of machines used in manufacturing process K6
CO5 Develop a methodology and establish a manufacturing sequence to fabricate engineering components. K3
COURSE OBJECTIVE:
➢ To improve the interpersonal skills, soft skills, effective team player and analyze strength and weakness to meet their professional career.

UNIT I  SOFT SKILLS I 6
Introduction to Personality Development – Meaning-Features of personality-Dimensions of Personality - Determinants of Personality-Features and Traits- Components of self concept- Barriers-Self analysis.

UNIT II  SOFT SKILLS II 6
Importance of Soft Skills – First Impression-Work Place requirements-Discipline-Cleanliness-Hygiene-general Appearance--Building Confidence—Concept of Thinking and Usage-Value of Time-Focus & Commitment.

UNIT III  SOFT SKILLS IN ACTION 6

UNIT IV  SELF AWARENESS AND SELF ESTEEM 6

UNIT V  SELF MOTIVATION 6

Total: 30 Hours

COURSE OUTCOMES:
After successful completion of the Personality Development I course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Develop the soft skills through personality features and get rid of barriers.</td>
<td>K3</td>
</tr>
<tr>
<td>CO2</td>
<td>Build the basic characters such as cleanliness, hygiene and appearance.</td>
<td>K3</td>
</tr>
<tr>
<td>CO3</td>
<td>Creating the soft skills in disciplinary actions.</td>
<td>K6</td>
</tr>
<tr>
<td>CO4</td>
<td>Understand the concept of self awareness and self esteem</td>
<td>K2</td>
</tr>
<tr>
<td>CO5</td>
<td>Adapt Familiar with the self motivation</td>
<td>K6</td>
</tr>
</tbody>
</table>

REFERENCES:
3. Emotion, motivation and Self regulation - Nathan C. Hall, McGill University, Canada, Thomas Goetz, University of Konstanz, Germany.
COURSE OBJECTIVE:
- To provide the necessary basic concepts of safety in the industrial environment
- To enable the students to learn about various functions and activities of safety department.
- To have knowledge about sources of information for safety promotion and training.
- To familiarize students with evaluation of safety performance in manufacturing environment.

UNIT I  SAFETY IN METAL WORKING MACHINERY AND WOOD WORKING MACHINES  6
General safety rules, principles, maintenance, Inspections of turning machines, boring machines, milling machine, planning machine and grinding machines, CNC machines.

UNIT II  PRINCIPLES OF MACHINE GUARDING  6
Guarding during maintenance, Zero Mechanical State (ZMS), Definition, Policy for ZMS – guarding of hazards - point of operation protective devices, machine guarding, types, fixed guard, interlock guard, automatic guard, trip guard, electron eye, positional control guard, fixed guard fencing- guard construction- guard opening Selection and suitability: lathe-drilling-boring-milling -grinding-shaping

UNIT III  SAFETY IN WELDING AND GAS CUTTING  6
Gas welding and oxygen cutting, resistances welding, arc welding and cutting, common hazards, personal protective equipment, training, safety precautions in brazing, soldering and metalizing – leak detection-pipe line safety-storage and handling of gas cylinders.

UNIT IV  SAFETY IN COLD FARMING AND HOT WORKING OF METALS  6
Cold working, power presses, point of operation safe guarding, auxiliary mechanisms, feeding and cutting mechanism, hand or foot-operated presses, power press electric controls.
Hot working safety in forging, hot rolling mill operation, safe guards in hot rolling mills Safety in gas furnace operation.

UNIT V  SAFETY IN FINISHING, INSPECTION AND TESTING  6
Heat treatment operations, electro plating, sand and shot blasting, safety in inspection and testing, dynamic balancing, hydro testing
Health and welfare measures in engineering industry-pollution control in engineering industry-industrial waste disposal.

TOTAL: 30 Hours
COURSE OUTCOMES:
After successful completion of the Industrial Safety course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Discuss the safety rules, Maintenance, Inspection of various equipment’s in machine shop.</td>
<td>K6</td>
</tr>
<tr>
<td>CO2</td>
<td>Discuss the importance of protective devices and various machine guarding components.</td>
<td>K6</td>
</tr>
<tr>
<td>CO3</td>
<td>Recommend the safety precautions of various welding processes such as arc, gas, resistance welding, brazing and soldering.</td>
<td>K5</td>
</tr>
<tr>
<td>CO4</td>
<td>Elaborate the functions of the safety in cold forming and hot working of metals.</td>
<td>K6</td>
</tr>
<tr>
<td>CO5</td>
<td>Applying the safety measures during heat treatment operations. Learn the measures of pollution control and waste disposal.</td>
<td>K3</td>
</tr>
</tbody>
</table>

REFERENCE BOOKS:

5. Indian Boiler acts and Regulations, Government of India.
COURSE OBJECTIVE:
- The objective is to provide the necessary basic concepts of a few statistical and numerical methods familiar with the procedures for solving numerically different kinds of problems occurring in engineering.

UNIT I  Testing of Hypothesis  12
Sampling distributions – Large samples – Tests for single mean, Proportion, Difference of means

UNIT II  Correlation and Regression Analysis  12

UNIT III  Solution of Equations  12

UNIT IV  Interpolation, Numerical Differentiation and Numerical Integration  12

UNIT V  NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS  12

TOTAL: 60 Hours

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

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Understanding the sampling methods based on normal distribution for mean and variances in statistics</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Improve the working knowledge in numerical techniques with some of the underpinning theoretical ideas</td>
<td>K6</td>
</tr>
<tr>
<td>CO3</td>
<td>Prove results for numerical root finding by applying an appropriate numerical methods</td>
<td>K5</td>
</tr>
<tr>
<td>CO4</td>
<td>Perform an error analysis for a given numerical method</td>
<td>K4</td>
</tr>
<tr>
<td>CO5</td>
<td>Solve a linear system of equation using an appropriate numerical methods</td>
<td>K6</td>
</tr>
</tbody>
</table>
TEXT BOOKS:


REFERENCE BOOKS:


18ESME401

COURSE OBJECTIVE:

- To understand the stresses developed in bars, compounds bars, beams, shafts, cylinders and spheres.

UNIT I  STRESS, STRAIN AND DEFORMATION OF SOLIDS

Rigid and Deformable bodies – Strength, Stiffness and Stability – Stresses; Tensile, Compressive and Shear – Deformation of simple and compound bars under axial load – Thermal stress – Elastic constants – Strain energy and unit strain energy – Strain energy in uniaxial loads.

UNIT II  BEAMS - LOADS AND STRESSES

Types of beams: Supports and Loads – Shear force and Bending Moment in beams – Cantilever, Simply supported and Overhanging beams – Stresses in beams – Theory of simple bending – Stress variation along the length and in the beam section – Effect of shape of beam section on stress induced – Shear stresses in beams – Shear flow.

UNIT III  TORSION


UNIT IV  BEAM DEFLECTION


UNIT V  ANALYSIS OF STRESSES IN TWO DIMENSIONS

Biaxial state of stresses – Thin cylindrical and spherical shells – Deformation in thin cylindrical and spherical shells – Biaxial stresses at a point – Stresses on inclined plane – Principal planes and stresses – Mohr’s circle for biaxial stresses – Maximum shear stress - Strain energy in bending and torsion.

TOTAL: 45 Hours
COURSE OUTCOMES:
After successful completion of the Strength of Materials course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Analyze the rigid bodies and deformable solids response when subjected to different stresses and measure the strain and the relationship of stress and strain.</td>
<td>K4</td>
</tr>
<tr>
<td>CO2</td>
<td>Analyze the different types of beam response when subjected to different types of loads, shear stresses and evaluation of shear force and bending moment diagram.</td>
<td>K4</td>
</tr>
<tr>
<td>CO3</td>
<td>Determine the different types of shaft and spring response when subjected to torsion forces axially and design of helical coil spring, analysis of deflection and stresses.</td>
<td>K5</td>
</tr>
<tr>
<td>CO4</td>
<td>Evaluation of beam deflection and slope using different mathematical methods and column subjected to different end conditions.</td>
<td>K5</td>
</tr>
<tr>
<td>CO5</td>
<td>Analyses of stresses in two dimensions of thin cylindrical and spherical shells and solve stresses at a point and inclined planes.</td>
<td>K4</td>
</tr>
</tbody>
</table>

TEXT BOOKS:

REFERENCE BOOKS:
COURSE OBJECTIVE:
- The main objective of this course is to provide wider and depth knowledge to the students in machine tools cutting methodology of various manufacturing machines.

UNIT I  THEORY OF METAL CUTTING  12

UNIT II  CENTRE LATHE AND SPECIAL PURPOSE LATHES  12
Centre lathe, constructional features, cutting tools, various operations, taper turning methods, thread cutting methods, special attachments, machining time and power estimation. Capstan and turret lathes – automatic lathes: semi automatic, automats – single spindle : cutting off, swiss type, automatic screw type – multi spindle; cutting off, bar type.

UNIT III  RECIPROCATING AND MILLING MACHINES  12
Reciprocating machine tools: shaper, planer, slotter; milling: types, milling cutters, operations; hole making: drilling, reaming, boring, tapping.

UNIT IV  SURFACE FINISHING PROCESSES  12

UNIT V  SAWING, BROACHING AND GEAR CUTTING  12

TOTAL: 60 Hours

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

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Understand the concept and basic mechanics of metal cutting process</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Construct and working principle of center lathe and special purpose lathe</td>
<td>K6</td>
</tr>
<tr>
<td>CO3</td>
<td>Develop knowledge about reciprocating machine tools and milling machines for various machining operations</td>
<td>K3</td>
</tr>
<tr>
<td>CO4</td>
<td>Create the constructive knowledge in surface finishing process</td>
<td>K6</td>
</tr>
<tr>
<td>CO5</td>
<td>Understand the concept and working principle of various sawing machines, broaching and various gear cutting machines</td>
<td>K2</td>
</tr>
</tbody>
</table>
**TEXT BOOKS:**

**REFERENCE BOOKS:**
COURSE OBJECTIVE:
- To understand the basic components and layout of linkages in the assembly of a system / machine.
- To understand the principles in analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism.
- To understand the motion resulting from a specified set of linkages, design few linkage mechanisms and cam mechanisms for specified output motions.
- To understand the basic concepts of toothed gearing and kinematics of gear trains and the effects of friction in motion transmission and in machine components.

UNIT I BASICS OF MECHANISMS

UNIT II KINEMATICS OF LINKAGE MECHANISMS

UNIT III KINEMATICS OF CAM MECHANISMS

UNIT IV GEARs AND GEAR TRAINs

UNIT V FRICTION

TOTAL: 45 Hours
COURSE OUTCOMES:
After successful completion of the kinematics of machinery course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Understand the principles of kinematic pairs, chains and their classification, DOF, inversions, and basics of mechanisms.</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Analyze the planar mechanisms for position, velocity and acceleration.</td>
<td>K4</td>
</tr>
<tr>
<td>CO3</td>
<td>Design and synthesize the cam mechanism for specified kinematic conditions.</td>
<td>K6</td>
</tr>
<tr>
<td>CO4</td>
<td>Explain the basic concepts of toothed gearing and kinematics of gear trains</td>
<td>K5</td>
</tr>
<tr>
<td>CO5</td>
<td>Solving the Problems related with friction and its applications in machine elements like belt and rope drives, brakes and clutches</td>
<td>K6</td>
</tr>
</tbody>
</table>

TEXT BOOKS:

REFERENCE BOOKS:
COURSE OBJECTIVE:
The applications of the conservation laws to flow through pipes and hydraulic machines are studied
- To understand the importance of dimensional analysis.
- To understand the importance of various types of flow in pumps and turbines.

UNIT I  INTRODUCTION
Units & Dimensions. Properties of fluids – Specific gravity, specific weight, viscosity, compressibility, vapour pressure and gas laws – capillarity and surface tension. Flow characteristics: concepts of system and control volume. Application of control volume to continuity equation, energy equation, momentum equation and moment of momentum equation.

UNIT II  FLOW THROUGH CIRCULAR CONDUITS
Laminar flow through circular conduits and circular annuli, Boundary layer concepts, Boundary layer thickness. Hydraulic and energy gradient, Darcy – Weisbach equation, Friction factor and Moody diagram, Commercial pipes, Minor losses, Flow through pipes in series and in parallel.

UNIT III  DIMENSIONAL ANALYSIS
Dimension and units: Buckingham’s π theorem, Discussion on dimensionless parameters, Models and similitude, Applications of dimensionless parameters.

UNIT IV  ROTO DYNAMIC MACHINES
Homologus units, Specific speed, Elementary cascade theory, Theory of turbo machines, Euler’s equation, Hydraulic efficiency, Velocity components at the entry and exit of the rotor. Velocity triangle for single stage radial flow and axial flow machines, Centrifugal pumps, turbines, performance curves for pumps and turbines.

UNIT V  POSITIVE DISPLACEMENT MACHINES
Positive displacement pumps and classification of pumps, Reciprocating pumps, characteristics of reciprocating pump, Indicator diagrams, Work saved by air vessels. Rotary pumps, Classification, Working and performance curves.

TOTAL: 45 Hours

COURSE OUTCOMES:
After successful completion of the Fluid Mechanics and Machinery course, the student will be able to

<table>
<thead>
<tr>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1 Understand and apply the basic concepts of Fluid Mechanics to carry out professional engineering activities</td>
<td>K2</td>
</tr>
<tr>
<td>CO2 Understand the major and minor losses in flow through circular conduits.</td>
<td>K2</td>
</tr>
<tr>
<td>CO3 Plan and carry out dimensional analysis, similitude and model analysis in accordance with the relevant specific technology</td>
<td>K3</td>
</tr>
</tbody>
</table>
CO4 Estimate the conservation laws to flow through pipes and hydraulic machines and the importance of various types of flow in pumps and turbines.

CO5 Apply and study the basic concepts of pumps, air vessels and its performance curves.

TEXT BOOKS:

REFERENCE BOOKS:
COURSE OBJECTIVE:

- To inculcate the importance of environmental pollution, preservation of nature and environmental management for human welfare.
- The student is expected to understand what constitutes the environment, what precious resources in the environment are, how to conserve these resources, what is the role of a human being in maintaining a clean environment and useful environment for the future generations and how to maintain ecological balance and preserve bio-diversity.
- The role of government and non-governmental organization in environmental management.

UNIT I  ENVIRONMENT, ECOSYSTEM AND BIODIVERSITY


Field Study of Common Plants, Insects and Birds. Field study of simple ecosystems - pond, river, hill slopes, etc.

UNIT II  ENVIRONMENTAL POLLUTION

Definition – Causes, Effects and Control Measures of (A) Air Pollution (B) Water Pollution (C) Soil Pollution (D) Marine Pollution (E) Noise Pollution (F) Thermal Pollution (G) Nuclear Hazards – Solid Waste Management: Causes, Effects and Control Measures of municipal solid wastes – Role of an Individual in Prevention of Pollution – Pollution Case Studies – disaster Management - Floods, Earthquake, Cyclone and Landslides.

Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III  NATURAL RESOURCES


Field study of local area to document environmental assets – river / forest / grassland / hill /
 UNIT IV  SOCIAL ISSUES AND THE ENVIRONMENT  

 UNIT V  HUMAN POPULATION AND THE ENVIRONMENT  

TOTAL: 30 Hours

COURSE OUTCOME
At the end of this course, the Student will be able to

<table>
<thead>
<tr>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1 Understand the concept of ecosystem, biodiversity, constitutes the environment and the precious resources available and how to conserve natural resources and the relationship between living and non living things and ethics</td>
<td>K2</td>
</tr>
<tr>
<td>CO2 Analyze the different types of pollution and their causes, effect and control measures and the role of a human being in maintaining a clean environment exposure.</td>
<td>K4</td>
</tr>
<tr>
<td>CO3 Analyze the uses of available natural resources and the effect of over exploitation and deforestation, equitable use of resources for sustainable development and role of individual for conservation of resources.</td>
<td>K4</td>
</tr>
<tr>
<td>CO4 Create awareness; understand the role of non-governmental organization for sustainable development and their importance, effects and the different laws for environmental protection.</td>
<td>K6</td>
</tr>
<tr>
<td>CO5 Create awareness about human population in worldwide and their causes effect and role of information technology on control measures for sustainable lifestyle.</td>
<td>K6</td>
</tr>
</tbody>
</table>

TEXT BOOKS:
1. De AK, Environmental Chemistry, Wiley Eastern Ltd.

REFERENCE BOOKS:
COURSE OBJECTIVE:
➢ To improve the leadership quality, team management, quantitative analyzing knowledge, ordering, sequencing and logical thinking knowledge to meet their professional career.

UNIT I SOFT SKILLS III
Basic Etiquette – Email etiquette – Business etiquette – Telephone etiquette – Meeting etiquette – Adjustment of Role & Leadership – Team Management & Development.

UNIT II QUANTITATIVE APTITUDE I

UNIT III QUANTITATIVE APTITUDE II
Mensuration Clocks and Calendars- Boats-Simple Interest –Compound Interest- Fractions and Decimals – Square roots – Functions.

