B.E
Mechanical Engineering

Curriculum and Syllabus
(Based on Choice Based Credit System)
Effective from the Academic year
2015-2016

Department of Mechanical Engineering
School of Engineering
PROGRAMME OUTCOMES:

Bachelor of Mechanical Engineering curriculum is designed to impart Knowledge, Skill and Attitude on the graduates to

1. Have a successful career in Mechanical Engineering and allied industries.
2. Have expertise in the areas of Design, Thermal, Materials and Manufacturing.
3. Contribute towards technological development through academic research and industrial practices.
4. Practice their profession with good communication, leadership, ethics and social responsibility.
5. Graduates will adapt to evolving technologies through life-long learning.

PROGRAMME SPECIFIC OUTCOMES:

1. An ability to apply knowledge of mathematics and engineering sciences to develop mathematical models for industrial problems.
2. An ability to identify, formulates, and solve the complex engineering problems with high degree of competence.
3. An ability to design and conduct experiments, as well as to analyze and interpret data obtained through those experiments.
4. An ability to design mechanical systems, component, or a process to meet desired needs within the realistic constraints such as environmental, social, political and economic sustainability.
5. An ability to use modern tools, software and equipment to analyze multidisciplinary problems.
6. An ability to demonstrate on professional and ethical responsibilities.
7. An ability to communicate, write reports and express research findings in a scientific community.
8. An ability to adapt quickly to the global changes and contemporary practices.
## B.E. - MECHANICAL ENGINEERING CURRICULUM

TOTAL NUMBER OF CREDITS: 195

<table>
<thead>
<tr>
<th>Category</th>
<th>Code No.</th>
<th>Course</th>
<th>Hours / Week</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lecture</td>
<td>Tutorial</td>
</tr>
<tr>
<td>SEMESTER 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AECC</td>
<td>15GBE201</td>
<td>Technical English</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>CORE</td>
<td>15GBE001</td>
<td>Mathematics – I</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>CORE</td>
<td>15GBE002</td>
<td>Engineering Physics</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>CORE</td>
<td>15GBE003</td>
<td>Fundamentals of Computing</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>CORE</td>
<td>15GBE004</td>
<td>Engineering Graphics</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>CORE</td>
<td>15GBE005</td>
<td>Engineering Practices Laboratory</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>CORE</td>
<td>15GBE006</td>
<td>Engineering Physics Lab</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>CORE</td>
<td>15GBE007</td>
<td>Computer Practice Laboratory</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td><strong>14</strong></td>
<td><strong>3</strong></td>
</tr>
<tr>
<td>SEMESTER 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AECC</td>
<td>15GBE202</td>
<td>Communication Skills</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>CORE</td>
<td>15GBE008</td>
<td>Mathematics – II</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>CORE</td>
<td>15GBE009</td>
<td>Engineering Chemistry</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>CORE</td>
<td>15GBE010</td>
<td>Material Science</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>CORE</td>
<td>15EME021</td>
<td>Engineering Mechanics</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>CORE</td>
<td>15EME022</td>
<td>Basic Electrical and Electronics</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>CORE</td>
<td>15GBE011</td>
<td>Engineering Chemistry Laboratory</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>AECC</td>
<td>15GBE203</td>
<td>Language Laboratory</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>CORE</td>
<td>15EME023</td>
<td>Computer Aided Drafting Laboratory</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td><strong>18</strong></td>
<td><strong>3</strong></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>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lecture</td>
<td>Tutorial</td>
</tr>
<tr>
<td>SEMESTER 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AECC</td>
<td>15CBME32</td>
<td>Environmental Science and Engineering</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>CORE</td>
<td>15CBME31</td>
<td>Mathematics – III</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>CORE</td>
<td>15CBME34</td>
<td>Engineering Thermodynamics</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>DSE</td>
<td>15DBME__</td>
<td>Discipline Specific Elective I</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>DSE</td>
<td>15DBME__</td>
<td>Discipline Specific Elective II</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>GE</td>
<td>15GBME__</td>
<td>Generic Elective I</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>SEC</td>
<td>15SUPD__</td>
<td>Skill Enhancement Elective I</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>CORE</td>
<td>15PBME31</td>
<td>Electrical Engineering Laboratory</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>CORE</td>
<td>15PBME32</td>
<td>Computer aided Machine Design Laboratory</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total</strong></td>
<td><strong>20</strong></td>
<td><strong>2</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SEMESTER 4</th>
<th></th>
<th></th>
<th>Lecture</th>
<th>Tutorial</th>
<th>Practical</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CORE</td>
<td>15CBME41</td>
<td>Statistics and numerical methods</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CORE</td>
<td>15CBME42</td>
<td>Fluid Mechanics and Machinery</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CORE</td>
<td>15CBME43</td>
<td>Strength of Materials</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>DSE</td>
<td>15DBME__</td>
<td>Discipline Specific Elective III</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>DSE</td>
<td>15DBME__</td>
<td>Discipline Specific Elective IV</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>GE</td>
<td>15GBME__</td>
<td>Generic Elective II</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>SEC</td>
<td>15SUPD__</td>
<td>Skill Enhancement Elective II</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>CORE</td>
<td>15PBME41</td>
<td>Fluid Mechanics and Strength of Materials Laboratory</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>CORE</td>
<td>15PBME42</td>
<td>Manufacturing Technology Laboratory</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>CORE</td>
<td>15BESY41</td>
<td>Basic Life Skills</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total</strong></td>
<td><strong>21</strong></td>
<td><strong>2</strong></td>
<td><strong>7</strong></td>
<td><strong>26</strong></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>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lecture</td>
<td>Tutorial</td>
</tr>
<tr>
<td>SEMESTER 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CORE</td>
<td>15CBME51</td>
<td>Engineering Metrology and Measurements</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>CORE</td>
<td>15CBME52</td>
<td>Design of Machine Elements</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>CORE</td>
<td>15CBME53</td>
<td>Dynamics Of Machinery</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>DSE</td>
<td>15DBME__</td>
<td>Discipline Specific Elective V</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>DSE</td>
<td>15DBME__</td>
<td>Discipline Specific Elective VI</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>GE</td>
<td>15GBME__</td>
<td>Generic Elective III</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>SEC</td>
<td>15SUPD__</td>
<td>Skill Enhancement Elective III</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>CORE</td>
<td>15PBME51</td>
<td>Metrology and Measurements Laboratory</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>CORE</td>
<td>15PBME52</td>
<td>Dynamics Laboratory</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>CORE</td>
<td>15CBME53</td>
<td>Industrial Safety</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>22</td>
<td>3</td>
</tr>
<tr>
<td>SEMESTER 6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CORE</td>
<td>15CBME61</td>
<td>Finite Element Analysis</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>CORE</td>
<td>15CBME62</td>
<td>Thermal Engineering</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>CORE</td>
<td>15CBME63</td>
<td>Design of Transmission Systems</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>DSE</td>
<td>15DBME__</td>
<td>Discipline Specific Elective VII</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>DSE</td>
<td>15DBME__</td>
<td>Discipline Specific Elective VIII</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>GE</td>
<td>15GBME__</td>
<td>Generic Elective IV</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>SEC</td>
<td>15SUPD__</td>
<td>Skill Enhancement Elective IV</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>CORE</td>
<td>15PBME61</td>
<td>Thermal Engineering Laboratory</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>CORE</td>
<td>15PBME62</td>
<td>CAM Laboratory</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>CORE</td>
<td>15PBME63</td>
<td>In-Plant Training</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>20</td>
<td>3</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>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lecture</td>
<td>Tutorial</td>
</tr>
<tr>
<td>SEMESTER 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CORE</td>
<td>15CBME71</td>
<td>Mechatronics</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>CORE</td>
<td>15CBME72</td>
<td>Computer Integrated Manufacturing</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>CORE</td>
<td>15CBME73</td>
<td>Power Plant Engineering</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>DSE</td>
<td>15DBME__</td>
<td>Discipline Specific Elective IX</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>DSE</td>
<td>15DBME__</td>
<td>Discipline Specific Elective X</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>GE</td>
<td>15GBME__</td>
<td>Generic Elective V</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>SEC</td>
<td>15SUPD__</td>
<td>Skill Enhancement Elective V</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>CORE</td>
<td>15PBME71</td>
<td>Computer Aided Simulation and Analysis Labor</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>CORE</td>
<td>15PBME72</td>
<td>Mechatronics Laboratory</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>CORE</td>
<td>15PBME73</td>
<td>Mini Project &amp; Seminar</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>20</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SEMESTER 8</th>
<th>Code No.</th>
<th>Course</th>
<th>Hours / Week</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSE</td>
<td>15DBME__</td>
<td>Discipline Specific Elective XI</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>DSE</td>
<td>15DBME__</td>
<td>Discipline Specific Elective XII</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>GE</td>
<td>15GBME__</td>
<td>Generic Elective VI</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>CORE</td>
<td>15RBME81</td>
<td>Project Work</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>9</td>
<td>0</td>
</tr>
</tbody>
</table>
### B.E. - MECHANICAL ENGINEERING CURRICULUM

#### List of Discipline Elective Courses

<table>
<thead>
<tr>
<th>Code No.</th>
<th>Course</th>
<th>Hours / Week</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>15DBME31</td>
<td>Special Casting Techniques</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>15DBME32</td>
<td>Failure Analysis and Design</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>15DBME33</td>
<td>Manufacture and Inspection of Gears</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>15DBME34</td>
<td>Refrigeration and Air Conditioning</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>15DBME35</td>
<td>Kinematics of Machinery</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>15DBME36</td>
<td>Production Technology</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>15DBME41</td>
<td>Manufacturing Technology</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>15DBME42</td>
<td>Engineering Materials and Metallurgy</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>15DBME43</td>
<td>Heat and Mass Transfer</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>15DBME44</td>
<td>Cryogenic Engineering</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>15DBME45</td>
<td>Rapid Prototyping, Tooling and Manufacture</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>15DBME51</td>
<td>Automobile Engineering</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>15DBME52</td>
<td>Applied Hydraulics and Pneumatics</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>15DBME53</td>
<td>Design of Pressure Vessels and Piping</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>15DBME54</td>
<td>Vibration and Noise Engineering</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>15DBME55</td>
<td>Gas Dynamics and Jet Propulsion</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>15DBME62</td>
<td>Unconventional Machining Processes</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>15DBME61</td>
<td>Industrial Automation, CNC and Robotics</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>15DBME63</td>
<td>Design of Jigs, Fixtures and Press Tools</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>15DBME64</td>
<td>Manufacture of Automotive Components</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>15DBME65</td>
<td>Design of Heat Exchangers</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>15DBME71</td>
<td>Non Destructive Testing and Materials</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>15DBME72</td>
<td>Process Planning and Cost Estimation</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>15DBME73</td>
<td>Micro Electro Mechanical Systems</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>15DBME74</td>
<td>Design and Analysis of Composites</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>15DBME75</td>
<td>Additive Manufacturing</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>15DBME81</td>
<td>Renewable Energy Sources</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>15DBME82</td>
<td>Advanced I.C. Engines</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>15DBME83</td>
<td>Waste Heat Recovery and Co-Generation</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>15DBME84</td>
<td>Fundamentals of Nano science</td>
<td>3 0 0 3</td>
<td></td>
</tr>
<tr>
<td>15DBME85</td>
<td>Product Development and Manufacture</td>
<td>3 0 0 3</td>
<td></td>
</tr>
</tbody>
</table>
**B.E - Mechanical Engineering**

**CURRICULUM**

**List of Generic Elective Courses**

<table>
<thead>
<tr>
<th>Code No.</th>
<th>Course</th>
<th>Hours / Week</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>15CBME33</td>
<td>Electrical Drives and Control</td>
<td>3 0 0</td>
<td>3</td>
</tr>
<tr>
<td>15GBME41</td>
<td>Entrepreneurship Development</td>
<td>3 0 0</td>
<td>3</td>
</tr>
<tr>
<td>15GBME51</td>
<td>Principles of Management and Professional Ethics</td>
<td>3 0 0</td>
<td>3</td>
</tr>
<tr>
<td>15GBME52</td>
<td>Operations Research</td>
<td>3 0 0</td>
<td>3</td>
</tr>
<tr>
<td>15GBME71</td>
<td>Industrial Marketing and Market Research</td>
<td>3 0 0</td>
<td>3</td>
</tr>
<tr>
<td>15GBME62</td>
<td>Value Analysis and Value Engineering</td>
<td>3 0 0</td>
<td>3</td>
</tr>
<tr>
<td>15GBME61</td>
<td>Total Quality Management</td>
<td>3 0 0</td>
<td>3</td>
</tr>
<tr>
<td>15GBME72</td>
<td>Energy Audit and Energy Conservation Methods</td>
<td>3 0 0</td>
<td>3</td>
</tr>
<tr>
<td>15GBME81</td>
<td>Supply Chain Management</td>
<td>3 0 0</td>
<td>3</td>
</tr>
<tr>
<td>15GBME82</td>
<td>Quality Control and Reliability Engineering</td>
<td>3 0 0</td>
<td>3</td>
</tr>
</tbody>
</table>