UNIT IV ANALYTICAL PROBLEMS

UNIT V LOGICAL PROBLEMS

TOTAL: 30 Hours

COURSE OUTCOMES:
After successful completion of the Personality Development II course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Develop the soft skills and basic etiquette</td>
<td>K6</td>
</tr>
<tr>
<td>CO2</td>
<td>Develop the quantitative aptitude skills</td>
<td>K6</td>
</tr>
<tr>
<td>CO3</td>
<td>Build the advanced aptitude skills</td>
<td>K6</td>
</tr>
<tr>
<td>CO4</td>
<td>Adapt Familiar with the analytical problem solving skills</td>
<td>K6</td>
</tr>
<tr>
<td>CO5</td>
<td>Build the knowledge on logical problem solving skills</td>
<td>K6</td>
</tr>
</tbody>
</table>

REFERENCE BOOKS:
1. Personality Enrichment--K R Dhanalakshmi And N S Raghunathan, Margham Publications
2. Personality Development --Dr V M Selvaraj Bhavani Publications
3. Quantitative Aptitude – R. S Aggarwal
4. Logical and Analytical Reasoning (English) 30th Edition – A.K Gupta
FLUID MECHANICS

COURSE OBJECTIVE:
- Upon completion of this subject, the students will be able to have hands-on experience in flow measurements using different devices and also perform calculations related to losses in pipes and also perform characteristic study of pumps, turbines etc.
- After completion of this laboratory, the students will be able to use measurement equipment for flow measurement and they can ability to do performance tests on different fluid machinery.

LIST OF EXPERIMENTS
1. Calibration of Flow Measuring instruments – venturimeter, orifice meter, rotometer,
2. Calibration of flows in open channels – weirs and notches.
3. Estimation of friction factor in flow through pipes.
4. Determination of performance characteristics of pumps – centrifugal pumps, submersible pumps, turbine pumps and positive displacement pumps and reciprocating and gear pumps.
5. Determination of performance characteristics of turbines – reaction turbines and impulse turbines.

TOTAL: 45 Hours

COURSE OUTCOMES:
After successful completion of the Fluid Mechanics and Strength of Materials Laboratory course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Understanding of the fundamental principles of mechanics of materials and determining the strength of materials under externally applied loads</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Analyzing deflection test on beams and compression test on helical springs and measure deformations, forces, and strains under a variety of loading conditions, including tension, compression, bending.</td>
<td>K4</td>
</tr>
<tr>
<td>CO3</td>
<td>Understand fluid mechanics system, especially in flow measurements using different devices.</td>
<td>K2</td>
</tr>
<tr>
<td>CO4</td>
<td>Determine the fluid coefficient of discharge of giving Orifice and Venturi meter. Conduct the experiments and draw characteristic curves of centrifugal and reciprocating pumps.</td>
<td>K5</td>
</tr>
<tr>
<td>CO5</td>
<td>Experiment with efficiency and characteristic curves of Francis and Kaplan turbines.</td>
<td>K3</td>
</tr>
</tbody>
</table>
STRENGTH OF MATERIALS

COURSE OBJECTIVE:

- To supplement the theoretical knowledge gained in Mechanics of Solids with practical testing for determining the strength of materials under externally applied loads. This would enable the student to have a clear understanding of the design for strength and stiffness.

LIST OF EXPERIMENTS

1. Tension test on mild steel rod.
2. Double shear test on metals.
3. Torsion test on mild steel rod.
4. Impact test on metal specimen.
5. Hardness test on metals.
6. Compression test on helical spring.
7. Deflection test on carriage spring.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the Fluid Mechanics and Strength of Materials Laboratory course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Understanding of the fundamental principles of mechanics of materials and determining the strength of materials under externally applied loads</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Analyzing deflection test on beams and compression test on helical springs and Measure deformations, forces, and strains under a variety of loading conditions, including tension, compression, bending.</td>
<td>K4</td>
</tr>
<tr>
<td>CO3</td>
<td>Understand fluid mechanics system, especially in flow measurements using different devices.</td>
<td>K2</td>
</tr>
<tr>
<td>CO4</td>
<td>Determine the fluid coefficient of discharge of giving Orifice and Venturi meter. Conduct the experiments and draw characteristic curves of centrifugal and reciprocating pumps.</td>
<td>K5</td>
</tr>
<tr>
<td>CO5</td>
<td>Experiment with efficiency and characteristic curves of Francis and Kaplan turbines.</td>
<td>K3</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVE:
- To supplement the principles learnt in kinematics and dynamics of machinery.
- To understand how certain measuring devices are used for dynamic testing.

STUDY EXPERIMENT

1. Study the Four bar chain mechanism
2. Study the Single slider crank mechanism
3. Study of Gear Mechanism

LIST OF EXPERIMENTS

1. Governors - Determination of sensitivity, effort, etc. for Watt, Porter, Proell, Hartnell governors
2. Cam - Study of jump phenomenon and drawing profile of the cam.
5. Balancing of reciprocating masses.
8. Vibrating system - spring mass system - Determination of damping co-efficient of single degree of freedom system.
10. Determination of transmissibility ratio - vibrating table.
11. Determination of torsional frequencies for compound pendulum and flywheel system with lumped Moment of inertia.

TOTAL: 45 Hours

LIST OF EQUIPMENTS (For a batch of 30 students)

1. Cam analyzer.
2. Motorised gyroscope.
5. Dynamic balancing machine.
6. Static and dynamic balancing machine.
7. Vibrating table
8. Vibration test facilities apparatus
COURSE OUTCOMES:
After successful completion of the Dynamics Laboratory course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Understand the principles of kinematic and dynamic behavior of machine parts, Analyze how certain measuring devices are used for dynamic testing.</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Determine the effect of unbalances resulting from rotary motions.</td>
<td>K5</td>
</tr>
<tr>
<td>CO3</td>
<td>Understand vibrations in single and multi degree of freedom system</td>
<td>K2</td>
</tr>
<tr>
<td>CO4</td>
<td>Understand working principle of the governor /gyroscope and demonstrate the effect of forces and moments on their motion, Evaluate cutting forces acting on machine elements using a dynamometer</td>
<td>K4</td>
</tr>
<tr>
<td>CO5</td>
<td>Analyze moment of inertia by an oscillation method for connecting rod and flywheel, Understand determination of torsional frequencies for compound pendulum and flywheel system with lumped Moment of inertia.</td>
<td>K5</td>
</tr>
</tbody>
</table>
OBJECTIVE:
Providing value education to improve the students’ character - understanding of principled life and physical health - maintaining youthfulness - measures and methods in five aspects of life

UNIT I  PHYSICAL HEALTH

UNIT II  LIFE FORCE
1. Reasons for Diseases - Natural reasons (Genetic / imprints, Planetary Position, Natural calamities and climatic changes) - Unnatural reasons (Food habits, Thoughts, Deeds)
3. Maintaining youthfulness : Postponing old age - Transformation of food into seven components - Importance of sexual vital fluid –

UNIT III  MENTAL HEALTH
1) Mental Frequencies - Beta, Alpha, Theta and Delta wave - Agna Meditation explanation - benefits.
2) Shanthi Meditation explanation - Benefits
3) Thuriya Meditation explanation - Benefits
4) Benefits of Blessing - Self blessing (Auto suggestion) - Family blessing - Blessing the others - World blessing - Divine protection

UNIT IV  VALUES
- Human Values:
  1) Self control - Self confidence - Honesty
  2) Contentment - Humility - Modesty
  3) Tolerance - Adjustment - Sacrifice - Forgiveness
  4) Purity (Body, Dress, Environment) - Physical purity - Mental purity - Spiritual purity

- Social Values:
  1) Non violence - Service
  2) Patriotism - Equality
  3) Respect for parents and elders - care and protection - Respect for teacher
  4) Punctuality - Time Management

UNIT V  MORALITY (VIRTUES)
1) Importance of Introspection - I - Mine (Ego, Possessiveness),
3) Maneuvering of Six Temperaments - Contentment - Tolerance - Charity - Chastity - Equality - Pardon (Forgiveness).
4) Five essential Qualities acquired through Meditation: Perspicacity - Magnanimity - Receptivity - Adaptability – Creativity.
5) Improved Memory Power - Success in the Examination.

**TOTAL: 30 Hours**

**COURSE OUTCOMES:**

After successful completion of the Basic Life Skills course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>Course Outcome Statements</th>
<th>Knowledge Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Understand youth empowerment through Yoga.</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Improve and Maintaining youthfulness through Kayakalpa practice</td>
<td>K6</td>
</tr>
<tr>
<td>CO3</td>
<td>Understand the concept of negative and positive energies</td>
<td>K2</td>
</tr>
<tr>
<td>CO4</td>
<td>Examine human values and social values principles for success in life.</td>
<td>K4</td>
</tr>
<tr>
<td>CO5</td>
<td>Importance of Introspection stress and its impact on individual behavior and the techniques to manage them</td>
<td>K5</td>
</tr>
</tbody>
</table>

**REFERENCE BOOKS:**

4. Rev.Dr.G.U.pope, 2016, Thirukkural, Giri Trading Agency,
7. Iyengar, B.K.S. 2008, Light on Yoga, Noida, UP India, Harber Collins Publishing India Ltd.,
CO1 Understand the basic concepts, elements of metrology and types of errors in measuring instruments  

CO2 Develop students’ knowledge on various linear and angular Metrological equipment’s available to measure the dimension of the components.
CO3 Improve students' knowledge on the correct procedure to be adopted to measure the dimension of the components with help from measuring instruments

CO4 Describes the advancements in metrology like laser interferometer and demonstrate CMM

CO5 Analysis the flow, power and temperature measurements by using metrology equipment’s

**TEXT BOOKS:**

**REFERENCES:**
COURSE OBJECTIVE:

➢ To gain knowledge on the principles and procedure for the design of Mechanical power transmission components.
➢ To understand the standard procedure available for Design of Transmission of Mechanical elements.
➢ To learn to use standard data and catalogues.

UNIT I  STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS  9

UNIT II  DESIGN OF SHAFTS AND COUPLINGS  9
Design of solid and hollow shafts based on strength, rigidity and critical speed – Design of keys and key ways - Design of rigid and flexible couplings – Introduction to gear and shock absorbing couplings - design of knuckle joints.

UNIT III  DESIGN OF FASTENERS AND WELDED JOINTS  9
Threaded fasteners - Design of bolted joints including eccentric loading – Design of welded joints for pressure vessels and structures - theory of bonded joints.

UNIT IV  DESIGN OF SPRINGS AND LEVERS  9
Design of helical, leaf, disc and torsional springs under constant loads and varying loads – Concentric torsion springs – Belleville springs – Design of Levers.

UNIT V  DESIGN OF BEARINGS AND FLYWHEELS  9
Design of bearings – sliding contact and rolling contact types – Cubic mean load – Design of journal bearings – Mckees equation – Lubrication in journal bearings – calculation of bearing dimensions – Design of flywheels involving stresses in rim and arm.

TOTAL: 45 Hours

Note: (Use of P S G Design Data Book is permitted in the University examination)

COURSE OUTCOMES:
After successful completion of the Dynamics of Machinery course, the student will be able to understand
<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Design of steady stresses and variable stresses in machine members</td>
<td>K6</td>
</tr>
<tr>
<td>CO2</td>
<td>Design of shafts and couplings</td>
<td>K6</td>
</tr>
<tr>
<td>CO3</td>
<td>Design of fasteners and welded joints</td>
<td>K6</td>
</tr>
<tr>
<td>CO4</td>
<td>Design of springs and levers</td>
<td>K6</td>
</tr>
<tr>
<td>CO5</td>
<td>Design of bearings and energy storing elements</td>
<td>K6</td>
</tr>
</tbody>
</table>

**TEXT BOOKS:**

**REFERENCES:**
COURSE OBJECTIVE:

- To understand the force-motion relationship in components subjected to external forces and analysis of standard mechanisms.
- To understand the undesirable effects of unbalances resulting from prescribed motions in mechanism.
- To understand the effect of Dynamics of undesirable vibrations.
- To understand the principles in mechanisms used for speed control and stability control.

UNIT I  FORCE ANALYSIS


UNIT II  BALANCING

Static and dynamic balancing - Balancing of rotating masses - Balancing a single cylinder Engine - Balancing Multi-cylinder Engines - Partial balancing in locomotive Engines - Balancing linkages - balancing machines.

UNIT III  FREE VIBRATION

Basic features of vibratory systems - idealized models - Basic elements and lumping of parameters - Degrees of freedom - Single degree of freedom - Free vibration - Equations of motion - natural frequency - Types of Damping - Damped vibration critical speeds of simple shaft - Torsional systems; Natural frequency of two and three rotor systems.

UNIT IV  FORCED VIBRATION


UNIT V  MECHANISMS FOR CONTROL


TOTAL: 60 Hours

COURSE OUTCOMES:

After successful completion of the Design of Machine Elements course, the student will be able to

CO1  Determine the rigid body dynamics and the principle of superposition.
CO2  Analyze static and dynamic balancing and balancing of rotating masses  
K4

CO3  Classify features of vibratory systems, degrees of freedom and equations of motions  
K2

CO4  Determine the harmonic forcing and forcing caused by unbalance and understand force transmissibility and amplitude transmissibility.  
K5

CO5  Classify the governors and analyze its mechanisms and gyroscopes.  
K2

TEXT BOOK:

REFERENCES:
COURSE OBJECTIVE:
➢ To expose the learner to the fundamentals of hydraulic and pneumatic power control and their circuits with industrial applications

UNIT I  FLUID POWER SYSTEMS AND FUNDAMENTALS  12

UNIT II  HYDRAULIC SYSTEM & COMPONENTS  12

UNIT III  HYDRAULIC CONTROL AND CIRCUITS  12

UNIT IV  PNEUMATIC CONTROL AND CIRCUITS  12

UNIT V  SERVO SYSTEMS, FLUIDICS AND FLUID POWER TROUBLE SHOOTING  12
Servo systems – Hydro Mechanical servo systems, Electro hydraulic servo systems and proportional valves, Fluidics – Introduction to fluidic devices, simple circuits, Introduction to Electro Hydraulic Pneumatic logic circuits, ladder diagrams, PLC applications in fluid power control. Fluid power circuits; failure and troubleshooting.

TOTAL: 60 Hours
COURSE OUTCOMES:
After successful completion of the Applied Hydraulics and Pneumatics course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Discuss properties of fluid and fluid power systems. Understand the concepts of fluid statics and dynamics applied to commercial and industrial applications.</td>
<td>K6</td>
</tr>
<tr>
<td>CO2</td>
<td>Discuss the hydraulic system and components. Study and understand the operations, applications, and maintenance of common fluid power components such as pumps, cylinders, motors, rotary actuators</td>
<td>K6</td>
</tr>
<tr>
<td>CO3</td>
<td>Functions of control valves and circuits. Understand electrical controls, relays, solenoids, accumulator, Intensifier and application circuits</td>
<td>K4</td>
</tr>
<tr>
<td>CO4</td>
<td>Understand the Pneumatic components such as Compressor, FRL and valves and its functions. Design of various circuits such as synchronizing, sequence and Electro pneumatic circuits.</td>
<td>K2</td>
</tr>
<tr>
<td>CO5</td>
<td>Discuss the servo system and fluid power trouble shooting. Demonstrate application of fluid power in Electro Hydraulic Pneumatic logic circuits and construction of ladder diagrams pneumatic control and PLC applications.</td>
<td>K6</td>
</tr>
</tbody>
</table>

TEXT BOOKS:

REFERENCE BOOKS:
COURSE OBJECTIVE:
➢ To improve the verbal aptitude, Speech Mechanism, Sentence Stress knowledge, Personality factors, time management and team building to meet their professional career.

UNIT I  VERBAL APPTITUDE I  6

UNIT II  VERBAL APTITUDE II  6

UNIT III  SOFT SKILLS IV  6
Attitude—Meaning- Features of attitude-Formation-Personality Factors-Types of attitude-change in attitude-Developing Positive attitude.

UNIT IV  TIME MANAGEMENT  6
Definition –Meaning-Importance, Value of time as an important resource- comparison of Time and Money-Circle of influence and circle of control—Definition of URGENT and IMPORTANT—Time Wasters and how to reduce—Procrastination—meaning and impact- 4 Quadrants.

UNIT V  TEAM BUILDING  6
Meaning—Aspects of team building—Process of team building—Types of Teams-Team ethics and Understanding-Team trust and commitment.

TOTAL: 30 Hours

COURSE OUTCOMES:
After successful completion of the Personality Development III course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Develop the personality skills</td>
<td>K3</td>
</tr>
<tr>
<td>CO2</td>
<td>Build the confidence level</td>
<td>K3</td>
</tr>
<tr>
<td>CO3</td>
<td>Evaluate the students skulls through SWOT analysis</td>
<td>K5</td>
</tr>
<tr>
<td>CO4</td>
<td>Develop the self awareness and self esteem</td>
<td>K6</td>
</tr>
<tr>
<td>CO5</td>
<td>Improve the motivation skills</td>
<td>K6</td>
</tr>
</tbody>
</table>

REFERENCES BOOKS:
COURSE OBJECTIVE:

- To familiar with different measurement equipments and use of this industry for quality inspection and Ability to handle different measurement tools and performs measurements in quality impulsion.

**LIST OF EXPERIMENTS**

1. Calibration of Vernier / Micrometer / Dial Gauge
2. Checking Dimensions of part using slip gauges
3. Measurements of Gear Tooth Dimensions
5. Measurement of straightness and flatness
6. Measurement of thread parameters
7. Setting up of comparators for inspection (Mechanical / Pneumatic / Electrical)
8. Measurement of Temperature using Thermocouple / Pyrometer
9. Measurement of Displacement
10. Measurement of Force
11. Measurement of Torque
12. Measurement of Vibration / Shock

**LIST OF EQUIPMENTS**

(For a batch of 30 students)

- Micrometer - 5 Nos.
- Vernier Caliper - 5 Nos.
- Vernier Height Gauge - 2 Nos.
- Vernier depth Gauge - 2 Nos.
- Slip Gauge Set - 1 No.
- Gear Tooth Vernier - 1 No.
- Sine Bar - 1 No.
- Sine Center - 1 No.
- Bevel Protractor - 1 No.
- Floating Carriage Micrometer - 1 No.
- Profile Projector / Tool Makers Microscope - 1 No.
- Mechanical / Electrical / Pneumatic Comparator - 1 No.
- Autocollimator - 1 No.
- Temperature Measuring Setup - 1 No.