**List of Skill Enhancement Elective Courses**

<table>
<thead>
<tr>
<th>Code No.</th>
<th>Course</th>
<th>Hours / Week</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>15SUPD31</td>
<td>PERSONALITY DEVELOPMENT I</td>
<td>2 0 0</td>
<td>2</td>
</tr>
<tr>
<td>15SUPD41</td>
<td>PERSONALITY DEVELOPMENT II</td>
<td>2 0 0</td>
<td>2</td>
</tr>
<tr>
<td>15SUPD51</td>
<td>PERSONALITY DEVELOPMENT III</td>
<td>2 0 0</td>
<td>2</td>
</tr>
<tr>
<td>15SUPD61</td>
<td>PERSONALITY DEVELOPMENT IV</td>
<td>2 0 0</td>
<td>2</td>
</tr>
<tr>
<td>15NSS255</td>
<td>NSS I</td>
<td>2 0 0</td>
<td>2</td>
</tr>
<tr>
<td>15NSS256</td>
<td>NSS II</td>
<td>2 0 0</td>
<td>2</td>
</tr>
<tr>
<td>15NSS257</td>
<td>NSS III</td>
<td>2 0 0</td>
<td>2</td>
</tr>
<tr>
<td>15NSS258</td>
<td>NSS IV</td>
<td>2 0 0</td>
<td>2</td>
</tr>
<tr>
<td>15NSS259</td>
<td>NSS V</td>
<td>2 0 0</td>
<td>2</td>
</tr>
<tr>
<td>15NSS260</td>
<td>NSS VI</td>
<td>2 0 0</td>
<td>2</td>
</tr>
</tbody>
</table>
SYLLABUS
CORE COURSES
COURSE OBJECTIVE:
- To develop listening skills for academic and professional purposes.
- To acquire the ability to speak effectively in English in real life situations.
- To inculcate reading habit and to develop effective reading skills.
- To improve their active and passive vocabulary.
- To write letters and reports effectively in formal and business situations.

UNIT I INTRODUCTION TO BASIC GRAMMAR AND VOCABULARY 9

UNIT II BASIC SKILL – LISTENING AND INTERPRETATION 9

UNIT III BASIC SKILL-WRITING SKILL AND STRUCTURES 9
Creative thinking and speaking, Tenses – Present Tense – simple present, present continuous, present perfect, present perfect continuous, Past Tense - simple past, past continuous, past perfect, past perfect continuous, Future Tense -simple future, future continuous, future perfect, future perfect continuous, Autobiographical writing, JAM session.

UNIT IV BASIC SKILLS: READING AND WRITING SKILL 9
Reading Skills- Skimming and Scanning, Comprehension Passage Paragraph Writing – Descriptive paragraph, Argumentative paragraph, Persuasive paragraph, Demonstrative paragraph, Compare and contrast, Conversations.

UNIT V BASIC SKILL: SPEAKING SKILL AND VOCABULARY 9
Vocabulary, Prefixes and Suffixes, Cause and Effect relationship, Clauses and Phrases, Superordinates and Hyponyms, Expressing Causal Relation, Article, Prepositions, Preposition phrases, Speaking about the future plans, Reading comprehensions, Situational dialogues.

TOTAL: 45 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 Learn, Speak, Read and Write skills.</td>
<td>K6</td>
</tr>
<tr>
<td>CO2:</td>
<td>Develop listening skills for academic and professional purposes.</td>
<td>K6</td>
</tr>
</tbody>
</table>
CO3: Utilize and carry on the tasks and activities through guided instructions and materials  K3

CO4: Improve their active and passive vocabulary.  K6

CO5: Importance of hands-on experience through case-studies, mini-projects, group and individual presentations.  K5

TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVE:

- To develop the skills in the areas of Matrices, Three dimensional Analytical Geometry, Differential calculus, Functions of several Variables and Multiple Integrals. To serve as a pre-requisite mathematics course for post graduate courses, specialized studies and research.

UNIT I  
MATRICES  
12


UNIT II  
THREE DIMENSIONAL ANALYTICAL GEOMETRY  
12


UNIT III  
DIFFERENTIAL CALCULUS  
12

Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes – Evolute as envelope of normals.

UNIT IV  
FUNCTIONS OF SEVERAL VARIABLES  
12


UNIT V  
MULTIPLE INTEGRALS  
12

Double integration – Cartesian and polar coordinates – Change of order of integration – Change of variables between Cartesian and polar coordinates – Triple integrals – Area as double integral

TOTAL: 60 Hours

COURSE OUTCOMES:

After successful completion of the Mathematics – 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>Identify and solve a 1st, 2nd and higher order differential equations and perform simple applications in Engineering.</td>
<td>K3</td>
</tr>
<tr>
<td>CO2</td>
<td>Determine the three dimensional objects equation of a sphere, cone and cylinder.</td>
<td>K5</td>
</tr>
<tr>
<td>CO3</td>
<td>Applying differential calculus to solve the curvature in cartesian co-ordinates, centre and radius of curvature.</td>
<td>K3</td>
</tr>
<tr>
<td>CO4</td>
<td>Develop the skills in the areas of matrices to calculate the three-dimensional analytical geometry.</td>
<td>K3</td>
</tr>
<tr>
<td>CO5</td>
<td>Solve the Double integration equations for Cartesian and polar coordinates and Triple integrals equations.</td>
<td>K6</td>
</tr>
</tbody>
</table>
TEXT BOOKS:


REFERENCES:

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 ULTRASONICS

UNIT II LASERS

UNIT III FIBRE OPTICS AND APPLICATIONS

UNIT IV QUANTUM PHYSICS

UNIT V CRYSTAL PHYSICS
Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – NaCl, ZnS, diamond and graphite structures – Polymorphism and allotropy – Crystal defects – point, line and surface defects – Burger vector.

TOTAL: 45 Hours
COURSE OUTCOMES:

After successful completion of the Engineering Physics 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>Apply the fundamental principles piezoelectric generator Detection of ultrasonics wave</td>
<td>K6</td>
</tr>
<tr>
<td>CO2:</td>
<td>Understand the about various applications and types of Lasers</td>
<td>K2</td>
</tr>
<tr>
<td>CO3:</td>
<td>Explain the fibre optics and applications</td>
<td>K5</td>
</tr>
<tr>
<td>CO4:</td>
<td>Function of Electron microscope, Scanning electron microscope and Transmission electron microscope.</td>
<td>K4</td>
</tr>
<tr>
<td>CO5:</td>
<td>Understand the basic inference in Quantum physics and crystal physics, Categorize between various environmental pollutants</td>
<td>K2</td>
</tr>
</tbody>
</table>

TEXT BOOKS:


REFERENCES:

COURSE OBJECTIVE:
- To understand the concepts of Programming language - C and Html.
- To learn the basics of C declarations, operators, expressions and html tags.
- To learn on the manipulation of strings, functions and pointers.

UNIT I  INTRODUCTION TO COMPUTERS  9

UNIT II  PROBLEM SOLVING AND OFFICE APPLICATION SOFTWARE  9

UNIT III  INTRODUCTION TO C  9
Overview of C: Constants, Variables, Keywords, Data Types – Compilation and Execution – Input and Output functions – Operators – C Instructions – Control Instructions: Decision control structure, Loop Control structure, Case Control Structure.

UNIT IV  FUNCTIONS AND POINTERS  9

UNIT V  STRUCTURES AND FILES  9

TOTAL: 45 Hours
COURSE OUTCOMES:
After successful completion of the Fundamentals of Computing, 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 characteristics, classifications and evolution of computers and the types of software, their development.</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Create and develop the computer program, basics of internet, evolution and software packages.</td>
<td>K6</td>
</tr>
<tr>
<td>CO3</td>
<td>Understand the overview of C program compilation, execution and control structure.</td>
<td>K2</td>
</tr>
<tr>
<td>CO4</td>
<td>Analyze the merits of pointers in C and Handle string manipulations, array and functions for various applications using C programming constructs.</td>
<td>K4</td>
</tr>
<tr>
<td>CO5</td>
<td>Explain the various file operations in C and Understand the difference in memory allocation while using structure and union in C programming.</td>
<td>K5</td>
</tr>
</tbody>
</table>

TEXT BOOKS:

REFERENCE:
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  LANE CURVES AND FREE HAND SKETCHING  12


UNIT II  PROJECTION OF POINTS, LINES AND PLANE SURFACES  12

Orthographic projection – principles - Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III  PROJECTION OF SOLIDS  12

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method and auxiliary plane method.

UNIT IV  PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES  12

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes.

UNIT V  ISOMETRIC AND PERSPECTIVE PROJECTIONS  12

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

COMPUTER AIDED DRAFTING (Demonstration Only)

Introduction to drafting packages and demonstration of their use.

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>Develop special curves and sketch by free hand orthographic views</td>
<td>K6</td>
</tr>
<tr>
<td>CO2</td>
<td>Understand and draw the projections of points, straight lines and planes</td>
<td>K2</td>
</tr>
<tr>
<td>CO3</td>
<td>Sketch the projections of simple solids like prisms, pyramids, cylinder and cone</td>
<td>K2</td>
</tr>
<tr>
<td>CO4</td>
<td>Develop lateral surfaces of the uncut and cut solids</td>
<td>K3</td>
</tr>
<tr>
<td>CO5</td>
<td>Develop the perspective projection of simple solids, truncated prisms, pyramids, cone and cylinders and sketch the isometric projection</td>
<td>K3</td>
</tr>
</tbody>
</table>

TEXT BOOK:

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. The examination will be conducted in appropriate sessions on the same day.
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.

LIST OF EXPERIMENTS

MECHANICAL ENGINEERING PRACTICE

1. Welding
   To make single V, butt, lap and T fillet joint by arc welding with the back hand and fore hand welding techniques as per the given dimensions.

2. Basic Machining
   To make Simple Turning and Taper turning in the lathe.

3. Fitting Work
   To make square, hexagonal, V joint in bench fitting as per the given dimensions and Tolerances.

4. Sheet Metal Work
   To make simple Cubical blocks, Rectangular trays in sheet metal with the jigs as per the given dimensions.

CIVIL ENGINEERING PRACTICE

1. Buildings
   a. Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

2. Plumbing Works
   a. Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.

   b. Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.

   TOTAL: 45 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>Understand the various type of welding joints</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Develop operating skill in turning and shaper machine</td>
<td>K3</td>
</tr>
<tr>
<td>CO3</td>
<td>Understand the various types of fitting work</td>
<td>K2</td>
</tr>
<tr>
<td>CO4</td>
<td>Develop simple Cubical blocks, Rectangular trays in sheet metal with the jigs as per the given dimensions.</td>
<td>K3</td>
</tr>
<tr>
<td>CO5</td>
<td>Study and understand the basic plumbing works</td>
<td>K2</td>
</tr>
</tbody>
</table>
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. Determination of Young’s modulus of the material – Non uniform bending.
2. Determination of Band Gap of a semiconductor material.
3. Determination of specific resistance of a given coil of wire – Carey Foster Bridge.
5. Spectrometer – Dispersive power of a prism.
6. Determination of Young’s modulus of the material – Uniform bending.
8. Ultrasonic Interferometer – Velocity of ultrasonic waves and compressibility of liquids.

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>Determination of Young’s modulus of the material – Non uniform bending and to Determination of Band Gap of a semiconductor material.</td>
<td>K5</td>
</tr>
<tr>
<td>CO2:</td>
<td>Determination of specific resistance of a given coil of wire – Carey Foster Bridge and Determination of viscosity of liquid – Poiseuille’s method.</td>
<td>K5</td>
</tr>
<tr>
<td>CO3:</td>
<td>Determination of Young’s modulus of the material – Uniform bending and Spectrometer – Dispersive power of a prism.</td>
<td>K5</td>
</tr>
<tr>
<td>CO4:</td>
<td>Determination of Rigidity modulus and Ultrasonic Interferometer – Velocity of ultrasonic waves and compressibility of liquids.</td>
<td>K5</td>
</tr>
<tr>
<td>CO5:</td>
<td>Determining Spectrometer – Grating – Wavelength of mercury spectrum and Determination of wavelength of LASER and particle size using Grating</td>
<td>K5</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVE:
The student should be made to:

- Be familiar with the use of Office software.
- Be exposed to presentation and visualization tools.
- Be exposed to problem solving techniques and flow charts.
- Be familiar with programming in C.
- Learn to use Arrays, strings, functions, structures and unions.

A) WORD PROCESSING

1. Document creation, Text manipulation with Scientific notations.
2. Table creation, Table formatting and Conversion.

B) SPREAD SHEET

1. Chart - Line, XY, Bar and Pie.
2. Formula - formula editor.
4. Sorting and Import / Export features.

C) POWERPOINT

1. Any presentation of minimum five slides.

D) SIMPLE C PROGRAMMING *

1. Data types, Expression Evaluation, Condition Statements.
2. Arrays.
4. Functions and Pointers.
5. File Operations.
- For programming exercises Flow chart and pseudo-code are essential.