**TOTAL: 45 Hours**
<table>
<thead>
<tr>
<th>Measuring Setup</th>
<th>Quant.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displacement Measuring Setup</td>
<td>1 No.</td>
</tr>
<tr>
<td>Force Measuring Setup</td>
<td>1 No.</td>
</tr>
<tr>
<td>Torque Measuring Setup</td>
<td>1 No.</td>
</tr>
<tr>
<td>Vibration / Shock Measuring Setup</td>
<td>1 No.</td>
</tr>
</tbody>
</table>

**COURSE OUTCOMES:**

After successful completion of the Metrology and Measurements Laboratory course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Measure the error in Vernier height gauge, Micrometer and Vernier caliper using given slip gauge</td>
<td>K5</td>
</tr>
<tr>
<td>CO2</td>
<td>Evaluate the important parameter in thread using Tool makers Microscope, Floating carriage micrometer and Gear tooth Vernier</td>
<td>K5</td>
</tr>
<tr>
<td>CO3</td>
<td>Estimate the bore diameter using Telescope gauge, Micrometer and Comparator</td>
<td>K6</td>
</tr>
<tr>
<td>CO4</td>
<td>Estimate the surface finish using surface finish measuring equipment's and Auto collimator.</td>
<td>K6</td>
</tr>
<tr>
<td>CO5</td>
<td>Measure, Force, Torque, Temperature and angle using Proving ring measurement, LVDT measurement, Thermocouple measurement and sine bar measurement devices.</td>
<td>K5</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVE:

- To give exposure to software tools needed to analyze engineering problems.
- To expose the students to different applications of simulation and analysis tools.

LIST OF EXPERIMENTS

A. SIMULATION

1. Simulation of Air conditioning system with condenser temperature and evaporator temperatures as input to get COP using C /MAT Lab.
2. Simulation of Hydraulic / Pneumatic cylinder using C / MAT Lab.
3. Simulation of cam and follower mechanism using C / MAT Lab.

B. ANALYSIS (SIMPLE TREATMENT ONLY)

1. Stress analysis of a plate with a circular hole.
2. Stress analysis of rectangular L bracket
3. Stress analysis of an axi-symmetric component
4. Stress analysis of beams (Cantilever, Simply supported, Fixed ends)
5. Mode frequency analysis of a 2D component
6. Mode frequency analysis of beams (Cantilever, Simply supported, Fixed ends)
7. Harmonic analysis of a 2D component
8. Thermal stress analysis of a 2D component
9. Conductive heat transfer analysis of a 2D component
10. Convective heat transfer analysis of a 2D component

TOTAL: 45 Hours

LIST OF EQUIPMENTS (For a batch of 30 students)

Computer System 30
17" VGA Color Monitor
Pentium IV Processor
40 GB HDD
512 MB RAM
Color Desk Jet Printer 01

Software
Suitable analysis software 30 licenses
C / MATLAB 5 licenses

COURSE OUTCOMES:

After successful completion of the Computer Aided Simulation and Analysis Laboratory course, the student will be able to:

- Understand and solve simple problems in vibration using MATLAB
- Analyze mechanism simulation using Multibody Dynamic software
- Solve stress analysis problems of link elements in Trusses, cables, beams, flat plates, simple shells and axi-symmetric components.
- Solve thermal stress and heat transfer analysis of plates, cylindrical shells.
Examine the model analysis of beams and harmonic, transient and spectrum analysis of simple systems.

OBJECTIVE:
- To introduce the concepts of Mathematical Modeling of Engineering Problems.
- To appreciate the use of FEM to a range of Engineering Problems.

UNIT I  FINITE ELEMENT FORMULATION OF BOUNDARY VALUE PROBLEMS  9

UNIT II  ONE DIMENSIONAL FINITE ELEMENT ANALYSIS  9

UNIT III  TWO DIMENSIONAL FINITE ELEMENT ANALYSIS  9

UNIT IV  DYNAMIC ANALYSIS USING FINITE ELEMENT METHOD  9

UNIT V  APPLICATIONS IN HEAT TRANSFER & FLUID MECHANICS  9
One dimensional heat transfer element – application to one-dimensional heat transfer problems – scalar variable problems in 2-Dimensions – Applications to heat transfer in 2-Dimension – Application to problems in fluid mechanics in 2-Dimensional.

TOTAL: 45 Hours
**COURSE OUTCOMES:**

After successful completion of the Finite Element Analysis course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Formulate the finite element mathematical modeling concepts for boundary value engineering Problems.</td>
<td>K6</td>
</tr>
<tr>
<td>CO2</td>
<td>Analyze the problems in one dimensional structures including trusses, beams and frames</td>
<td>K4</td>
</tr>
<tr>
<td>CO3</td>
<td>Analyze the problems in two dimensional structures including plain stress, plane strain and axisymmetric applications</td>
<td>K4</td>
</tr>
<tr>
<td>CO4</td>
<td>Evaluate the solution of Eigen value, longitudinal and transverse vibration problems.</td>
<td>K5</td>
</tr>
<tr>
<td>CO5</td>
<td>Apply the finite element method to solve two dimensional problems in the applications of fluid mechanics and heat transfer.</td>
<td>K6</td>
</tr>
</tbody>
</table>

**TEXT BOOK:**


**REFERENCE BOOKS:**

COURSE OBJECTIVE:

- To integrate the concepts, laws and methodologies from the first course in thermodynamics into analysis of cyclic processes.
- To apply the thermodynamic concepts into various thermal application like IC engines, Steam Turbines, Compressors and Refrigeration and Air conditioning systems.

UNIT I  
GAS POWER CYCLES
9
Otto, Diesel, Dual, Brayton cycles, Calculation of mean effective pressure and air standard efficiency, Actual and theoretical PV diagram of Four stroke engines, Actual and theoretical PV diagram of two stroke engines.

UNIT II  
INTERNAL COMBUSTION ENGINES
9

UNIT III  
STEAM NOZZLES AND TURBINES
9
Flow of steam through nozzles, shapes of nozzles, effect of friction, critical pressure ratio, supersaturated flow. Impulse and reaction principles, compounding, velocity diagrams for simple and multistage turbines, speed regulations-governors and nozzle governors.

UNIT IV  
AIR COMPRESSOR
9
Classification and working principle, work of compression with and without clearance. Volumetric efficiency, Isothermal efficiency and isentropic efficiency of reciprocating air compressors. Multistage air compressor and inter cooling – work of multistage air compressor, various types of compressors (Descriptive treatment only).

UNIT V  
REFRIGERATION AND AIR-CONDITIONING
9

TOTAL: 45 Hours

(Use of standard thermodynamic tables, Mollier diagram, Psychometric chart and Refrigerant property tables are permitted in the Examination)
**COURSE OUTCOMES:**

After successful completion of the Thermal Engineering course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Analyze and compare various gas power cycles based on the principles of thermodynamics</td>
<td>K4</td>
</tr>
<tr>
<td>CO2</td>
<td>Compare and analyze petrol and diesel engine based on the construction, working and performance</td>
<td>K5</td>
</tr>
<tr>
<td>CO3</td>
<td>Analyze and classify different types of nozzles, turbines based on the principle of conservation of energy and also understand the governing mechanism</td>
<td>K5</td>
</tr>
<tr>
<td>CO4</td>
<td>Understand the construction, working principle of reciprocating and rotary air compressors.</td>
<td>K2</td>
</tr>
<tr>
<td>CO5</td>
<td>Compare vapour compression and absorption refrigeration systems and also analyze the different types of air conditioning systems</td>
<td>K4</td>
</tr>
</tbody>
</table>

**TEXT BOOKS:**


**REFERENCES:**

COURSE OBJECTIVE:
- To gain knowledge on the principles and procedure for the design of Mechanical power Transmission components.
- To understand the standard procedure available for Design of Transmission of Mechanical elements.
- To learn to use standard data and catalogues.

UNIT I  DESIGN OF TRANSMISSION SYSTEMS FOR FLEXIBLE ELEMENTS  12
Selection of V belts and pulleys – selection of Flat belts and pulleys - Wire ropes and pulleys – Selection of Transmission chains and Sprockets, Design of pulleys and sprockets.

UNIT II  SPUR GEARS AND PARALLEL AXIS HELICAL GEARS  12
Gear Terminology-Speed ratios and number of teeth-Force analysis -Tooth stresses - Dynamic effects - Fatigue strength - Factor of safety - Gear materials – Module and Face width-power rating calculations based on strength and wear considerations - Parallel axis Helical Gears – Pressure angle in the normal and transverse plane- Equivalent number of teeth-forces and stresses, Estimating the size of the helical gears.

UNIT III  BEVEL, WORM AND CROSS HELICAL GEARS  12
**Straight bevel gear:** Tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating the dimensions of pair of straight bevel gears.

**Worm Gear:** Merits and demerits- Terminology. Thermal capacity, materials-forces and stresses, efficiency, estimating the size of the worm gear pair.

**Cross helical:** Terminology-helix angles-Estimating the size of the pair of cross helical gears.

UNIT IV  DESIGN OF GEAR BOXES  12
Geometric progression - Standard step ratio - Ray diagram, kinematics layout -Design of sliding mesh gear box -Constant mesh gear box. – Design of multi speed gear box.

UNIT V  DESIGN OF CAM CLUTCHES AND BRAKES  12
Cam Design: Types-pressure angle and under cutting base circle determination-forces and surface stresses. Design of plate clutches –axial clutches-cone clutches-internal expanding rim clutches-internal and external shoe brakes.

**TOTAL: 60 Hours**

NOTE: (Usage of P.S.G Design Data Book is permitted in the University examination)

COURSE OUTCOMES:
After successful completion of the Design of Transmission Systems course, the student will be able to

<table>
<thead>
<tr>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1 Understand the principles and the procedure for the design of mechanical power transmissions components.</td>
<td>K2</td>
</tr>
<tr>
<td>CO2 Analyse the gear terminology of spur gear and helical gear and its parallel axis.</td>
<td>K4</td>
</tr>
<tr>
<td>CO3 Estimate the dimensions of bevel, worm and cross helical gears.</td>
<td>K6</td>
</tr>
<tr>
<td>CO4 Construct the gear boxes</td>
<td>K6</td>
</tr>
<tr>
<td>CO5 Design cams, clutches and brakes</td>
<td>K6</td>
</tr>
</tbody>
</table>
TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVE:
➢ To improve the communication by understanding the elements of communication, presentation skills, understanding the audience, Personality factors, improve the skill in seminars and conferences presentation.

UNIT I SOFT SKILLS V
6
Assertiveness—Meaning—Importance of assertiveness—Characteristics of assertive communication-Merits —forms of assertion—Causes of misunderstanding.

UNIT II COMMUNICATION SKILLS
6
Meaning—Elements of communication—Functions of communication—Principles of communication—Formal and Informal communication—Barriers in Communication—Characteristics of good communication—Feedback—communication systems.

UNIT III PRESENTATION SKILLS I
6
Meaning—Importance of Presentation—Concept of 5 w’s and one H —understanding the audience—Types of presentations—How to make effective presentation.

UNIT IV PRESENTATION SKILLS II
6
Use of slide, PPT’s. and visuals—Rules for slide presentation—precautions-seminars and conferences-Steps to eliminate Stage fear.

UNIT V CHANGE MANAGEMENT
6

TOTAL: 30 Hours

COURSE OUTCOMES:
After successful completion of the Personality Development IV course, the student will be able to

CO1 Adapt the thermodynamic concepts into various thermal applications like IC engines, Steam Turbines and to Learn the concepts, laws and methodologies from the first course in thermodynamics into an analysis of cyclic processes.

CO2 Evaluate the performance of an internal combustion engine and various gas power cycles and Understand the principles involved in air-conditioning systems and able to Estimate cooling loads.

CO3 Understand computational aspects of isentropic flow through variable area and Analyse gas turbine cycles and able to compare the operational aspects of jet engines.

CO4 Understand the different cycles used in thermal engineering and Get exposure on internal combustion engine and able to analyze their performance.

CO5 Estimate the cooling load calculation for vapor compression system.
REFERENCE BOOKS:
2. Who Moved My Cheese by Spencer Johnson published by Vermilion first edition
COURSE OBJECTIVE:
- To study the value timing-V diagram and performance of IC Engines.
- To Study the characteristics of fuels/Lubricates used in IC Engines.
- To study the Performance of steam generator/ turbine.

LIST OF EXPERIMENTS

I.C ENGINE LAB AND FUELS LAB
1. Valve Timing and Port Timing Diagrams
2. Performance Test on 4-stroke Diesel Engine.
3. Heat Balance Test on 4-stroke Diesel Engine
4. Morse Test on Multicylinder Petrol Engine
5. Determination of Viscosity – Red Wood Viscometer
6. Determination of Flash Point and Fire Point
7. Study of Steam Generators and Turbines

HEAT TRANSFER
1. Thermal conductivity of pipe insulation using lagged pipe apparatus
2. Natural convection heat transfer from a vertical cylinder
3. Forced convection inside tube
4. Determination of Stefan-Boltzmann constant
5. Effectiveness of Parallel/counter flow heat exchanger

REFRIGERATION AND AIR CONDITIONING
1. Determination of COP of a refrigeration/ air conditioning system
2. Performance test on single/two stage reciprocating air compressor

TOTAL: 45 Hours

COURSE OUTCOMES:
After successful completion of the Thermal Engineering Laboratory course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Analyze the performance of internal combustion Engines</td>
<td>K4</td>
</tr>
<tr>
<td>CO2</td>
<td>Estimate the performance of different thermal equipment’s like reciprocating compressors, refrigeration and air conditioning systems</td>
<td>K5</td>
</tr>
<tr>
<td>CO3</td>
<td>Predict the valve timing diagram and port timing diagram of IC engines</td>
<td>K6</td>
</tr>
<tr>
<td>CO4</td>
<td>Estimate the Thermal conductivity of pipe insulation using lagged pipe apparatus</td>
<td>K6</td>
</tr>
<tr>
<td>CO5</td>
<td>Evaluate the Natural convection heat transfer from a vertical cylinder</td>
<td>K5</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVE:

- To study the features of CNC Machine Tool and expose students to modern control systems (Fanuc, Siemens etc.)
- To know the application of various CNC machines like CNC lathe, CNC Vertical Machining centre, CNC EDM and CNC wire-cut and studying of Rapid prototyping.

1. **MANUAL CNC PART PROGRAMMING**

2. **COMPUTER AIDED PART PROGRAMMING**
   (Ex: CL Data Generation by Using CAM Software– Post Process Generation for Different Control System – Machining of Computer Generated Part Program by Using Machining Center and Turning Center.)

3. **STUDY EXPERIMENTS**
   Multi-axial Machining in CNC Machining Center – EDM – EDM Wire Cut - Rapid Prototyping.

**LIST OF EQUIPMENTS** (Requirement for a batch of 30 students)

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Description of Equipment</th>
<th>Quantity Required</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HARDWARE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Computer Server</td>
<td>1 No.</td>
</tr>
<tr>
<td>2.</td>
<td>Computer nodes or systems (High end CPU with at least 1 GB main memory) networked to the server</td>
<td>30 Nos.</td>
</tr>
<tr>
<td>3.</td>
<td>A3 size plotter</td>
<td>1 No.</td>
</tr>
<tr>
<td>4.</td>
<td>Laser Printer</td>
<td>1 No.</td>
</tr>
<tr>
<td>5.</td>
<td>Trainer CNC Lathe</td>
<td>1 No.</td>
</tr>
<tr>
<td>6.</td>
<td>Trainer CNC milling</td>
<td>1 No.</td>
</tr>
<tr>
<td><strong>SOFTWARE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>CAD/CAM software (Pro-E or IDEAS or Unigraphics or CATIA)</td>
<td>15 licenses</td>
</tr>
<tr>
<td>8.</td>
<td>CAM Software (CNC Programming and tool path simulation for FANUC/Sinumeric and Heiden controller)</td>
<td>15 licenses</td>
</tr>
<tr>
<td>9.</td>
<td>Licensed operating system</td>
<td>Adequate</td>
</tr>
<tr>
<td>10.</td>
<td>AutoCAD</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>ANSYS</td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Master CAM</td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL: 45 Hours**
COURSE OUTCOMES:
After successful completion of the Advanced Machining Laboratory course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Understanding features of CNC Machine Tool.</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Build the manual CNC Part Programming Using Standard G and M Codes.</td>
<td>K6</td>
</tr>
<tr>
<td>CO3</td>
<td>Develop the basic machining of simple components by Using CNC machines.</td>
<td>K3</td>
</tr>
<tr>
<td>CO4</td>
<td>Understand the data Generation by Using CAM Software.</td>
<td>K2</td>
</tr>
<tr>
<td>CO5</td>
<td>Formulate the manual part programming for given drawing to execute CNC turning lathe and milling machine.</td>
<td>K6</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVE:
- To know the method of programming the microprocessor and also the design, modeling & analysis of basic electrical, hydraulic & pneumatic Systems which enable the students to understand the concept of mechatronics.

LIST OF EXPERIMENTS
1. Design and testing of pneumatic circuits to control
   (i) Velocity (ii) direction and (iii) force of single and double acting actuators
2. Design of circuits with logic sequence using Electro pneumatic trainer kits.
3. Simulation of basic Hydraulic, Pneumatic and Electric circuits using software
4. Circuits with multiple cylinder sequences in Electro pneumatic using PLC
5. Speed Control of AC & DC drives
6. Servo controller interfacing for DC motor
7. PID controller interfacing
8. Stepper motor interfacing with 8051 Micro controller
   (i) Full step resolution (ii) half step resolution
9. Modeling and analysis of basic electrical, hydraulic and pneumatic systems using LAB VIEW
10. Computerized data logging system with control for process variables like pressure flow and temperature.