E) HTML PROGRAMMING*

1. Create a webpage to embed an image in that page using HTML tags.
2. HTML program for Table creation.

TOTAL: 45 Hours
### COURSE OUTCOMES:

After successful completion of the Computer Practice 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 concepts of Office software, email to many different people by using mail merge option and letter</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Analyze data using spreadsheet</td>
<td>K4</td>
</tr>
<tr>
<td>CO3</td>
<td>Demonstrate visualization tool using power point</td>
<td>K2</td>
</tr>
<tr>
<td>CO4</td>
<td>Develop the programs on 'C'</td>
<td>K6</td>
</tr>
<tr>
<td>CO5</td>
<td>Formulate HTML programs</td>
<td>K6</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVE:

- To develop listening skills for academic and professional purposes.
- To acquire the ability to speak effectively in English in real life situations.
- To inculcate reading habit and to develop effective reading skills.
- To improve their active and passive vocabulary.
- To write letters and reports effectively in formal and business situations.

UNIT I  TECHNICAL VOCABULARY  9

UNIT II  READING AND INTERPRETATION  9

UNIT III  LETTER AND NON-VERBAL COMMUNICATION DRAFTING  9
Letters - formal, informal, Cover Letter and CV, Synonyms and Antonyms, Indefinite Adjectives, Non-verbal communication, Interactive sessions. Role Plays, Critical reading Listening and Note taking.

UNIT IV  DIALOGUE WRITING AND GROUP ACTIVITIES  9

UNIT V  LISTENING AND COMPREHENDING THE CONVERSATIONS  9
Reports – Types, structure, data collection, content, form, Definitions, extended definition, Recommendations, Memos and Checklists. Group Discussions, Listening and comprehending the conversations.

TOTAL: 45 Hours

COURSE OUTCOMES:
After successful completion of the Communication Skills Laboratory course, the student will be able to
CO1: Formulate and practice effective reading strategy to enhance technical communication. Get assess strengths in writing skills and set goals for future growth.

Knowledge Level: K6

CO2: Understand perceive the full repertoire of listening strategies by using authentic listening tasks. Can create learning situations to develop speaking skills based on sound educational and communication theories.

Knowledge Level: K2

CO3: Discover and understanding of the process of oral communication and originate knowledgeable audience-centered speaking and understanding of the process of oral communication and originate knowledgeable audience-centered speaking.

Knowledge Level: K2

CO4: Adapt with multiple opportunities to practice and share their reading skills in the development and to build knowledge in order to improve critical thinking and analytical skills.

Knowledge Level: K6

CO5: Develop a milestone for leadership and group participation through communication skills. Speak in group discussion without any fear.

Knowledge Level: K3

TEXT BOOKS:


REFERENCES:


COURSE OBJECTIVE

- To acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
- To learn the concepts of vector calculus needed for problems in all engineering disciplines.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow the of electric current.
- To understand the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

UNIT I ORDINARY DIFFERENTIAL EQUATIONS 12
Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy's and Legendre's linear equations – Simultaneous first order linear equations with constant coefficients.

UNIT II VECTOR CALCULUS 12

UNIT III ANALYTIC FUNCTIONS 12
Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy – Riemann equation and Sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping : w= z+c, cz, 1/z, and bilinear transformation.

UNIT IV COMPLEX INTEGRATION 12

UNIT V LAPLACE TRANSFORM 12

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>Evaluate ordinary differential equations</td>
<td>K5</td>
</tr>
<tr>
<td>CO2</td>
<td>Understand vector calculus Green's theorem in a plane, Gauss divergence theorem and stoke's theorem</td>
<td>K2</td>
</tr>
<tr>
<td>CO3</td>
<td>Solve a complex variable and Analytic functions</td>
<td>K6</td>
</tr>
<tr>
<td>CO4</td>
<td>Understand Statement and applications of Cauchy's integral theorem and Cauchy's integral formula</td>
<td>K2</td>
</tr>
<tr>
<td>CO5</td>
<td>Solve the Laplace transforms and use it to represent system dynamic models and evaluate their time responses.</td>
<td>K6</td>
</tr>
</tbody>
</table>

TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVE:
- To learn the basics of chemistry and application of water technology, principles of
electrochemistry, nuclear chemistry, Nano chemistry, engineering materials, polymer and
composites, corrosion and storage devices etc., and to apply these fundamental principles to
solve practical problems related to materials used for engineering applications.

UNIT I WATER TECHNOLOGY
Characteristics – alkalinity – types of alkalinity and determination – hardness – types of estimation by
EDTA method (problem) – Domestic water treatment – disinfection methods (Chlorination, ozonation.
UV treatment) – Boiler feed water – requirements – disadvantages of using hard water in boilers –
internal conditioning (phosphate, calgon and carbonate conditioning methods) – external conditioning
– de mineralization process – desalination and reverse osmosis.

UNIT II ELECTROCHEMISTRY, NUCLEAR CHEMISTRY AND NANO CHEMISTRY
Introduction -Electrochemical cells – reversible and irreversible cells – EMF – measurement of emf –
electrode – Calomel electrode – Ion selective electrode – glass electrode and measurement of pH -
Nuclear energy – fission and fusion reactions and light water nuclear reactor for power generator
(block diagram only) – Breeder reactor, Nano materials – introduction to Nano chemistry – carbon
Nano tubes and their applications.

UNIT III ENGINEERING MATERIALS
Refractories – classification – acidic, basic and neutral refractoriness – properties (refractoriness,
refractoriness under load, dimensional stability, porosity, thermal spalling) – manufacture of alumina,
magnetite and zirconia bricks and their applications. Abrasives – natural and synthetic abrasives –
quartz, corundum, emery, garnet, diamond, silicon carbide and boron carbide. Lubricants –
mechanism of lubrications – properties – viscosity index – flash and fire points, cloud and pour points

UNIT IV POLYMERS AND COMPOSITES
Polymers – definition – polymerization – types – addition and condensation polymerization –free
radical polymerization and mechanism – Plastics, classification – preparation, properties and uses of
PVC, Teflon, polycarbonate, polyurethane, nylon-6,6, PET – Rubber – vulcanization of rubber.
Synthetic rubbers. Composites – definition, types, polymer matrix composites – FRP only Conducting
polymers, semiconducting polymers, molecular switches—examples, mechanism and applications.