TOTAL: 45 Hours

LIST OF EQUIPMENTS (For a batch of 30 students)

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Description of Equipment</th>
<th>Quantity Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Basic Pneumatic Trainer Kit with manual and electrical controls/ PLC Control</td>
<td>1 No.</td>
</tr>
<tr>
<td>2</td>
<td>Basic Hydraulic Trainer Kit</td>
<td>1 No.</td>
</tr>
<tr>
<td>3</td>
<td>Hydraulics and Pneumatics Systems Simulation Software / Automation studio sets</td>
<td>10 Nos</td>
</tr>
<tr>
<td>4</td>
<td>8051 - Microcontroller kit with stepper motor and drive circuit sets</td>
<td>2 Nos.</td>
</tr>
<tr>
<td>5</td>
<td>LAB VIEW software with Sensors to measure Pressure, Flow rate, direction, speed, velocity and force. seats</td>
<td>2 Nos.</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>CO</th>
<th>Course Outcome Statements</th>
<th>Knowledge Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1:</td>
<td>Design and test of pneumatic test circuits</td>
<td>K6</td>
</tr>
<tr>
<td>CO2:</td>
<td>Design of simple mechatronics system.</td>
<td>K6</td>
</tr>
<tr>
<td>CO3:</td>
<td>Apply the PID control to AC and DC motors.</td>
<td>K3</td>
</tr>
<tr>
<td>CO4:</td>
<td>Measure load, displacement and temperature using analogue and digital sensors.</td>
<td>K5</td>
</tr>
<tr>
<td>CO5:</td>
<td>Develop microcontroller programming to guide a robot.</td>
<td>K3</td>
</tr>
</tbody>
</table>

86
COURSE OBJECTIVE:
- To develop character of volunteerism with understanding the youth issues, challenges and opportunities.
- To learn about the community mobilization.

UNIT I  INTRODUCTION AND BASIC CONCEPTS OF NSS  6

UNIT II  NSS PROGRAMS AND ACTIVITIES  6
Concept of regular activities- special camping-day camps-Basis of adoption of village/slums, Methodology of conducting survey-Financial pattern of the scheme- other youth program/schemes of GOI- Coordination with different agencies- Maintenance of the dairy.

UNIT III  UNDERSTANDING YOUTH  6
Youth: Definition, profile of youth, categories – youth: Issues, challenges and opportunities - Youth as an agent of social change.

UNIT IV  COMMUNITY MOBILIZATION  6
Mapping of community stakeholders-Designing the message in the context of the problem and the culture of the community-Identifying methods of mobilization-Youth adult partnership.

UNIT V  VOLUNTEERISM AND SHRAMDAN  6
Indian Tradition of volunteerism-Needs& Importance of volunteerism- Motivation and constraints of volunteerism-Shramdan as a part of volunteerism.

TOTAL: 30 Hours

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

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Understand themselves in relation to their community and develop among themselves since of social and civic and responsibility.</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Identify the needs and problem of the community an involve them in problem solving.</td>
<td>K3</td>
</tr>
<tr>
<td>CO3</td>
<td>Utilize their knowledge in finding practical solution to individual and community problem.</td>
<td>K3</td>
</tr>
<tr>
<td>CO4</td>
<td>Develop the confidence require for group living and sharing of responsibilities of acquire leader ship qualities and democratic attitudes.</td>
<td>K6</td>
</tr>
<tr>
<td>CO5</td>
<td>Develop the capacity to meet emergencies and natural disasters and practice national integration and social harmony.</td>
<td>K6</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVE:

- The main objective is to give an opportunity to the student to get hands-on training in the fabrication of one or more components of a complete working model, which is designed by them.

GUIDELINE FOR REVIEW AND EVALUATION

The students may be grouped into 2 to 4 and work under a project supervisor. The device/system/component(s) to be fabricated may be decided in consultation with the supervisor and if possible with an industry. A project report to be submitted by the group and the fabricated model, which will be reviewed and evaluated for internal assessment by a Committee constituted by the Head of the Department. At the end of the semester examination the project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

Total 45 hours

After successful completion of the project phase I, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>Course Outcome Statements</th>
<th>Knowledge Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1:</td>
<td>Identify a topic in advanced areas of Mechanical Engineering.</td>
<td>K3</td>
</tr>
<tr>
<td>CO2:</td>
<td>Develop a prototypes/models, experimental set-up and software systems necessary to meet the objectives.</td>
<td>K3</td>
</tr>
<tr>
<td>CO3:</td>
<td>Conclude and search the literature.</td>
<td>K4</td>
</tr>
<tr>
<td>CO4:</td>
<td>Identify and compare technical and practical issues related to the area of course specialization.</td>
<td>K3</td>
</tr>
<tr>
<td>CO5:</td>
<td>Adapt to the presentation skills by seminars in front of grown without fairness.</td>
<td>K6</td>
</tr>
</tbody>
</table>

TOTAL: 45 Hours
COURSE OBJECTIVE:

➢ To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

GUIDELINE FOR REVIEW AND EVALUATION

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepare a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

After successful completion of the project work, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>Course Outcome Statements</th>
<th>Knowledge Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1:</td>
<td>Identify and compare the technical and practical issues related to the area of course specialization.</td>
<td>K5</td>
</tr>
<tr>
<td>CO2:</td>
<td>Organize a report by employing the elements of technical writing and critical thinking.</td>
<td>K3</td>
</tr>
<tr>
<td>CO3:</td>
<td>Identify the methods and materials to carry out experiments/develop code.</td>
<td>K3</td>
</tr>
<tr>
<td>CO4:</td>
<td>Analyze and discuss the results to draw valid conclusions.</td>
<td>K4</td>
</tr>
<tr>
<td>CO5:</td>
<td>Develop the possibility of publishing papers in peer reviewed journals/conference proceedings.</td>
<td>K3</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVE:

- To introduce the concepts of basic casting processes and fabrication techniques and study the various special casting technique such as shell moulding, investment casting, centrifugal and die-casting, etc.

UNIT I INTRODUCTION
Introduction to sand casting - Conventional mould and Core making - Need for special casting process - applications.

UNIT II SHELL MOULDING

UNIT III INVESTMENT CASTING
Process - Pattern and mould materials - Block mould and ceramic shell mould - Mercast and shaw process - Application.

UNIT IV CENTRIFUGAL AND DIE-CASTING
Types of Centrifugal processes - calculation of rotating speed of the mould - Equipment - Application.

UNIT V CONTINUOUS CASTING CO2 SAND PROCESS AND FULL MOULD PROCESSES
Reciprocating continuous mould process - Direct chill process - Use of steel, aluminium, brass material in continuous casting, CO2 mould / core hardening process - principles Full mould process - Applications.
Other special process like squeeze casting and electro slag casting processes.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the Special Casting Techniques course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>Course Outcome Statements</th>
<th>Knowledge Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Develop the conventional mould and Core making knowledge for special casting process.</td>
<td>K5</td>
</tr>
<tr>
<td>CO2</td>
<td>Understand process parameters and characteristics of shell mould castings.</td>
<td>K2</td>
</tr>
<tr>
<td>CO3</td>
<td>Explain the block mould and ceramic shell moulding techniques</td>
<td>K3</td>
</tr>
<tr>
<td>CO4</td>
<td>Compare the centrifugal and Die-casting methods.</td>
<td>K5</td>
</tr>
<tr>
<td>CO5</td>
<td>Understand the Continuous casting process, CO2 sand process and full mould processes.</td>
<td>K2</td>
</tr>
</tbody>
</table>

TEXT BOOKS:

REFERENCES:

COURSE OBJECTIVE:
➢ To enable the student to understand the principles of failure analysis and design.

UNIT I MATERIALS AND DESIGN PROCESS
Factors affecting the behavior of materials in components, effect of component geometry and shape factors, design for static strength, stiffness, designing with high strength and low toughness materials, designing for hostile environments, material processing and design, processes and their influence on design, process attributes, systematic process selection, screening, process selection diagrams, ranking, process cost.

UNIT II FRACTURE MECHANICS
Ductile fracture, brittle fracture, Cleavage-fractography, ductile-brittle transition-Fracture mechanics approach to design-energy criterion, stress intensity approach, time dependent crack growth and damage.

UNIT III LINEAR ELASTIC FRACTURE MECHANICS

UNIT IV DYNAMIC AND TIME-DEPENDENT FRACTURE
Dynamic fracture, rapid loading of a stationary crack, rapid crack propagation, dynamic contour integral, Creep crack growth-C Integral, Visco elastic fracture mechanics, visco elastic J integral, Experimental determination of plane strain fracture toughness, K- R curve testing, J measurement, CTOD testing, effect of temperature, strain rate on fracture toughness.

UNIT V FAILURE ANALYSIS TOOLS
Reliability concept and hazard function, life prediction, life extension, application of poisson, exponential and Weibull distribution for reliability, bath tub curve, parallel and series system, MTBF,MTTR, FMEA definition-Design FMEA, Process FMEA , analysis causes of failure, modes, ranks of failure modes, fault tree analysis, industrial case studies/projects on FMEA.

TOTAL: 45 Hours

COURSE OUTCOMES:
After successful completion of the Failure Analysis and Design course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>Course Outcome Statements</th>
<th>Knowledge Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1:</td>
<td>Understand the theories of failure analysis for all types of materials.</td>
<td>K6</td>
</tr>
<tr>
<td>CO2:</td>
<td>Understand the basic principles and approaches for static loading and dynamic loading.</td>
<td>K6</td>
</tr>
<tr>
<td>CO3:</td>
<td>Identify the factors affecting the behavior of materials under various force condition.</td>
<td>K3</td>
</tr>
<tr>
<td>CO4:</td>
<td>Design the component based on statics strength and stiffness.</td>
<td>K6</td>
</tr>
<tr>
<td>CO5:</td>
<td>Understand different fracture mechanics of brittle and ductile materials</td>
<td>K5</td>
</tr>
</tbody>
</table>
TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVE:
➢ To understand the basic terminology of gear and the various inspection techniques for checking of gears.

UNIT I INTRODUCTION TO GEARS AND GEAR MATERIALS 9
Types of gears, classification, gear drawings, gearboxes, application of gears, gear production methods, an overview. Non-metallic, ferrous and non-ferrous gears, Properties of gear materials, selection of material for typical gears and applications—blank preparation methods for different gears, size, type and material.

UNIT II PRODUCTION OF GEARS & SCREW THREADS 9
Gear milling different gears, cut quality obtainable. Gear hobbling, types of gears cut, hobbling cutters, work holding methods gear shaping, disc type and rack type gear shapers, Production of straight bevel gears and spiral gears, milling, and generation by straight bevel gear generator. Screw thread terminology, Types of screw thread, Methods of producing screw threads, Effect of pitch errors, measurement of various elements of screw threads. Thread rolling, Thread Grinding, Mass Production of Screws.

UNIT III HEAT TREATMENT OF GEARS 9
Through hardening, case hardening, flames hardening, induction hardening of gears, Nit riding of gears. Tuft riding of gears. Inspection of gears for hardening defects. Gear finishing advantages, finishing of gears by grinding, shaving, lapping, honing methods and cold rolling of gears, Description of machines, process and process parameters.

UNIT IV GEAR INSPECTION 9
Types of gear errors, gear quality standards tooth thickness and base tangent length measurement, pitch errors, radial run out errors, profile errors and pitch error measurement. Composite error measurement, Computerized gear inspection centers. Reasons and remedies for gear errors.

UNIT V MODERN GEAR PRODUCTION METHODS 9
Gear production by stamping, die casting, power metal process, injection and compression Moulding in plastics. Die casting, cold and hot rolling, mass production methods shear speed shaping. Gear broaching—Gleason. G-Trac Gear generation method

TOTAL: 45 Hours
COURSE OUTCOMES:

After successful completion of the Manufacture and Inspection of Gears course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>Course Outcome Statements</th>
<th>Knowledge Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Understand the basic terminology of gear.</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Understand various inspection techniques for checking of gears.</td>
<td>K2</td>
</tr>
<tr>
<td>CO3</td>
<td>Understand manufacturing of gears through gear hobbing machines.</td>
<td>K2</td>
</tr>
<tr>
<td>CO4</td>
<td>Understand Manufacturing of gears through milling machines.</td>
<td>K2</td>
</tr>
<tr>
<td>CO5</td>
<td>Understand Modern Gear Production Methods</td>
<td>K2</td>
</tr>
</tbody>
</table>

TEXT BOOKS:


REFERENCES:

COURSE OBJECTIVE:

- This course provides the knowledge about refrigeration and air conditioning system, and enables them to do simple design calculations and analysis of these systems.

UNIT I REFRIGERATION CYCLES
Air refrigeration cycles - reversed Carnot cycle, bell Coleman cycle, simple vapour compression refrigeration cycle, compound compression refrigeration cycles, and cascade refrigeration cycles.

UNIT II VAPOUR ABSORPTION
Properties of refrigerant, classification of refrigerants - primary and secondary refrigerants, Performance analysis of aqua ammonia refrigeration system, study of lithium bromide water Refrigeration system, ozone friendly refrigerants.

UNIT III SYSTEM COMPONENTS
Refrigerant compressors - reciprocating, rotary and centrifugal compressors, evaporators- flooded, dry Expansion, shell and tube and double pipe evaporators, condensers - air cooled, water cooled and Evaporative condensers, expansion devices - automatic, capillary tube and thermostatic expansion Valve.

UNIT IV AIR HANDLING
Air distribution systems - study of different types of duct systems, methods of duct design, duct Insulation, air purity - air cleaning methods.

UNIT V AIR CONDITIONING
Psychometric, psychomotor, psychometric processes, moist air behavior, effective temperatures, Sensible heat factor ratio and cooling load estimation for an air conditioned space.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the refrigeration and air conditioning course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>Course Outcome Statements</th>
<th>Knowledge Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Understand the basic working principle of refrigeration and air conditioning systems.</td>
<td>K6</td>
</tr>
<tr>
<td>CO2</td>
<td>Explain the simple vapour abortion Refrigeration cycle.</td>
<td>K6</td>
</tr>
<tr>
<td>CO3</td>
<td>Discuss the difference system components.</td>
<td>K3</td>
</tr>
<tr>
<td>CO4</td>
<td>Classify the Air distribution systems and duct systems.</td>
<td>K6</td>
</tr>
<tr>
<td>CO5</td>
<td>Understand the air conditioning process</td>
<td>K5</td>
</tr>
</tbody>
</table>

TEXT BOOKS:

REFERENCES:

COURSE OBJECTIVES

➢ To understand the basics of welding and to know about the various types of welding processes

UNIT I  INTRODUCTION

UNIT II  SPECIAL WELDING PROCESS
Special Welding Processes- Power sources, equipments and accessories, application, limitation and other characteristics of: (a) Gas tungsten arc (TIG) welding (b) Gas metal arc (MIG) welding (c) Submerged arc welding (d) Electro slag welding processes. Resistance welding processes-principle-Types (spot, seam, projection, percussion, flash), Equipment required for each application.

UNIT III  MODERN WELDING PROCESS

UNIT IV  WELDING DEFECTS AND TESTING
Weldment Testing- Defects in welding in various processes-Causes and remedies; Destructive testing of weldments - Strength, hardness, ductility, fatigue, creep properties etc. Nondestructive testing of weldments; Ultrasonic dye penetrant, magnetic particle inspection. X-ray testing procedures and identification of defects – case studies. Weld thermal cycle – Residual stressed distortion in welding stress relieving techniques.

UNIT V  DESIGN OF WELDMENTS

TOTAL: 45 Hours

COURSE OUTCOMES
After successful completion of the welding technology course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Understand the theoretical aspects of welding technology in depth.</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Classify the various special types of welding process</td>
<td>K5</td>
</tr>
<tr>
<td>CO3</td>
<td>Study the various Modern Welding Processes.</td>
<td>K4</td>
</tr>
<tr>
<td>CO4</td>
<td>Identify the various welding defects and testing</td>
<td>K5</td>
</tr>
</tbody>
</table>
TEXT/REFERENCE BOOKS

6. "AWS Welding Hand Book", Volume 1 to 4, AWS.
COURSE OBJECTIVE:

- To understand the mechanisms of heat transfer under steady and transient conditions.
- To understand the concepts of heat transfer through extended surfaces.
- To learn the thermal analysis and sizing of heat exchangers and to understand the basic concepts of mass transfer. (Use of standard HMT data book permitted)

UNIT I CONDUCTION


UNIT II CONVECTION


UNIT III PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS


UNIT IV RADIATION


UNIT V MASS TRANSFER


TOTAL: 45 Hours

Note: (Use of standard heat and mass transfer data book is permitted in the University examination)

COURSE OUTCOMES:

After successful completion of the Heat and Mass Transfer course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>Course Outcome Statements</th>
<th>Knowledge Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Understand and solve the problems in the mechanism of heat transfer under steady state, transient conditions and heat transfer through extended surfaces.</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Identify and solve the problems in the convection of heat Transfer through</td>
<td>K3</td>
</tr>
</tbody>
</table>
internal and external flow.

**CO3:** Analyze the various sizing of heat exchangers and to learn the basic concepts of boiling and condensation.  
**CO4:** Estimate the radiation of heat transfer by using different analytical techniques.  
**CO5:** Ability to solve the problems in mass transfer and to be known about the basics concepts.

**TEXT BOOKS:**

**REFERENCES:**
COURSE OBJECTIVE:

- The main aim of this course is to make the students to know and understand the cryogenic engineering is various stages.

UNIT I INTRODUCTION 9
Insight on Cryogenics, Properties of Cryogenic fluids, Material properties at Cryogenic Temperatures. Applications of cryogenics in space, Food Processing, super Conductivity, Electrical Power, Biology, Medicine, Electronics and Cutting Tool Industry.

UNIT II LIQUEFACTION CYCLES 9

UNIT III SEPARATION OF CRYOGENIC GASES 9

UNIT VI CRYOGENIC REFRIGERATORS 9
Joule Thomson Cry coolers, Stirling Cycle Refrigerators, G.M.Cryocoolers, Pulse Tube Refrigerators. Regenerators used in Cryogenic Refrigerators, Magnetic Refrigerators.

UNIT V STORAGE, INSULATION AND INSTRUMENTATION 9
Cryogenic Storage vessels, Transportation, and Transfer Lines., Thermal insulation and their performance at cryogenic temperatures, Super Insulations, Vacuum insulation, Powder insulation and Cryo-pumping. Instrumentation to measure Pressure, Flow, Level and Temperature

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the Cryogenic Engineering course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>Course Outcome Statements</th>
<th>Knowledge Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1:</td>
<td>Understand the principles of cryogenics systems and their application.</td>
<td>K2</td>
</tr>
<tr>
<td>CO2:</td>
<td>Understand low temperature processes and techniques related issues.</td>
<td>K2</td>
</tr>
<tr>
<td>CO3:</td>
<td>Evaluate the properties of material at low temperature.</td>
<td>K4</td>
</tr>
<tr>
<td>CO4:</td>
<td>Understand different types of cryogenic insulation techniques.</td>
<td>K6</td>
</tr>
</tbody>
</table>
TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVE:

- At the end of the course, the students are expected to identify the new methodologies / technologies for effective utilization of renewable energy sources.

UNIT I  SOLAR ENERGY  9

UNIT II  WIND ENERGY  9

UNIT III  BIO – ENERGY  9

UNIT IV  OTEC, TIDAL, GEOTHERMAL AND HYDEL ENERGY  9

UNIT V  NEW ENERGY SOURCES  9
Hydrogen, generation, storage, transport and utilisation, Applications: power generation, transport – Fuel cells – technologies, types – economics and the power generation.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the Renewable Energy Sources course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>Course Outcome Statements</th>
<th>Knowledge Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Understand the Concepts of solar energy and Measurements of solar Radiation and sunshine.</td>
<td>K5</td>
</tr>
<tr>
<td>CO2</td>
<td>Understand the wind energy and Wind Data and Energy Estimation</td>
<td>K5</td>
</tr>
<tr>
<td>CO3</td>
<td>Understand the Biomass, Biogas, Source, Composition, Technology for utilization and function of bio gas plant</td>
<td>K4</td>
</tr>
<tr>
<td>CO4</td>
<td>Understand the function and process involved in the Geo thermal energy system and explain the working principle of the Ocean thermal power plant.</td>
<td>K5</td>
</tr>
<tr>
<td>CO5</td>
<td>Compare function and process involved in the Fuel cells and hydrogen technologies.</td>
<td>K5</td>
</tr>
</tbody>
</table>

TEXT BOOKS:
REFERENCES:
COURSE OBJECTIVE:

➢ To understand the fundamentals of composite material strength and its mechanical behavior.
➢ Understanding the analysis of fiber reinforced Laminate design for different combinations of plies with different orientations of the fiber.
➢ Thermo-mechanical behavior and study of residual stresses in Laminates during processing. Implementation of Classical Laminate Theory (CLT) to study and analysis for residual stresses in an isotropic layered structure such as electronic chips.

UNIT I  COMPOSITE MATERIALS AND THEIR APPLICATIONS  9

UNIT II  CONCEPTS OF SOLID MECHANICS  9
Tensors Stress and strain Plane stress and plane strain energy density Generalized Hooke's Law Material symmetry Engineering constants 3 Coordinate transformations Thermal effects, Moisture effects Chemical aging, flammability.

UNIT III  CONCEPTS OF MICROMECHANICS  9
Effective properties Survey and model comparison from strength of materials approximations, continuum mechanics approaches.

UNIT IV  STRESS-STRAIN FOR AN ORTHOTROPIC LAMINA AND AMINATE ANALYSIS  9
Orthotropic properties in plane stress, Deformation due to extension/shear and bending/torsion A, B, D matrices hydrothermal behavior Special laminates Average stress-strain properties.

UNIT V  CONCEPTS OF FAILURE OF LAMINATES AND SHAFTS  9
Tensile failure of fiber composites Compressive failure of fiber composites Effect of multi axial stresses (failure criteria by Tsai-Wu, Hashin, etc.) Edge effects, Effective stiffness of beams Effective stiffness of shafts

TOTAL: 45 Hours

COURSE OUTCOMES:
After successful completion of the Design and Analysis of Composites course, the student will be able to

CO  Course Outcome Statements  Knowledge Level
CO1:  Understand the fundamentals of composite materials and its mechanical behavior.  K2
CO2:  Analysis of fiber reinforced Laminate design for different combinations of plies with different orientations of the fiber.  K4
CO3:  Examine Thermo-mechanical behavior and residual stresses in Laminates  K4
CO4:  Apply Classical Laminate Theory (CLT) to study and analysis of residual stresses in an isotropic layered structure such as electronic chips.  K3
**TEXT BOOKS:**

1. Carl T. Herakovich, Mechanics of Fibrous Composites, 1997,

**REFERENCES:**

COURSE OBJECTIVE:
- To understand the construction and working principle of various parts of an automobile.
- To have the practice for assembling and dismantling of engine parts and transmission system.

UNIT I VEHICLE STRUCTURE AND ENGINES 9
Types of automobiles, vehicle construction and different layouts, chassis, frame and body, resistances to vehicle motion and need for a gearbox, components of engine-their forms, functions and materials, variable valve timing (VVT).

UNIT II ENGINE AUXILIARY SYSTEMS 9
Electronically controlled gasoline injection system for SI engines, Electronically controlled diesel injection system (Unit injector system, Rotary distributor type and common rail direct injection system), Electronic ignition system, Turbo chargers, Engine emission control by three way catalytic converter system.

UNIT III TRANSMISSION SYSTEMS 9
Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, Over drive, transfer box, fluid flywheel –torque converter, propeller shaft, slip joints, universal joints, Differential, and rear axle, Hotchkiss Drive and Torque Tube Drive.

UNIT IV STEERING, BRAKES AND SUSPENSION SYSTEMS 9
Steering geometry and types of steering gear box-Power Steering, Types of Front Axle, Types of Suspension Systems, Pneumatic and Hydraulic Braking Systems, Antilock Braking System and Traction Control

UNIT V ALTERNATIVE ENERGY SOURCES 9

TOTAL: 45 Hours

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

<table>
<thead>
<tr>
<th>CO</th>
<th>Course Outcome Statements</th>
<th>Knowledge Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1:</td>
<td>Explain the vehicle construction and engines in automobiles.</td>
<td>K5</td>
</tr>
<tr>
<td>CO2:</td>
<td>Demonstrate the fuel injection, ignition systems and starting systems.</td>
<td>K3</td>
</tr>
<tr>
<td>CO3:</td>
<td>Function of the transmission and cooling systems.</td>
<td>K4</td>
</tr>
<tr>
<td>CO4:</td>
<td>Discuss the steering systems, braking systems and suspension systems.</td>
<td>K6</td>
</tr>
<tr>
<td>CO5:</td>
<td>Discuss the IC engine emissions, alternative fuels, and their conversion kits used in automobile.</td>
<td>K6</td>
</tr>
</tbody>
</table>
TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVE:

- To understand the different types of stresses and their effects in pressure vessel.
- To understand the piping layout and the stresses acting on it.

UNIT I  CYLINDRICAL SHELL AND VARIOUS CLOSURES  9
Membrane theory for thin shells, stresses in cylindrical, spherical and conical shells, dilation of above shells, general theory of membrane stresses in vessel under internal pressure and its application to ellipsoidal and torispherical end closures. Bending of circular plates and determination of stresses in simply supported and clamped circular plate. Introduction to ASME code and formulae.

UNIT II  JUNCTION STRESSES, OPENING AND REINFORCEMENTS  9
Discontinuity stresses. Stress concentration in plate having circular hole due to bi-axial loading. Theory of reinforced opening and reinforcement limits.

UNIT III  SUPPORT DESIGN  9
Supports for vertical & horizontal vessels. Design of base plate and support lugs. Types of anchor bolt, its material and allowable stresses. Design of saddle supports.

UNIT IV  BUCKLING IN VESSELSB  9
Buckling of vessels under external pressure. Elastic buckling of long cylinders, buckling modes, Collapse under external pressure. Design for stiffening rings. Buckling under combined external pressure and axial loading.

UNIT V  PIPING STRESS ANALYSIS  9

TOTAL : 45 Hours

COURSE OUTCOMES:
After successful completion of the Design of Pressure Vessels and Piping course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>Course Outcome Statements</th>
<th>Knowledge Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Design of cylindrical shell and various closures</td>
<td>K6</td>
</tr>
<tr>
<td>CO2</td>
<td>Stress analysis circular hole due to bi-axial loading.</td>
<td>K4</td>
</tr>
<tr>
<td>CO3</td>
<td>Design of saddle stress</td>
<td>K6</td>
</tr>
<tr>
<td>CO4</td>
<td>Design of buckling vessels</td>
<td>K6</td>
</tr>
<tr>
<td>CO5</td>
<td>Design of piping stress analysis</td>
<td>K6</td>
</tr>
</tbody>
</table>
TEXT BOOKS:
1. Harvey J F , 'Pressure vessel design' CBS publication
2. Brownell. L E & Young. E. D , 'Process equipment design', Wiley Eastern Ltd., India

REFERENCES:
1. ASME Pressure Vessel and Boiler code, Section VIII Div 1 & 2, 2003
2. American standard code for pressure piping , B 31.1
COURSE OBJECTIVE:
- To familiarize the students with the sources of vibration and noise in machines and make design modifications to reduce the vibration and noise and improve the life of the components.

UNIT I INTRODUCTION
Relevance of and need for vibrational analysis, Mathematical modeling of vibrating systems - discrete and continuous systems - single-degree of freedom systems, free and forced vibrations, various damping models.

UNIT II TWO DEGREES OF FREEDOM SYSTEMS
Generalized co-ordinates, principal co-ordinates, derivation of equations of motion, co-ordinate coupling, and Lagrange's equation.

UNIT III MULTI DEGREES OF FREEDOM SYSTEMS
Derivation of equations of motion, influence coefficients, orthogonality principle, calculation of natural frequencies by Raleigh, Stodala, Dunkerley, Holzer and matrix iteration methods, branched system, geared system.

UNIT IV VIBRATION MEASUREMENT AND CONTROL
Measurement of vibration, FFT analyzer, Methods of vibration control - excitation reduction at source, balancing of rigid, flexible and variable mass rotors. Dynamic properties and selection of structural materials - viscoelastic polymers, vibration absorbers- tuned absorber, tuned and damped absorber (qualitative treatment only), untuned viscous damper, vibration isolation.

UNIT V TRANSIENT VIBRATION AND NOISE
Impulse and arbitrary excitation, base excitation, Laplace transform formulation, response spectrum, Properties of sound - sound level meter, Sound isolation - machine enclosures, silencers and mufflers.

TOTAL: 45 Hours

COURSE OUTCOMES:
After successful completion of the Vibration and Noise Engineering course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>Course Outcome Statements</th>
<th>Knowledge Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Identify the sources of vibration and noise in machines.</td>
<td>K3</td>
</tr>
<tr>
<td>CO2</td>
<td>Relationship for derivation of equations of motion, co-ordinate coupling, and Lagrange's equation.</td>
<td>K4</td>
</tr>
<tr>
<td>CO3</td>
<td>Understand the derivation of equations of motion in multi degrees of freedom system.</td>
<td>K2</td>
</tr>
<tr>
<td>CO4</td>
<td>Measurement of vibration, FFT analyzer</td>
<td>K4</td>
</tr>
<tr>
<td>CO5</td>
<td>Design and develop the transient vibration and noise.</td>
<td>K6</td>
</tr>
</tbody>
</table>
TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVE:
- To understand the basic difference between incompressible and compressible flow.
- To understand the phenomenon of shock waves and its effect on flow.
- To gain some basic knowledge about jet propulsion and Rocket Propulsion.

(Use of Standard Gas Tables permitted)

UNIT I  COMPRESSIBLE FLOW – FUNDAMENTALS  9
Energy and momentum equations for compressible fluid flows, various regions of flows, reference velocities, stagnation state, velocity of sound, critical states, Mach number, critical Mach number, types of waves, Mach cone, Mach angle, effect of Mach number on compressibility.

UNIT II  FLOW THROUGH VARIABLE AREA DUCTS  9
Isentropic flow through variable area ducts, Nozzle flow - T-s and h-s diagrams for nozzle and diffuser flows, area ratio as a function of Mach number, mass flow rate through nozzles and diffusers, chocked mass flow rate of the nozzle - effect of friction in flow through nozzles.

UNIT III  FLOW THROUGH CONSTANT AREA DUCTS  9
Flow in constant area ducts with friction – Fanno curves and Fanno flow equation, variation of flow properties, variation of Mach number with duct length. Isothermal flow with friction in constant area ducts. Flow in constant area ducts with heat transfer, Rayleigh line and Rayleigh flow equation, variation of flow properties, maximum heat transfer.

UNIT IV  NORMAL SHOCK  9
Governing equations, variation of flow parameters like static pressure, static temperature, density, stagnation pressure and entropy across the normal shock, Prandtl - Meyer equation, impossibility of shock in subsonic flows, flow in convergent and divergent nozzle with shock, normal shock in Fanno and Rayleigh flows, flow with oblique shock.

UNIT V  PROPULSION  9
Aircraft propulsion – types of jet engines – energy flow through jet engines, study of turbojet engine components – diffuser, compressor, combustion chamber, turbine and exhaust systems, performance of turbojet engines – thrust, thrust power, propulsive and overall efficiencies, thrust augmentation in turbojet engine, ram jet and pulse jet engines. Rocket propulsion – rocket engines thrust equation – effective jet velocity specific impulse – rocket engine performance, solid and liquid propellants, comparison of different propulsion systems.

TOTAL: 45 Hours

Note: (Use of approved gas tables is permitted in the University examination)
COURSE OUTCOMES:

After successful completion of the Gas Dynamics and Jet Propulsion course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>Course Outcome Statements</th>
<th>Knowledge Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Understand the basic difference between incompressible and compressible flow.</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Understand the phenomenon of shockwaves and effect on flow.</td>
<td>K2</td>
</tr>
<tr>
<td>CO3</td>
<td>Study the basic concepts and isentropic flows.</td>
<td>K2</td>
</tr>
<tr>
<td>CO4</td>
<td>Study the flow through constant area and variable area duct.</td>
<td>K2</td>
</tr>
<tr>
<td>CO5</td>
<td>Identify the effect of friction in flow through nozzles.</td>
<td>K2</td>
</tr>
</tbody>
</table>

TEXT BOOKS:


REFERENCES:

18DBME56 DESIGN OF JIGS, FIXTURES AND PRESS TOOLS

COURSE OBJECTIVE:

- To understand the functions and design principles of Jigs, fixtures and press tools
- To gain proficiency in the development of required views of the final design.

UNIT I LOCATING AND CLAMPING PRINCIPLES

COURSE OBJECTIVE of tool design - Function and advantages of Jigs and fixtures - Basic elements - principles of location - Locating methods and devices - Redundant Location - Principles of clamping - Mechanical actuation - pneumatic and hydraulic actuation Standard parts - Drill bushes and Jig buttons - Tolerances and materials used.

UNIT II JIGS AND FIXTURES

Design and development of jigs and fixtures for given component - Types of Jigs – Post, Turnover, Channel, latch, box, pot, angular post jigs – Indexing jigs – General principles of milling, Lathe, boring, broaching and grinding fixtures – Assembly, Inspection and Welding fixtures – Modular fixturing systems- Quick change fixtures.

UNIT III PRESS WORKING TERMINOLOGIES AND ELEMENTS OF CUTTING DIES


UNIT IV BENDING AND DRAWING DIES


UNIT V OTHER FORMING TECHNIQUES

Bulging, Swaging, Embossing, coining, curling, hole flanging, shaving and sizing, assembly, fine Blanking dies – recent trends in tool design- computer Aids for sheet metal forming Analysis – basic introduction - tooling for numerically controlled machines- setup reduction for work holding – Single minute exchange of dies – Poka Yoke.

TOTAL: 45 Hours

Note: (Use of P S G Design Data Book is permitted in the University examination)

COURSE OUTCOMES:

After successful completion of the Design of Jigs, Fixtures and Press Tools course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>Course Outcome Statements</th>
<th>Knowledge Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1:</td>
<td>Understand the principles of designing jigs, fixtures and press tools.</td>
<td>K2</td>
</tr>
<tr>
<td>CO2:</td>
<td>Understand the parts in various designs.</td>
<td>k3</td>
</tr>
<tr>
<td>CO3:</td>
<td>Adopt a standard procedure for the design of Jigs.</td>
<td>K5</td>
</tr>
</tbody>
</table>
CO4: Understand the fixtures and press tools. K6

CO5: Understand the press working terminologies and elements of cutting dies. K4

TEXT BOOKS:

REFERENCES:
5. ASTME Fundamentals of Tool Design Prentice Hall of India.
COURSE OBJECTIVE:

- To understand the functions of the basic components of a Robot.
- To study the use of various types of End of Effectors and Sensors
- To impart knowledge in Robot Kinematics and Programming
- To learn Robot safety issues and economics.