UNIT V CORROSION, CORROSION CONTROL AND STORAGE DEVICES
Chemical corrosion – Pilling – Bedworth rule – electrochemical corrosion – different types – galvanic
corrosion – differential aeration corrosion – factors influencing corrosion – corrosion control –
sacrificial anode and impressed cathodic current methods – corrosion inhibitors – protective coatings
– paints – constituents and functions – metallic coatings – electroplating (Au) and electroless (Ni)
– Batteries – alkaline batteries – lead – acid batteries – nickel – cadmium batteries and lithium
batteries.

TOTAL: 45 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>Analyzing water technology</td>
<td>K4</td>
</tr>
<tr>
<td>CO2</td>
<td>Understanding the basic concept of electrochemistry, nuclear chemistry and nano chemistry</td>
<td>K2</td>
</tr>
<tr>
<td>CO3</td>
<td>Explain the classification and application engineering materials</td>
<td>K5</td>
</tr>
<tr>
<td>CO4</td>
<td>Examine Polymer and composites.</td>
<td>K4</td>
</tr>
<tr>
<td>CO5</td>
<td>Identify factors influencing corrosion and corrosion controls</td>
<td>K3</td>
</tr>
</tbody>
</table>

**TEXT BOOKS:**

**REFERENCES:**
COURSE OBJECTIVE:

- To learn the basics of conducting materials, semiconducting materials, magnetic superconducting materials, Dielectric materials and Modern Engineering Materials etc., and to apply these fundamental principles to solve practical problems related to materials used for engineering applications.

UNIT I CONDUCTING MATERIALS 9


UNIT II SEMICONDUCTING MATERIALS 9


UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS 9


UNIT IV DIELECTRIC MATERIALS 9


UNIT V MODERN ENGINEERING MATERIALS 9


TOTAL: 45 Hours
COURSE OUTCOMES:
After successful completion of the Material 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>Understand the various conductors for classical free electron theory of metals with Electrical and thermal conductivity</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Explain the semiconductor materials and their applications</td>
<td>K5</td>
</tr>
<tr>
<td>CO3</td>
<td>Classify the various types of superconductors and explain the magnetic moment of the material</td>
<td>K4</td>
</tr>
<tr>
<td>CO4</td>
<td>Explain the uses of dielectric materials and its applications.</td>
<td>K5</td>
</tr>
<tr>
<td>CO5</td>
<td>Understand the Nano materials synthesis and its applications</td>
<td>K2</td>
</tr>
</tbody>
</table>

TEXT BOOKS:

REFERENCES:
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:


REFERENCES:

COURSE OBJECTIVE:
- To provide exposure to the students of basic electrical and electronics engineering.

UNIT I  ELECTRICAL CIRCUITS AND MEASUREMENTS  12

UNIT II  ELECTRICAL MACHINES  12
Construction, Principle of Operation, Basic Equations and Applications of DC Generators, DC Motors, 1-Phase Transformer, 3-phase Induction Motors.

UNIT III  SEMICONDUCTOR DEVICES AND APPLICATIONS  12

UNIT IV  DIGITAL ELECTRONICS  12

UNIT V  FUNDAMENTALS OF COMMUNICATION ENGINEERING  12

TOTAL: 60 Hours

COURSE OUTCOMES:
After successful completion of the Basic Electrical and Electronics 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 electrical circuits and measurements.</td>
<td>K5</td>
</tr>
<tr>
<td>CO2:</td>
<td>Understand the principle and construction of DC motor and generator.</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>Design the logic gates and basics of digital electronics</td>
<td>K6</td>
</tr>
<tr>
<td>CO5:</td>
<td>Explain the fundamentals of communication engineering.</td>
<td>K5</td>
</tr>
</tbody>
</table>
TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVE:

- To acquire practical skills in the determination of water quality parameters through volumetric analysis.
- To determine the molecular weight of a polymer by viscometry.

LIST OF EXPERIMENTS

1. Determine the total, permanent and temporary hardness of the given water sample by EDTA method. A standard hard water and EDTA solutions are provided.
2. Determine the type and amount of alkalinity present in the given water sample. A standard solution of sodium hydroxide of strength 0.1N is given.
3. Estimate the amount of chloride present in the water sample by Argentometric analysis. A standard solution of strength 0.01N and sodium chloride solutions are provided.
4. Determination of molecular weight of given polymer solution by Ostwald viscometer method.
5. Determine the amount of strong acid and weak acid (HCl and CH3COOH) present in 1 litre of the given mixture of acid solution by conducto-meteric titration using standard NaOH of normality 0.2N.
6. Determine the amount of barium chloride present in 1 liter of the given solution by conduct metric titration using standard solution of sodium sulphate of normality 0.2N.
7. Estimate the amount of ferrous ion present in the whole of the given solution. A standard solution of potassium dichromate of strength 0.1N is provided.
8. Determine the strength of the given hydrochloric acid by pH-metry with 0.2N sodium hydroxide solution.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the Engineering Chemistry 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>Estimate different types of hardness of water using complexometric titrations of given water sample.</td>
<td>K6</td>
</tr>
<tr>
<td>CO2</td>
<td>Determine the amount of alkalinity of the given water sample using standard NaOH.</td>
<td>K5</td>
</tr>
<tr>
<td>CO3</td>
<td>Examine the amount of chloride ion present in the given solution using argentometric method.</td>
<td>K4</td>
</tr>
<tr>
<td>CO4</td>
<td>Find the molecular weight of the unknown polymer solution using viscosity method.</td>
<td>K1</td>
</tr>
<tr>
<td>CO5</td>
<td>Determine the amount of strong acid present in the given mixture of acid solution using conductometric titrations.</td>
<td>K5</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.

A. ENGLISH LANGUAGE LAB 18 Hours

I. PC based session (Weightage 40%) 24 Hours

1. LISTENING COMPREHENSION 6
   Listening and typing – Listening and sequencing of sentences – Filling in the blanks - Listening and answering questions.

2. READING COMPREHENSION 6
   Filling in the blanks - Close exercises – Vocabulary building - Reading and answering questions.

3. SPEAKING 6
   Phonetics: Intonation - Ear training - Correct Pronunciation – Sound recognition exercises – Common Errors in English. Conversations: Face to Face Conversation – Telephone conversation – Role play activities (Students take on roles and engage in conversation)

B. DISCUSSION OF AUDIO-VISUAL MATERIALS 6 Hours

(Samples are available to learn and practice)

1. RESUME / REPORT PREPARATION / LETTER WRITING (1)
   Structuring the resume / report - Letter writing / Email Communication - Samples.

2. PRESENTATION SKILLS: (1)
   Elements of effective presentation – Structure of presentation – Presentation tools – Voice Modulation – Audience analysis - Body language – Video samples

3. SOFT SKILLS: (2)
   Time management – Articulateness – Assertiveness – Psychometrics – Innovation and Creativity - Stress Management & Poise - Video Samples

4. GROUP DISCUSSION: (1)

5. INTERVIEW SKILLS: (1)
   Kinds of interviews – Required Key Skills – Corporate culture – Mock interviews- Video samples.
   1. Resume / Report Preparation / Letter writing: Students prepare their own resume and report. (2)
   2. Presentation Skills: Students make presentations on given topics. (8)
   3. Group Discussion: Students participate in group discussions. (6)
   4. Interview Skills: Students participate in Mock Interviews (8)
II. Practice Session (Weight age – 60%) 

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>Develop language capability for reading and writing</td>
<td>K6</td>
</tr>
<tr>
<td>CO3</td>
<td>Build their professional skills and resume</td>
<td>K3</td>
</tr>
<tr>
<td>CO4</td>
<td>Discuss their own topic of interest on group discussion</td>
<td>K6</td>
</tr>
<tr>
<td>CO5</td>
<td>Build the student to face the interview</td>
<td>K3</td>
</tr>
</tbody>
</table>

TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVE:

- To develop the student’s graphic skill for communication of concepts, ideas and design of engineering products and expose them to existing CAD Packages related to technical drawings.

List of Exercises using software capable of Drafting

1. Importance of graphics in engineering applications – BIS conventions and specifications – Size and layout of drawing sheets – Lettering and dimensioning. Study of capabilities of CAD Packages for drafting – Coordinate systems. (Theory)
2. Creation of simple figures like polygon and general multi-line figures.
3. Construction of ellipse, Parabola and hyperbola.
5. Projection of points and straight lines located in the first quadrant – Determination of true lengths and true inclinations.
6. Projection of polygonal surface and circular lamina inclined to one reference planes.
7. Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.
8. Sectioning of simple solids like prisms, pyramids, cylinder and cone in vertical position by cutting planes inclined to one reference plane and perpendicular to the other.
9. Draw the orthographic projection in the 1st angle for the objects such as step block, solid bearing block, gland as per the dimensions given.
10. Draw the isometric view or 3D model of a V – block, shaft bracket, jig plate as per the dimensions given.

TOTAL: 45 Hours

COURSE OUTCOMES:

After successful completion of the Computer Aided Drafting 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 role of CAD in mechanical component and system design by creating geometric models and engineering drawings.</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Creation of simple figures for polygon, ellipse, hyperbola, involutes for polygon.</td>
<td>K6</td>
</tr>
<tr>
<td>CO3</td>
<td>Create surface primitives using parametric modeling and the different solid primitives using the different representation schemes.</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>Develop the isometric view or 3D model of a V – block, shaft bracket, jig plate.</td>
<td>K3</td>
</tr>
</tbody>
</table>
TEXT BOOKS:

REFERENCES:
OBJECTIVE

- At the end of this course the student is expected to understand what constitutes the environment, what are precious resources in the environment, 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 managements.

UNIT I  ENVIRONMENT, ECOSYSTEMS 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 / mountain.

UNIT IV  SOCIAL ISSUES AND THE ENVIRONMENT


UNIT V HUMAN POPULATION AND THE ENVIRONMENT


COURSE OUTCOMES:

After successful completion of the Environmental Science and 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 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</td>
<td>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</td>
<td>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</td>
<td>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</td>
<td>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:


REFERENCES:

COURSE OBJECTIVE:

- To introduce Fourier series analysis, which is central to many applications in engineering apart from its use in solving boundary value problems. The understanding of the mathematical principles on Fourier series and transforms, partial differential equations and Z transform would provide them the ability to formulate and solve some of the physical problems of engineering.

UNIT I  FOURIER SERIES  12

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 both homogeneous and non-homogeneous types.

UNIT IV  APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS  12
Classification PDE-Method of separation of variables - Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional heat equation (excluding Insulated edges).

UNIT V  Z-TRANSFORM AND DIFFERENCE EQUATIONS  12

Total: 60 Hours
COURSE OUTCOMES:

After successful completion of the Engineering 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>Apply and solve one dimensional and wo-dimensional wave equation – One dimensional equation of heat conduction</td>
<td>K3</td>
</tr>
<tr>
<td>CO5</td>
<td>Analyze the Elementary properties Z -transform and difference equations</td>
<td>K4</td>
</tr>
</tbody>
</table>

TEXTBOOKS:


REFERENCES:

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

TOTAL: 45 Hours
(Use of standard thermodynamic tables, Mollier diagram, Psychrometric chart and refrigerant property tables are permitted)
COURSE OUTCOMES:
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>Apply the second law of thermodynamics for solving the problems in Carnot cycle, Clausius equality.</td>
<td>K3</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>Understand the psychrometry and psychrometric charts and evaluate the property calculations of air vapour mixtures.</td>
<td>K2</td>
</tr>
</tbody>
</table>

TEXT BOOKS:

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

To provide exposure to the students with hands on experience on various basic engineering practices in Electrical Engineering.

LIST OF EXPERIMENTS

1. Speed Control of DC Shunt Motor
2. Load Test on DC Shunt Motor
3. Study of DC Motors
4. Swinburne’s Test
5. Load Test on DC Series Motor
6. Load Test on DC Compound Motor
7. Load Test on 3 Phase Induction Motor
8. Study of AC Motor Starters
9. No load and Blocked Rotor Test on 3 Phase Induction Motor

TOTAL: 45 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>Student can apply the concepts to analyze and design AC and DC circuits</td>
<td>K3</td>
</tr>
<tr>
<td>CO2</td>
<td>Understand the electro-mechanical energy conversion using electrical machines</td>
<td>K2</td>
</tr>
<tr>
<td>CO3</td>
<td>Evaluate the characteristics of DC generators and three-phase induction motors.</td>
<td>K5</td>
</tr>
<tr>
<td>CO4</td>
<td>Measuring characteristics and efficiency of a DC Compound &amp; series Motor</td>
<td>K5</td>
</tr>
<tr>
<td>CO5</td>
<td>Analyze the model parameters of No load and Blocked Rotor Test on 3 Phase Induction Motor</td>
<td>K4</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVE:
- To develop skill to use software to create 2D and 3D models.