UNIT I AUTOMATION 12
Basic principles of automation; Hard Automation, Flexible Automation extending the capabilities of conventional machines through improved devices and manipulators; Transfer Machines for Assembly, Multi spindle Automatics

UNIT II CNC 12
Basic principles of numerical control; Methods of coding and programming; CNC, DNC and Machining Centres; Manual Programming, Computer Aided (APT) programming; Adaptive control; Economics of numerical control.

UNIT III FUNDAMENTALS OF ROBOT 12

UNIT IV ROBOT DRIVE SYSTEMS AND END EFFECTORS 12

UNIT V SENSORS AND MACHINE VISION 12

TOTAL: 60 Hours

COURSE OUTCOMES:

After successful completion of the Automation, CNC and Robotics course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>Course Outcome Statements</th>
<th>Knowledge Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Explain the principles of automation</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Applying the programming knowledge on CNC machining.</td>
<td>K3</td>
</tr>
</tbody>
</table>
CO3:  Design and development of robot anatomy model and its structure.  

CO4:  Construction of Robot End effectors and drive system.  

CO5:  Measure the sensors data and explain the machine vision system to robotics.  

TEXT BOOK:


REFERENCES:

COURSE OBJECTIVE:
➢ To learn about various unconventional machining processes, the various process parameters and their influence on performance and their applications.

UNIT I INTRODUCTION
Need for non-traditional machining methods - Classification of modern machining processes - Considerations in process selection, Materials, Applications. Ultrasonic machining - Elements of the process, mechanics of metal removal process parameters, economic considerations, Applications and limitations, recent development.

UNIT II MECHANICAL PROCESSES
Abrasive jet machining, Water jet machining and abrasive water jet machining Basic principles, equipments, process variables, mechanics of metal removal, MRR, application and limitations. Ultrasonic Machining, AJM, WJM and USM, Working Principles - equipment used - Process parameters - MRR- Variation in techniques used - Applications.

UNIT III ELECTRO - CHEMICAL PROCESSES
Fundamentals of electro chemical machining, electrochemical grinding, electro chemical honing and deburring process, metal removal rate in ECM, Tool design, Surface finish and accuracy economic aspects of ECM - Simple problems for estimation of metal removal rate. Fundamentals of chemical machining, advantages and applications.

UNIT IV THERMAL METAL REMOVAL PROCESSES – I
General Principle and applications of Electric Discharge Machining, Electric Discharge Grinding and electric discharge wire cutting processes - Power circuits for EDM, Mechanics of metal removal in EDM, Process parameters, selection of tool electrode and dielectric fluids, methods surface finish and machining accuracy, characteristics of spark eroded surface and machine tool selection. Wire EDM, principle, applications.

UNIT V THERMAL METAL REMOVAL PROCESSES - II

TOTAL: 45 Hours

COURSE OUTCOMES:
After successful completion of the Unconventional Machining Processes course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>Course Outcome Statements</th>
<th>Knowledge Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1:</td>
<td>Study and understand the non-traditional machining methods.</td>
<td>K2</td>
</tr>
<tr>
<td>CO2:</td>
<td>Identify best mechanics of metal removal for various abrasive and water jet machining.</td>
<td>k3</td>
</tr>
</tbody>
</table>
CO3: Evaluate the various types of electro and chemical process.  

CO4: Create and development of metal removal process with help of electric discharge machining and Wire cut electric discharge machining.  

CO5: Classify the various types of thermal metal removal process.  

TEXT BOOKS:  

REFERENCES:  
COURSE OBJECTIVE:

- To understand the various forms of manufacturing processes used in the automobile components.
- To familiarize the students with the forging, extrusion, casting, machining process and recent trends in manufacturing of auto components.

UNIT I MANUFACTURE OF ENGINE & ENGINE COMPONENTS

- Introduction
- Casting of engine block
- Drilling of cylinder holes
- Water cooling passages
- Preparation of casting for cylinder heads
- Design of cores
- Forging of crankshafts and connecting rod
- Casting piston and drilling of oil holes
- Upset forging of valves
- Heat treatment of crankshafts and connecting rod
- Drilling of oil holes and grinding of crank shafts
- Forging and heat treatment of camshafts

UNIT II MANUFACTURE OF CLUTCH, GEAR BOX AND PROPELLER SHAFT

- Manufacturing friction plates
- Manufacture of composite friction lining
- Composite moulding of phenol formaldehyde lining
- Casting of gear box casing
- Introduction to gear milling
- Hobbling
- Manufacturing and inspection of gears
- Casting of propeller shaft
- Extrusion of propeller shaft
- Extrusion dies
- Heat treatment and surface hardening of propeller shaft

UNIT III MANUFACTURE OF AXLES & SPRINGS AND BODY PANELS

- Forging of axles
- Casting of front and rear axles
- Provision of KPI
- Wrap forming of coil springs
- Introduction to the thermoforming and hydro-forming
- Press forming
- Welding of body panels
- Resistance welding and other welding processes

UNIT IV MANUFACTURE OF AUTOMOTIVE PLASTIC COMPONENTS

- Introduction
- Principle of injection moulding
- Injection moulding of instrument panel
- Moulding of bumpers
- Tooling and tooling requirements
- Hand lay-up process for making composite panels
- Filament winding of automotive spring and propeller shaft
- Manufacture of metal/Polymer/Metal panels

UNIT V MANUFACTURE OF ENGINE COMPONENTS USING CERAMIC MATRIX COMPOSITES

- Introduction
- Ceramic matrix piston rings
- Chemical vapour deposition
- Cryogenic grinding of powders
- Sol-gel processing
- Machining concepts using NC
- Generation of numerical control codes using Pro-E and IDEAS package
- Interfacing the CNC machine and manufacturing package
- Introduction to rapid prototyping
- Rapid prototyping of using resins

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the Manufacture of Automotive Components course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>Course Outcome Statements</th>
<th>Knowledge Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Understand the various forms of manufacturing processes used in the automobile components.</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Explain forging, extrusion, casting and other machining process used for manufacturing the auto components.</td>
<td>k3</td>
</tr>
</tbody>
</table>
CO3: Understand manufacturing methods for engine and engine components

CO4: Identify various manufacturing methods and materials used for the clutch.

CO5: Identify various manufacturing methods and materials used for the gear box.

TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVE:

- To learn the thermal and stress analysis on various parts of the heat exchangers
- To analyze the sizing and rating of the heat exchangers for various applications

UNIT I   DIFFERENT CLASSIFICATION OF HEAT EXCHANGERS

Parallel flow, counter flow and cross flow; shell and tube and plate type; single pass and multi-pass; once through steam generators etc.

UNIT II   PROCESS DESIGN OF HEAT EXCHANGERS

Heat transfer correlations, Overall heat transfer coefficient, LMTD, sizing of finned tube heat exchangers, U tube heat exchangers, fouling factors, pressure drop calculations.

UNIT III   MECHANICAL DESIGN OF SHELL AND TUBE TYPE

Thickness calculation, Tubesheet design using TEMA formula, concept of equivalent plate for analysing perforated analysis, flow induced vibration risks including acoustic issues and remedies, tube to tube sheet joint design, buckling of tubes, thermal stresses.

UNIT IV   COMPACT AND PLATE HEAT EXCHANGER

Types – Merits and Demerits – Design of compact heat exchangers, plate heat exchangers, performance influencing parameters, limitations.

UNIT V   CONDENSORS AND COOLING TOWERS

Design of surface and evaporative condensers – cooling tower – performance Characteristics

TOTAL: 45 hours

COURSE OUTCOMES:

After successful completion of the design of heat exchangers course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>Course Outcome Statements</th>
<th>Knowledge Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1:</td>
<td>Understand the basic principles of heat exchangers systems and their application.</td>
<td>K2</td>
</tr>
<tr>
<td>CO2:</td>
<td>Explain the different classification of heat exchangers.</td>
<td>k3</td>
</tr>
<tr>
<td>CO3:</td>
<td>Differentiate the Parallel flow, counter flow and cross flow for heat exchangers.</td>
<td>K5</td>
</tr>
<tr>
<td>CO4:</td>
<td>Understand the thermal and stress analysis on various parts of the heat exchangers.</td>
<td>K6</td>
</tr>
<tr>
<td>CO5:</td>
<td>Calculate the Heat transfer correlations, Overall heat transfer coefficient, LMTD, etc.</td>
<td>K4</td>
</tr>
</tbody>
</table>
TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVE:

- To know the principle methods, areas of usage, possibilities and limitations as well as environmental effects of the Additive Manufacturing technologies.
- To be familiar with the characteristics of the different materials those are used in Additive Manufacturing.

UNIT I  INTRODUCTION

UNIT II  CAD & REVERSE ENGINEERING

UNIT III  LIQUID BASED AND SOLID BASED ADDITIVE MANUFACTURING SYSTEMS
Classification – Liquid based system – Stereolithography Apparatus (SLA) - Principle, process, advantages and applications - Solid based system – Fused Deposition Modeling - Principle, process, advantages and applications, Laminated Object Manufacturing.

UNIT IV  POWDER BASED ADDITIVE MANUFACTURING SYSTEMS

UNIT V  MEDICAL AND BIO-ADDITIVE MANUFACTURING

TOTAL : 45 Hours

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

<table>
<thead>
<tr>
<th>CO</th>
<th>Course Outcome Statements</th>
<th>Knowledge Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Understand why the Advanced/Additive manufacturing (AM) has become one of the most important technology trends in decades of product development and innovation.</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Understand the comprehensive knowledge of the broad range of AM processes, devices, Capabilities and materials available.</td>
<td>K3</td>
</tr>
<tr>
<td>CO3</td>
<td>Understand the various software tools and reverse engineering techniques.</td>
<td>K4</td>
</tr>
<tr>
<td>CO4</td>
<td>Know how to create liquid based and solid based additive manufacturing system and additive manufacturing devices and processes.</td>
<td>K6</td>
</tr>
</tbody>
</table>
CO5: Understand the powder based additive manufacturing system.

TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVE:

➢ To develop the ability to understand the advanced manufacturing techniques of rapid prototyping, tooling and manufacture.

UNIT I INTRODUCTION


UNIT II LIQUID BASED AND SOLID BASED RAPID PROTOTYPING SYSTEMS


UNIT III POWDER BASED RAPID PROTOTYPING SYSTEMS


UNIT IV MATERIALS FOR RAPID PROTOTYPING SYSTEMS


UNIT V REVERSE ENGINEERING AND NEW TECHNOLOGIES

Introduction, measuring device- contact type and non-contact type, CAD model creation from point clouds-preprocessing, point clouds to surface model creation, medical data processing -types of medical imaging, software for making medical models, medical materials, other applications - Case study.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the Rapid Prototyping, Tooling and Manufacture course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>Course Outcome Statements</th>
<th>Knowledge Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Understand advanced manufacturing technologies</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Get the knowledge on development of rapid prototyping system</td>
<td>k3</td>
</tr>
<tr>
<td>CO3</td>
<td>Apply rapid prototyping methods for medical applications</td>
<td>K5</td>
</tr>
<tr>
<td>CO4</td>
<td>Known Liquid based rapid prototyping system</td>
<td>K6</td>
</tr>
<tr>
<td>CO5</td>
<td>Known Solid based rapid prototyping system</td>
<td>K4</td>
</tr>
</tbody>
</table>
TEXT BOOKS:

REFERENCE BOOKS:
COURSE OBJECTIVE:
➢ To impart knowledge about the elements and techniques involved in Mechatronics systems which are very much essential to understand the emerging field of automation.

UNIT I MECHATRONICS, SENSORS AND TRANSDUCERS

UNIT II ACTUATION SYSTEMS

UNIT III SYSTEM MODELS AND CONTROLLERS

UNIT IV PROGRAMMING LOGIC CONTROLLERS

UNIT V DESIGN OF MECHATRONICS SYSTEM

TOTAL: 45 Hours

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

CO COURSE OUTCOME STATEMENTS KNOWLEDGE LEVEL
CO1 Function of various sensors and transducers. K4
CO2 Identify the various Actuation system K3
CO3 Design and develop Mechatronics systems and primary actuating systems. K6
CO4 Evaluate the performance Programmable Logic Controllers. K5
CO5 Apply the mechatronics principles to engineering application. K3

TEXT BOOKS:

REFERENCE BOOKS:

COURSE OBJECTIVE:

- To understand the application of computers in various aspects of manufacturing viz.,
design, proper planning, manufacturing cost, layout & material handling system.

UNIT I   COMPUTER AIDED DESIGN

Concept of CAD as drafting and designing facility, desirable features of CAD package, drawing
features in CAD – Scaling, rotation, translation, editing, dimensioning, labeling, Zoom, pan,
redraw and regenerate, typical CAD command structure, wire frame modeling, surface modeling
and solid modeling (concepts only) in relation to popular CAD packages.

UNIT II   COMPONENTS OF CIM

CIM as a concept and a technology, CASA/SME model of CIM, CIM II, benefits of CIM,
communication matrix in CIM, fundamentals of computer communication in CIM – CIM data
transmission methods – serial, parallel, asynchronous, synchronous, modulation, demodulation,
simplex and duplex. Types of communication in CIM – point to point (PTP), star and
multiplexing. Computer networking in CIM – the seven layer OSI model, LAN model, MAP model,
network topologies – star, ring and bus, advantages of networks in CIM.

UNIT III   GROUP TECHNOLOGY AND COMPUTER AIDED PROCESS PLANNING

History Of Group Technology – role of G.T in CAD/CAM Integration – part families- classification
and coding – DCLASS and MCLASS and OPTIZ coding systems – facility design using G.T –
benefits of G.T – cellular manufacturing. Process planning - role of process planning in CAD/CAM
Integration – approaches to computer aided process planning – variant approach and generative
approaches – CAPP and CMPP systems.

UNIT IV   SHOP FLOOR CONTROL AND INTRODUCTION TO FMS

Shop floor control – phases – factory data collection system – automatic identification methods –
Bar code technology – automated data collection system.
FMS – components of FMS – types – FMS workstation – material handling and storage system –
FMS layout- computer control systems – applications and benefits.

UNIT V   COMPUTER AIDED PLANNING AND CONTROL AND COMPUTER
MONITORING

Production planning and control – cost planning and control – inventory management – material
requirements planning (MRP) – shop floor control, Lean and Agile Manufacturing. Types of
production monitoring systems – structure model of manufacturing – process control and
strategies – direct digital control.

TOTAL: 45 Hours
COURSE OUTCOMES:
After successful completion of the Computer Integrated Manufacturing course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Understand the basic Concepts of drafting, designing facility of CAD package and CAD drawing command structure i.e. Scaling, rotation, translation, editing, dimensioning, labeling, Zoom, pan, redraw and regenerate.</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Identify and classify the various communication system used in Computer integrated manufacturing.</td>
<td>K3</td>
</tr>
<tr>
<td>CO3</td>
<td>Explain various coding systems, process planning and new technologies used in the Computer integrated manufacturing environment.</td>
<td>K5</td>
</tr>
<tr>
<td>CO4</td>
<td>Explain shop floor control and flexible manufacturing system.</td>
<td>K5</td>
</tr>
<tr>
<td>CO5</td>
<td>Estimate the cost planning and control in production environment.</td>
<td>K6</td>
</tr>
</tbody>
</table>

TEXT BOOK:

REFERENCE BOOKS:
COURSE OBJECTIVE:

- Providing an overview of Power Plants and detailing the role of Mechanical Engineers in their operation and maintenance.

UNIT I  INTRODUCTION TO POWER PLANTS AND BOILERS  9

UNIT II  STEAM POWER PLANT  9

UNIT III  NUCLEAR AND HYDEL POWER PLANTS  9

UNIT IV  DIESEL AND GAS TURBINE POWER PLANT  9

UNIT V  OTHER POWER PLANTS AND ECONOMICS OF POWER PLANTS  9
Geo thermal- OTEC- Tidel- Pumped storage – Solar central receiver system Cost of electric Energy- Fixed and operating costs-Energy rates- Types tariffs- Economics of load sharing, comparison of various power plants.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the Power Plant Engineering course, the student will be able to

CO  COURSE OUTCOME STATEMENTS  KNOWLEDGE LEVEL
CO1 Understand the functions of the component of power plant, modern boilers & subsystems of power plants  K4
CO2 Solve problems based on rankine cycle and binary cycle and explain the subsystems of steam power plant  K3
CO3 Evaluate the design layout and working of Nuclear and hydroelectric power plants.  K5
CO4 Construct diesel and gas turbine power plant  K6
CO5 Analyze other power plants and Evaluate economic feasibility and its implications on power generating units.  K5
TEXT / REFERENCE BOOKS:

COURSE OBJECTIVES

The objective of the course is to learn how to solve the Navier-Stokes and Euler equations for engineering problems using computational algorithms and programming. Various numerical solution techniques will be introduced and applied to several course projects.

UNIT I  FINITE DIFFERENCE METHODS  9
Governing Differential Equations and Finite Difference Method - Classification of PDEs - Initial and Boundary conditions - Initial and Boundary value problems - Finite difference method - Central, Forward, Backward difference for a uniform grid - Central difference expressions for a non-uniform grid - Numerical error - Accuracy of solution - Grid independence test.

UNIT II  CONDUCTION HEAT TRANSFER  9
Conduction Heat Transfer - Applications of Heat conduction - Steady and Unsteady conduction - One dimensional steady state problems - Two dimensional steady state problems - Three dimensional steady state problems - Transient one dimensional problems.

UNIT III  CONVECTION HEAT TRANSFER  9
Convection Heat Transfer - Introduction - Steady one dimensional Convection Diffusion - Unsteady one. Dimensional Convection - Diffusion - Unsteady two dimensional Convection - Diffusion.