INTRODUCTION
Introduction to machine components and interpret drawings of machine component 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>Construct both 2-D and 3-D drawings of any components using Auto CAD software.</td>
<td>K6</td>
</tr>
<tr>
<td>CO2</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>CO3</td>
<td>Create surface primitives using parametric modeling and different solid primitives using the different representation schemes</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 Editing, Dimensioning, Plotting Commands, Layering Concepts, Hatching, Detailing,</td>
<td>K2</td>
</tr>
</tbody>
</table>

TEXT BOOKS:


REFERENCES:

15CBME41  STATISTICS AND NUMERICAL METHODS  L  T  P  C  
3  1  0  3

COURSE OBJECTIVE:

- This course helps the students to have a clear perception of the power of statistical and numerical techniques, ideas and would be able to demonstrate the applications of these techniques to problems drawn from industry, management and other engineering fields.

UNIT I  TESTING OF HYPOTHESIS  12

UNIT II  DESIGN OF EXPERIMENTS  12
Completely randomized design – Randomized block design – Latin square design -22 factorial design.

UNIT III  SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS  12

UNIT IV  INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION  12
Lagrange’s and Newton’s divided difference interpolation –Newton’s forward and backward difference interpolation - Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal and Simpson’s 1/3 rules.

UNIT V  NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS  12

Total: 60 Hours
COURSE OUTCOMES:
After successful completion of the Statistics and Numerical Methods 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:

3. Education, Asia, 7th edition, 2007 (For units 1 and 2).

REFERENCES:

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

UNIT I  STRESS, STRAIN AND DEFORMATION OF SOLIDS  9
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  9
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  9

UNIT IV  BEAM DEFLECTION  9

UNIT V  ANALYSIS OF STRESSES IN TWO DIMENSIONS  9
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:

REFERENCES:
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
Homologous 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. Rotory 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>CO</th>
<th>Course Outcome Statements</th>
<th>Knowledge Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1:</td>
<td>Understand and apply the basic concepts of Fluid Mechanics to carry out professional engineering activities</td>
<td>K2</td>
</tr>
<tr>
<td>CO2:</td>
<td>Understand the major and minor losses in flow through circular conduits.</td>
<td>K2</td>
</tr>
<tr>
<td>CO3:</td>
<td>Plan and carry out dimensional analysis, similitude and model analysis in accordance with the relevant specific technology</td>
<td>K3</td>
</tr>
<tr>
<td>CO4:</td>
<td>Estimate the conservation laws to flow through pipes and hydraulic machines and the importance of various types of flow in pumps and turbines.</td>
<td>K6</td>
</tr>
<tr>
<td>CO5:</td>
<td>Apply and study the basic concepts of pumps, air vessels and its performance curves.</td>
<td>K3</td>
</tr>
</tbody>
</table>

TEXT BOOKS:

REFERENCES:
FLUID MECHANICS

COURSE OBJECTIVE

- Upon completion of this subject, the students can have hands-on experience in flow measurements using different devices and also perform calculations related to losses in pipes and also perform characteristic studies of pumps, turbines etc.

- After completion of this laboratory, the students can acquire ability to use the measurement equipment for flow measurement and they can acquire ability to do performance tests on different fluid machinery.

LIST OF EXPERIMENTS

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

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 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:

<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 Mechanics of metal cutting &amp; Machining Operations</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Understand the concept of shaper machines and its functions and Study the drilling operations performed in different types of drilling machine and its applications.</td>
<td>K2</td>
</tr>
<tr>
<td>CO3</td>
<td>Improve the knowledge of various milling machines and operations</td>
<td>K6</td>
</tr>
<tr>
<td>CO4</td>
<td>Study and construction details of different types of machines used in manufacturing process</td>
<td>K6</td>
</tr>
<tr>
<td>CO5</td>
<td>Develop a methodology and establish a manufacturing sequence to fabricate engineering components.</td>
<td>K3</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  6

UNIT II  LIFE FORCE  6
1. Reasons for Diseases - Natural reasons (Genetic / imprints, Planetary Position, Natural calamities and climatic changes) - Unnatural reasons (Food habits, Thoughts, Deeds)

UNIT III  MENTAL HEALTH  6
1) Mental Frequencies - Beta, Apha, 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  6
- 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)  6
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.,
COURSE OBJECTIVE:
- To provide knowledge on various Metrological equipments available to measure the dimension of the components.
- To provide knowledge on the correct procedure to be adopted to measure the dimension of the components.

UNIT I  CONCEPT OF MEASUREMENT  9
General concept – Generalised measurement system-Units and standards-measuring instruments: sensitivity, stability, range, accuracy and precision-static and dynamic response-repeatability-systematic and random errors-correction, calibration - Introduction to Dimensional and Geometric Tolerancing – interchangeability

UNIT II  LINEAR AND ANGULAR MEASUREMENT  9

UNIT III  FORM MEASUREMENT  9
Measurement of screw threads: Thread gauges, floating carriage micrometer-measurement of gear tooth thickness: constant chord and base tangent method-Gleason gear testing machine – radius measurements-surface finish: equipment and parameters, straightness, flatness and roundness measurements.

UNIT IV  LASER AND ADVANCES IN METROLOGY  9
Precision instruments based on laser-Principles- laser interferometer-application in measurements and machine tool metrology- Coordinate measuring machine (CMM): need, construction, types, applications- computer aided inspection.

UNIT V  MEASUREMENT OF MECHANICAL PARAMETERS  9

TOTAL: 45 Hours
COURSE OUTCOMES:

After successful completion of the Engineering metrology and measurements 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, elements of metrology and types of errors in measuring instruments</td>
<td>K2</td>
</tr>
<tr>
<td>CO2:</td>
<td>Develop students' knowledge on various linear and angular Metrological equipment's available to measure the dimension of the components.</td>
<td>K3</td>
</tr>
<tr>
<td>CO3:</td>
<td>Improve students' knowledge on the correct procedure to be adopted to measure the dimension of the components with help from measuring instruments</td>
<td>K6</td>
</tr>
<tr>
<td>CO4:</td>
<td>Describes the advancements in metrology like laser Interferometer and demonstrate CMM</td>
<td>K2</td>
</tr>
<tr>
<td>CO5:</td>
<td>Analysis the flow, power and temperature measurements by using metrology equipment's</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  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

<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 FORCED BALANCE 12

UNIT II BALANCING 12
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 12
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 12

UNIT V MECHANISMS FOR CONTROL 12

TOTAL: 60 Hours

COURSE OUTCOMES:

After successful completion of the Design of Machine Elements 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>Determine the rigid body dynamics and the principle of superposition.</td>
<td>K5</td>
</tr>
<tr>
<td>CO2:</td>
<td>Analyze static and dynamic balancing and balancing of rotating masses</td>
<td>K4</td>
</tr>
</tbody>
</table>
CO3: Classify features