UNIT IV  INCOMPRESSIBLE FLUID FLOW  9
Incompressible Fluid Flow - Introduction - Governing equations - Difficulties in solving Navier-Stokes equation - Stream function - Vorticity method - Inviscid flow (steady) - Determination of pressure for viscous flow.

UNIT V  APPLICATIONS OF COMPUTATIONAL FLUID DYNAMICS  9
Applications of Computational Fluid Dynamics - Computer graphics in CFD - Future of CFD - Enhancing the design process - understanding - Applications - Automobile, Engine, Industrial, Civil, Environmental.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the computational fluid dynamics course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Understand basic properties of computational methods – accuracy of solutions, stability, and consistency.</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Classification of computational solution techniques for time integration of ordinary differential equations.</td>
<td>K4</td>
</tr>
<tr>
<td>CO3</td>
<td>Understand the computational solution techniques for various types of partial differential equations.</td>
<td>K2</td>
</tr>
<tr>
<td>CO4</td>
<td>Solve the Euler and Navier-Stokes equations computationally.</td>
<td>K6</td>
</tr>
<tr>
<td>CO5</td>
<td>Develop the basic programming and graphic skills to conduct the flow field calculations and data analysis.</td>
<td>K3</td>
</tr>
</tbody>
</table>
TEXT/REFERENCE BOOKS:
COURSE OBJECTIVE:

➢ To understand the underlying principles of operation of different IC Engines and components.
➢ To provide knowledge on pollutant formation, control, alternate fuel etc.

UNIT I SPARK IGNITION ENGINES 9

UNIT II COMPRESSION IGNITION ENGINES 9

UNIT III POLLUTANT FORMATION AND CONTROL 9

UNIT IV ALTERNATIVE FUELS 9
Alcohol, Hydrogen, Compressed Natural Gas, Liquefied Petroleum Gas and Bio Diesel - Properties, Suitability, Merits and Demerits - Engine Modifications.

UNIT V RECENT TRENDS 9

TOTAL: 45 Hours

COURSE OUTCOMES:
After successful completion of the Advanced I.C Engine course, the student will be able to

Co  Course Outcome Statements  Knowledge Level

CO1: Understand the working of a spark ignition engine.  K2

CO2: Explain the working of a compression ignition engine.  K2

CO3: Analyze the engine exhaust emission and its control.  K4

CO4: Evaluate the different types of alternative fuels and select them based upon the need.  K5

CO5: Discus and recognize the recent trends in IC engines.  K6
TEXT BOOKS:


REFERENCES:

COURSE OBJECTIVE:

- To understand the different types of stresses and their effects in pressure vessel.
- To understand the piping layout and the stresses acting on it.

UNIT I INTRODUCTION

Nanoscale Science and Technology - Implications for Physics, Chemistry, Biology and Engineering
classifications of nanostructured materials - nano particles- quantum dots, nano wires-ultra-thin films
ultilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, ptical,
Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II PREPARATION METHODS

Bottom-up Synthesis-Top-down Approach: Precipitation, Mechanical Milling, Colloidal routes,
Selfassembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy,
Atomic Layer Epitaxy, MOMBE.

UNIT III PATTERNING AND LITHOGRAPHY FOR NANOSCALE DEVICES

Introduction to optical/UV electron beam and X-ray Lithography systems and processes, Wetetching, dry
(Plasma /reactive ion) etching, Etch resists-dip pen lithography

UNIT IV PREPARATION ENVIRONMENTS

Clean rooms: specifications and design, air and water purity, requirements for particular processes,
Vibration free environments: Services and facilities required. Working practices, sample cleaning,
Chemical purification, chemical and biological on tamination, Safety issues, flammable and toxic hazards,
biohazards.

UNIT V CHARACTERIZATION TECHNIQUES

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission
Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM,STM,
SNOM, ESCA, SIMS-Nano indentation

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the Fundamentals of Nano science course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>Course Outcome Statements</th>
<th>Knowledge Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Gain the working knowledge of nanotechnology principles and industrial applications.</td>
<td>K4</td>
</tr>
<tr>
<td>CO2</td>
<td>Understand the Nano-scale paradigm in terms of properties at the Nano-scale dimensions.</td>
<td>K6</td>
</tr>
<tr>
<td>CO3</td>
<td>Understand the concepts in materials science, chemistry, physics, biology and engineering.</td>
<td>K4</td>
</tr>
</tbody>
</table>
CO4: Gain the knowledge in the field of nanotechnology. K4
CO5: Understand the current nanotechnology solutions in design, engineering and Manufacturing. K3

TEXT BOOKS:

REFERENCES:
1. G Timp (Editor), Nanotechnology, AIP press/Springer, 1999
COURSE OBJECTIVE:
➢ To introduce the various concepts of product design tools and techniques while designing a product.

UNIT I INTRODUCTION
Product Development process – Product development organizations, Gather raw data – Interpret raw data – organize the needs into a hierarchy – Relative importance of the needs. Product life cycle management - concepts, benefits, value addition to customer. Lifecycle Models- creation of projects and roles, users and project management, system administration, Access control and its use in life cycle.

UNIT II PRODUCT SPECIFICATIONS

UNIT III PRODUCT ARCHITECTURE
Concept selection- Screening – scoring, Product architecture – Implication of architecture – Establishing the architecture – Related system level design issues.

UNIT IV INDUSTRIAL DESIGN
Need for industrial design – Impact of industrial design – Industrial design process – Management of industrial design process – Assessing the quality of industrial design, design for Manufacturing- cost considerations, Impact of DFM decisions on other factors.

UNIT V PRINCIPLES OF PROTOTYPING AND ECONOMIC ANALYSIS

TOTAL: 45 Hours

COURSE OUTCOMES:
After successful completion of the Product Development and Manufacture course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>Course Outcome Statements</th>
<th>Knowledge Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1:</td>
<td>Understand the new product management through the manufacturing area.</td>
<td>K4</td>
</tr>
<tr>
<td>CO2:</td>
<td>Introduce the various concepts of product design tools.</td>
<td>K6</td>
</tr>
<tr>
<td>CO3:</td>
<td>Identification of design criteria which are used in designing a product.</td>
<td>K4</td>
</tr>
<tr>
<td>CO4:</td>
<td>Gathering and interpreting and organizing of raw data.</td>
<td>K4</td>
</tr>
<tr>
<td>CO5:</td>
<td>Understand Product lifecycle management (PLM) and Product Data Management (PDM).</td>
<td>K3</td>
</tr>
</tbody>
</table>
TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVE:

- To stress the importance of NDT in engineering.
- To introduce all types of NNDT and their applications in Engineering.

UNIT I  
OVERVIEW OF NDT  
9
NDT Versus Mechanical testing, Overview of the Non Destructive Testing Methods for the detection of manufacturing defects as well as material characterisation. Relative merits and limitations, Various physical characteristics of materials and their applications in NDT, Visual inspection – Unaided and aided.

UNIT II  
SURFACE NDE METHODS  
9

UNIT III  
THERMOGRAPHY AND EDDY CURRENT TESTING (ET)  
9

UNIT IV  
ULTRASONIC TESTING (UT) AND ACOUSTIC EMISSION (AE)  
9

UNIT V  
RADIOGRAPHY (RT)  
9

TOTAL : 45 Hours

COURSE OUTCOMES:

After successful completion of the Non Destructive Testing and Materials course, the student will be able to

CO  
Course Outcome Statements  
Knowledge Level

CO1:  
Understand the NDT versus mechanical testing.  
K2

CO2:  
Analyze Liquid Penetrant Testing and its properties and, Principles and methods of demagnetization  
K4

CO3:  
Determine thermography principles and eddy current testing  
K5
CO4: Classify ultrasonic testing principles and acoustic emission technique

CO5: Discuss and understand the principle of radiography and film techniques.

TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVE:

- The objective of the course is to provide a mathematical introduction to the mechanics and control of robots that can be modeled as kinematic chains.

UNIT I INTRODUCTION

Introduction to Robotics- Robot, Robotics, Types of Robot, Robot classification, Types of Robot, Degrees of freedom.

UNIT II KINEMATICS AND DYNAMICS OF ROBOTIC LINKS


UNIT III SENSORS AND ACTUATORS

Sensors and actuators- Strain gauge, resistive potentiometers, Tactile and force sensors, tachometers, LVDT, Piezoelectric accelerometer, Hall effect sensors, Optical Encoders, Pneumatic and Hydraulic actuators, servo valves, DC motor, stepper motor, drives.

UNIT IV CONTROLLERS

Control of Manipulators- Feedback control of II order linear systems, Joint control, Trajectory control, Controllers, PID control.

UNIT V ROBOT PROGRAMMING

Robot Programming-Language-overview, commands for elementary operations.

TOTAL: 45 Hours

COURSE OUTCOMES

After successful completion of the Industrial Robotics course, the student will be able to:

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Identify the electrical, electronic and mechanical components and use of them design or machine elements and transmission system.</td>
<td>K3</td>
</tr>
<tr>
<td>CO2</td>
<td>Understand the features and operation of automation products.</td>
<td>K2</td>
</tr>
<tr>
<td>CO3</td>
<td>Identify the various sensors and actuators using in the manufacturing cells with robotic control.</td>
<td>K3</td>
</tr>
<tr>
<td>CO4</td>
<td>Understand the various controllers’ manipulators using in industrial robotics.</td>
<td>K2</td>
</tr>
<tr>
<td>CO5</td>
<td>Write the programming for the industrial robotics.</td>
<td>K1</td>
</tr>
</tbody>
</table>

TEXT/REFERENCE BOOKS:

7. Eronini Umez-Eronini, System Dynamics & Control, Brooks/ Cole Publishing Company,
After successful completion of the Micro Electro Mechanical Systems course, the student will be able to

**CO1:** Understand the operational theory of common MEMS sensors and MEMS actuators.

**CO2:** Identify situations where MEMS sensors and actuators would be ideal for applications to various products.

**CO3:** Apply the scaling laws to determine that MEMS devices would perform better than existing Non micro scale devices.

**CO4:** Analyze the engineering, science and physics of MEMS devices at the micro scale level including electrostatics, thermodynamics, piezoresistive, piezoelectric, magnetism, micro fluidics and optics.
CO5: Understand the fabrication methods used to build/construct MEMS.

TEXTBOOK:
COURSE OBJECTIVE:

- To introduce the various Modern manufacturing systems.
- To understand the concepts and applications of flexible manufacturing systems.

UNIT I PLANNING, SCHEDULING AND CONTROL OF FLEXIBLE MANUFACTURING SYSTEMS


UNIT II COMPUTER CONTROL AND SOFTWARE FOR FLEXIBLE MANUFACTURING SYSTEMS


UNIT III FMS SIMULATION AND DATA BASE


UNIT IV GROUP TECHNOLOGY AND JUSTIFICATION OF FMS


UNIT V APPLICATIONS OF FMS AND FACTORY OF THE FUTURE


TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the Product Development and Manufacture course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Understand the Perform Planning, Scheduling and control of Flexible Manufacturing systems.</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Build the simulation skills on software's use of group technology to product classification.</td>
<td>K3</td>
</tr>
<tr>
<td>CO3</td>
<td>Develop the prototype of a FMS simulation and data base.</td>
<td>K3</td>
</tr>
<tr>
<td>CO4</td>
<td>Determine Group Technology and justification of FMS layout.</td>
<td>K5</td>
</tr>
<tr>
<td>CO5</td>
<td>Identify the applications of FMS and factory of the future.</td>
<td>K3</td>
</tr>
</tbody>
</table>
TEXT BOOKS:

REFERENCES:
OPEN ELECTIVE COURSES
COURSE OBJECTIVE:
➢ To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization.

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS

UNIT II PLANNING

UNIT III ORGANISING

UNIT IV DIRECTING

UNIT V CONTROLLING
System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Productivity problems and management – control and performance – direct and preventive control – reporting.

TOTAL: 45 Hours

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

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Understand the management roles, skills, and evolution of the management.</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Understand the functions and applications of the principles organization.</td>
<td>K2</td>
</tr>
<tr>
<td>CO3</td>
<td>Understand the planning and organizing system of the management.</td>
<td>K2</td>
</tr>
<tr>
<td>CO4</td>
<td>Understand the directing and controlling system of the management.</td>
<td>K2</td>
</tr>
<tr>
<td>CO5</td>
<td>Identify and analyze the ethical issue in the subject matter under</td>
<td>K4</td>
</tr>
</tbody>
</table>
investigation.

TEXT BOOKS:

REFERENCE BOOKS:
COURSE OBJECTIVE:
- To provide knowledge and training in using optimization techniques under limited resources for the engineering and business problems.

UNIT I  LINEAR MODELS  15

UNIT II  TRANSPORTATION MODELS AND NETWORK MODELS  8

UNIT III  INVENTORY MODELS  6
Inventory models – Economic order quantity models – Quantity discount models – Stochastic inventory models – Multi product models – Inventory control models in practice

UNIT IV  QUEUEING MODELS  6
Queueing models - Queueing systems and structures – Notation parameter – Single server and multi server models – Poisson input – Exponential service – Constant rate service – Infinite population – Simulation.

UNIT V  DECISION MODELS  10

TOTAL: 45 Hours

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

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Develop the operational research models for the verbal description of the real system of linear models.</td>
<td>K6</td>
</tr>
<tr>
<td>CO2</td>
<td>Understand the mathematical optimization tools to solve optimization problems.</td>
<td>K4</td>
</tr>
<tr>
<td>CO3</td>
<td>Use mathematical and simulation software to solve the proposed models.</td>
<td>K6</td>
</tr>
<tr>
<td>CO4</td>
<td>Understand the transportation &amp; network models and various techniques of operations research.</td>
<td>K6</td>
</tr>
<tr>
<td>CO5</td>
<td>Understand the techniques used in operations research to solve the real life problem in minimizing the industrial problems suggest an optimum solution.</td>
<td>K5</td>
</tr>
</tbody>
</table>
TEXT / REFERENCE BOOKS:
COURSE OBJECTIVE:
➢ To sensitize the Engineering students to various aspects of Human Rights.

UNIT I Introduction to Human Rights

UNIT II Evolution and Laws of Human Rights

UNIT III Theories and perspectives UN Laws and Agencies
Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV Human Rights in India
Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V Human Rights Various Commissions

Total: 45 Hours

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

CO COURSE OUTCOME STATEMENTS KNOWLEDGE LEVEL
CO1 Understand basics of Human Rights K2
CO2 Understand the Evolution and Laws of Human Rights K2
CO3 Summarize the various theories and perspectives UN Laws and Agencies K2
CO4 Understand the Human Rights in India K2
CO5 Understand the Human Rights of Various Commissions in India K2

REFERENCE BOOKS:
COURSE OBJECTIVE:
➢ To enable the students to create an awareness on Engineering Ethics and Human Values to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

UNIT I  HUMAN VALUES

UNIT II  ENGINEERING ETHICS

UNIT III  ENGINEERING AS SOCIAL EXPERIMENTATION
Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV  SAFETY, RESPONSIBILITIES AND RIGHTS

UNIT V  GLOBAL ISSUES

TOTAL: 45 Hours

COURSE OUTCOMES:
After successful completion of the professional ethics in engineering course, the student will be able to

CO  COURSE OUTCOME STATEMENTS   KNOWLEDGE LEVEL
CO1  Identify the multiple ethical interests at stake in a real-world situation or in practice.   K4
CO2  Understand the variety of moral issues related to engineering ethics.   K2
CO3  Identify the ethical concerns in research and intellectual contexts, including academic integrity.   K4
CO4  Understand the risk Benefit Analysis and Reducing Risk in the work environment.   K2
CO5  Understand the internships, fieldwork nature and safety responsibilities with rights.   K2
TEXT BOOKS:


REFERENCE BOOKS:

COURSE OBJECTIVE:

➢ To make the students to understand the various quality control techniques and to construct the various quality control charts for variables and attributes and also the design concepts for reliable system and maintenance aspects in industries.

UNIT I INTRODUCTION AND PROCESS CONTROL FOR VARIABLES
Introduction, definition of quality, basic concept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance, Quality control: Quality cost-Variation in process causes of variation – Theory of control chart- uses of control chart – Control chart for – process capability – process capability studies variables – X chart, R chart and simple problems, Six sigma concepts.

UNIT II PROCESS CONTROL FOR ATTRIBUTES
Control chart for attributes – control chart for non-conforming – p chart and np chart – control chart for nonconformities– C and U charts, State of control and process out of control identification in charts, pattern study.

UNIT III ACCEPTANCE SAMPLING

UNIT IV LIFE TESTING – RELIABILITY

UNIT V QUALITY AND RELIABILITY

Note: Use of approved statistical table permitted in the examination

TOTAL: 45 Hours

COURSE OUTCOMES:
After successful completion of the Quality Control and Reliability Engineering course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Understand the concepts of Quality Control and Statistical Process Control variables (SPC).</td>
<td>K6</td>
</tr>
<tr>
<td>CO2</td>
<td>Understand the Control Charts for Variables and Central Limit Theorem.</td>
<td>K4</td>
</tr>
<tr>
<td>CO3</td>
<td>Understand the Natural and assignable causes of variation and process control for attributes</td>
<td>K6</td>
</tr>
</tbody>
</table>
CO4  Draw and explain the Mean Chart Limits (x-Charts) and Setting the Range Chart Limits (R-Charts)  K6

CO5  Understand the Mean and Range Charts and acceptance sampling.  K5

TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVE:
➢ To provide the basic concepts and features of value analysis and value engineering.

UNIT I CONCEPTS

UNIT II TECHNIQUES

UNIT III ANALYSIS

UNIT IV VALUE ENGINEERING IN JOB PLAN

UNIT V CASE STUDIES
Water treatment plant – engineering management, pump component, motor component, wet grinder, automobile, hospital.

TOTAL: 45 Hours

COURSE OUTCOMES:
After successful completion of the Value Analysis and Value Engineering course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>Course Outcome Statements</th>
<th>Knowledge Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1:</td>
<td>Solve complex engineering tasks based on technical-economic disciplines.</td>
<td>K6</td>
</tr>
<tr>
<td>CO2:</td>
<td>Calculation of costs and evaluation of worth in Value Engineering Methodology.</td>
<td>K4</td>
</tr>
<tr>
<td>CO3:</td>
<td>Understand the general techniques of brainstorming and ABC analysis.</td>
<td>K6</td>
</tr>
<tr>
<td></td>
<td>Understand functionality important for the customer will improve the worth of the Product and eliminate the unwanted functionality to reducing the overall cost.</td>
<td></td>
</tr>
<tr>
<td>CO4:</td>
<td>Apply Value Engineering and Value Analysis in the manufacturing products.</td>
<td>K5</td>
</tr>
</tbody>
</table>
TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVE:
➢ To facilitate the understanding of Quality Management principles and process.

UNIT I   INTRODUCTION

UNIT II   TQM PRINCIPLES
Leadership – Strategic quality planning, Quality statements - Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement – PDSA cycle, 5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

UNIT III   TQM TOOLS & TECHNIQUES I

UNIT IV   TQM TOOLS & TECHNIQUES II

UNIT V   QUALITY SYSTEMS

TOTAL: 45 Hours

COURSE OUTCOMES:
After successful completion of the Total Quality Management course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Develop an understanding on quality management philosophies and frameworks.</td>
<td>K6</td>
</tr>
<tr>
<td>CO2</td>
<td>Adopt TQM methodologies for continuous improvement of quality.</td>
<td>K6</td>
</tr>
<tr>
<td>CO3</td>
<td>Measure the cost of poor quality, process effectiveness and efficiency to identify areas for improvement.</td>
<td>K5</td>
</tr>
<tr>
<td>CO4</td>
<td>Apply benchmarking and business process reengineering to improve management processes.</td>
<td>K3</td>
</tr>
<tr>
<td>CO5</td>
<td>Determine the set of indicators to evaluate performance excellence of an organization.</td>
<td>K5</td>
</tr>
</tbody>
</table>
TEXT BOOK:

REFERENCE BOOKS:
OBJECTIVES:

- To understand the various components and functions of production planning and control such as work study, product planning, process planning, production scheduling, Inventory Control.
- To know the recent trends like manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).

UNIT I  INTRODUCTION
Objectives and benefits of planning and control-Functions of production control-Types of production-job- batch and continuous-Product development and design-Marketing aspect - Functional aspects- Operational aspect-Durability and dependability aspect aesthetic aspect. Profit consideration- Standardization, Simplification & specialization-Break even analysis-Economics of a new design.

UNIT II  WORK STUDY
Method study, basic procedure-Selection-Recording of process - Critical analysis, Development - Implementation - Micro motion and memo motion study – work measurement - Techniques of work measurement - Time study - Production study - Work sampling - Synthesis from standard data- Predetermined motion time standards.

UNIT III  PRODUCT PLANNING AND PROCESS PLANNING
Product planning-Extending the original product information-Value analysis-Problems in lack of product planning-Process planning and routing-Pre requisite information needed for process planning- Steps in process planning-Quantity determination in batch production-Machine capacity, balancing- Analysis of process capabilities in a multi product system.

UNIT IV  PRODUCTION SCHEDULING

UNIT V  INVENTORY CONTROL AND RECENT TRENDS IN PPC
Inventory control-Purpose of holding stock-Effect of demand on inventories-Ordering procedures. Two bin system - Ordering cycle system-Determination of Economic order quantity and economic lot size- ABC analysis - Recorder procedure-Introduction to computer integrated production planning systems- elements of JUST IN TIME SYSTEMS-Fundamentals of MRP II and ERP.

OUTCOMES:

- Upon completion of this course, the students can able to prepare production planning and control activities such as work study, product planning, production scheduling, Inventory Control.
- They can plan manufacturing requirements manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).
TEXT BOOKS:


REFERENCES:


COURSE OBJECTIVE:

- This course provides the knowledge about energy audit and energy conservation methods in I.C. Engines.

UNIT I ENERGY AND ENVIRONMENT

Introduction - fossil fuels reserves - world energy consumption - green house effect, global warming - Renewable energy sources - environmental aspects utilization - energy prizes - energy policies.

UNIT II ENERGY CONSERVATION

Energy conservation schemes - industrial energy use - energy surveying and auditing - energy index – Energy cost - cost index - energy conservation in engineering and process industry, in thermal Systems, in buildings and non-conventional energy resources scheme.

UNIT III ENERGY TECHNOLOGIES

Fuels and consumption - boilers - furnaces - waste heat recovery systems - heat pumps and Refrigerators - storage systems - insulated pipe work systems - heat exchangers.

UNIT IV ENERGY MANAGEMENT

Energy management principles - energy resource management - energy management information Systems - instrumentation and measurement - computerized energy management - energy Auditing.

UNIT V ECONOMICS AND FINANCE

Costing techniques - cost optimization - optimal target investment schedule - financial appraisal and Profitability - project management.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the Energy Audit and Energy Conservation Methods course, the student will be able to

<table>
<thead>
<tr>
<th>Course Outcome Statements</th>
<th>Knowledge Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1: Understanding the basics of demand side management and mechanisms (technical, legal or financial) that influences energy consumption. Recognizing opportunities for increasing rational use of energy.</td>
<td>K6</td>
</tr>
<tr>
<td>CO2: Understanding the basics of energy auditing with application on different sectors.</td>
<td>K6</td>
</tr>
<tr>
<td>CO3: Understood and acquired fundamental knowledge on the science of energy and on both the conventional and non-conventional energy technologies</td>
<td>K5</td>
</tr>
<tr>
<td>CO4: Acquired the skills needed for the energy monitoring, auditing and management.</td>
<td>K3</td>
</tr>
<tr>
<td>CO5: Capable of design and analysis of energy conversion systems.</td>
<td>K5</td>
</tr>
</tbody>
</table>
TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVE:

➢ To make the students to understand the various quality control techniques and to construct the various quality control charts for variables and attributes and also the design concepts for reliable system and maintenance aspects in industries.

UNIT I  INTRODUCTION AND PROCESS CONTROL FOR VARIABLES

Introduction, definition of quality, basic concept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance, Quality control: Quality cost-Variation in process causes of variation –Theory of control chart- uses of control chart – Control chart for chart -process capability – process capability studies-variables – X chart, R chart and simple problems, Six sigma concepts.

UNIT II  PROCESS CONTROL FOR ATTRIBUTES

Control chart for attributes –control chart for non-conforming – p chart and np chart – control chart for nonconformities- C and U charts, State of control and process out of control identification in charts, pattern study.

UNIT III  ACCEPTANCE SAMPLING


UNIT IV  LIFE TESTING – RELIABILITY


UNIT V  QUALITY AND RELIABILITY


Note: Use of approved statistical table permitted in the examination

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the Quality Control and Reliability Engineering course, the student will be able to

CO1  Understand the concepts of Quality Control and Statistical Process Control variables (SPC).

CO2  Understand the Control Charts for Variables and Central Limit Theorem.

CO3  Understand the Natural and assignable causes of variation and process control for attributes

CO4  Draw and explain the Mean Chart Limits (x-Charts) and Setting the Range

K6

K4

K6

K6

169
Chart Limits (R-Charts)

CO5 Understand the Mean and Range Charts and acceptance sampling.

K5

TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVE:
- To introduce the process planning concepts to make cost estimation for various products after process planning.

UNIT I  WORK STUDY AND ERGONOMICS  9

UNIT II  PROCESS PLANNING  9

UNIT III  INTRODUCTION TO COST ESTIMATION  9

UNIT IV  COST ESTIMATION  9
Types of estimates – Methods of estimates – Data requirements and sources – Collection of cost – Allowances in estimation.

UNIT V  PRODUCTION COST ESTIMATION  9
Estimation of material cost, labour cost and over heads – Allocation of overheads – Estimation for different types of jobs manufactured by casting – Forging – Welding and machining.

TOTAL: 45 Hours

COURSE OUTCOMES:
After successful completion of the Process Planning and Cost Estimation course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Understand the concept of work study and ergonomics.</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Develop manufacturing logic and knowledge with help of production planning process.</td>
<td>K3</td>
</tr>
<tr>
<td>CO3</td>
<td>Analyze the various type of cost estimating process.</td>
<td>K4</td>
</tr>
<tr>
<td>CO4</td>
<td>Estimate data requirements and sources, Collection of cost, Allowances in production.</td>
<td>K6</td>
</tr>
<tr>
<td>CO5</td>
<td>Determine the machining time for various operation in various machines in production Shops.</td>
<td>K5</td>
</tr>
</tbody>
</table>
TEXT BOOKS:

REFERENCE BOOKS:
COURSE OBJECTIVE:
➢ To make the students familiar with the various concepts and functions of supply chain management, so that the students will be in a position to manage the supply chain management.

UNIT I INTRODUCTION
Definition of Logistics and SCM: Evolution, Scope, Importance& Decision Phases – Drivers of SC Performance and Obstacles.

UNIT II LOGISTICS MANAGEMENT

UNIT III SUPPLY CHAIN NETWORK DESIGN

UNIT IV SOURCING, AND PRICING IN SUPPLY CHAIN
Supplier selection and Contracts - Design collaboration - Procurement process. Revenue management in supply chain.

UNIT V COORDINATION AND TECHNOLOGY IN SUPPLY CHAIN

TOTAL: 45 Hours

COURSE OUTCOMES:
After successful completion of the Supply Chain Management course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Understand the logistics and supply chain management</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Analyze the design options for Transportation Networks for logistics management.</td>
<td>K4</td>
</tr>
<tr>
<td>CO3</td>
<td>Develop Framework for network Decisions in managing cycle inventory and safety</td>
<td>K3</td>
</tr>
<tr>
<td>CO4</td>
<td>Evaluating the Revenue management in supply chain Management</td>
<td>K5</td>
</tr>
<tr>
<td>CO5</td>
<td>Find the solution for various types of case analysis in supply chain management</td>
<td>K1</td>
</tr>
</tbody>
</table>
TEXT BOOKS:

REFERENCE BOOKS:
COURSE OBJECTIVE:
- To enable students to deal with newer concepts of marketing concepts like strategic marketing segmentation, pricing, advertisement and strategic formulation. The course will enable a student to take up marketing as a professional career.

UNIT I  INDUSTRIAL MARKETING
Nature of Industrial Marketing: Industrial Marketing Vs Consumer Marketing Relational approach to Industrial Marketing- The Nature of Industrial Demand &Industrial Customer. Types of Industrial Products: Major Equipment; Accessory Equipment; Raw and Processed Materials; Component Parts and Sub-Assemblies; Operating Supplies; Standardized and Non-standardized parts, Industrial services.

UNIT II  PRICING

UNIT III  MARKET RESEARCH

UNIT IV  TECHNIQUES

UNIT V  IMPLEMENTATION
Setting up & Implementation of Marketing Research Project, Steps in formulating Market Research Projects, One project for consumer durables and one for non-durables to be discussed.

TOTAL: 45 Hours
COURSE OUTCOMES:
After successful completion of the Industrial Marketing and Market Research course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Understand the industrial and consumer marketing research and to learn about the various industrial products</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Analyze the price for industrial products and Evaluate the industrial purchasing decisions</td>
<td>K4</td>
</tr>
<tr>
<td>CO3</td>
<td>Apply selected research methods and Analyze and interpret both qualitative and quantitative data. Build a simple questionnaire from a web-based survey administration site.</td>
<td>K3</td>
</tr>
<tr>
<td>CO4</td>
<td>Evaluate appropriate research problem formulation and measurement levels of data</td>
<td>K5</td>
</tr>
<tr>
<td>CO5</td>
<td>Develop new product strategies &amp; innovations</td>
<td>K6</td>
</tr>
</tbody>
</table>

TEXT BOOKS:

REFERENCE BOOKS:
3. Ramanuj Majumdar, "Marketing Research-Text, Applications and Case Studies”.
COURSE OBJECTIVE:
➢ To give an idea about IPR, registration and its enforcement.

UNIT I   INTRODUCTION
Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT II   REGISTRATION OF IPRs
Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad.

UNIT III AGREEMENTS AND LEGISLATIONS

UNIT IV   DIGITAL PRODUCTS AND LAW

UNIT V   ENFORCEMENT OF IPRs
Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

Total: 45 Hours

COURSE OUTCOMES:
After successful completion of the Intellectual Property Rights course, the student will be able to

CO1 Apply the Intellectual Property portfolio to enhance the value of the firm.

CO2 Understand the Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and international.

CO3 Understanding various practical aspects of registration of Copy agreements and legislations of intellectual property rights.

CO4 Understand and lean the digital products and law intellectual property rights Knowledge.

CO5 Understand enforcement of intellectual property rights through the Case Studies.

TEXT BOOKS:
REFERENCE BOOKS:

COURSE OBJECTIVE:

- To provide basic conceptual understanding of disasters and its relationships with development.
- To gain understanding of approaches of Disaster Risk Reduction (DRR) and the relationship between vulnerability, disasters, disaster prevention and risk reduction.
- To understand Medical and Psycho-Social Response to Disasters.

UNIT I INTRODUCTION TO DISASTER


UNIT II APPROACHES TO DISASTER RISK REDUCTION

Disasters- Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills etc); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

UNIT III PRINCIPLES OF DISASTER MEDICAL MANAGEMENT

Disaster Impacts - Disaster impacts (environmental, physical, social, ecological, economical, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate-change and urban disasters.

UNIT IV PUBLIC HEALTH RESPONSE AND INTERNATIONAL COOPERATION

Disaster Risk Reduction (DRR) - Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems; Post-disaster environmental response (water, sanitation, food safety, waste management, disease control); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

UNIT V DISASTER RISK MANAGEMENT

Disasters, Environment and Development - Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land-use changes, urbanization etc.), sustainable and environmental-friendly recovery; reconstruction and development methods.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the disaster management course, the student will be able to

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Understanding about the basic concepts of Disaster Management.</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Develop the knowledge by providing existing models in risk reduction strategies.</td>
<td>K3</td>
</tr>
<tr>
<td>CO3</td>
<td>Develop awareness among students in the disaster medicine and make them understand and prepare the natural and manmade disaster.</td>
<td>K3</td>
</tr>
</tbody>
</table>
Understand the health management of disaster is to build capacities that will reduce disaster health risks and contribute to public health.

Create awareness among participants on Disaster Management Scenario.

TEXT/REFERENCE BOOKS:
COURSE OBJECTIVE:
- To enable students to understand the fundamental economic concepts applicable to engineering and to learn the techniques of incorporating inflation factor in economic decision making.

UNIT I INTRODUCTION TO ECONOMICS

UNIT II VALUE ENGINEERING
Make or buy decision, Value engineering – Function, aims, Value engineering procedure. Interest formulae and their applications –Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factor- equal payment series capital recovery factor - Uniform gradient series annual equivalent factor, Effective interest rate, Examples in all the methods.

UNIT III CASH FLOW
Methods of comparison of alternatives – present worth method (Revenue dominated cash flow diagram), Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), rate of return method, Examples in all the methods.

UNIT IV REPLACEMENT AND MAINTENANCE ANALYSIS
Replacement and Maintenance analysis – Types of maintenance, types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset – capital recovery with return and concept of challenger and defender, Simple probabilistic model for items which fail completely.

UNIT V DEPRECIATION

TOTAL : 45 Hours

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

<table>
<thead>
<tr>
<th>CO</th>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Understand the skills to apply the basics of economics and cost analysis to engineering and take economically sound decisions.</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Identify the worthiness of the product by Make or buy decision and know the value of the time value of money.</td>
<td>K3</td>
</tr>
</tbody>
</table>
Understand the cash flow of the industrial system by various methods.

Analyze the capital recovery with return and concept of challenger and defender replacement with maintenance analysis.

Identify the depreciation of the components of the industrial system by Straight line, declining balance, Sum of the year's digits and sinking fund methods.

TEXT BOOKS:


REFERENCES:

COURSE OBJECTIVE:
➢ To develop and strengthen entrepreneurial quality and motivation in students and to impart basic entrepreneurial skills and understanding to run a business efficiently and effectively.

UNIT I ENTREPRENEURSHIP

UNIT II MOTIVATION
Major Motives Influencing an Entrepreneur – Achievement Motivation Training, Self Rating, Business Games, Thematic Apperception Test – Stress Management, Entrepreneurship Development Programs – Need, objective.

UNIT III BUSINESS

UNIT IV FINANCING AND ACCOUNTING

UNIT V SUPPORT TO ENTREPRENEURS

TOTAL : 45 Hours

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

<table>
<thead>
<tr>
<th>COURSE OUTCOME STATEMENTS</th>
<th>KNOWLEDGE LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1 Understand the basic concepts of entrepreneurship and its application in the recognition of product/service/process opportunities</td>
<td>K2</td>
</tr>
<tr>
<td>CO2 Analyze the issues associated with securing and managing financial resources in new and established organizations.</td>
<td>K4</td>
</tr>
<tr>
<td>CO3 Develop the distinct entrepreneurial, assess opportunities and constraints for new business ideas</td>
<td>K6</td>
</tr>
<tr>
<td>CO4 Understanding of new knowledge or new technology with her/his insights for the business.</td>
<td>K2</td>
</tr>
<tr>
<td>CO5 Identifying opportunities and challenges affiliated with the organization and financing of new initiatives such as new business ventures.</td>
<td>K3</td>
</tr>
</tbody>
</table>
TEXT BOOKS:

REFERENCE BOOKS: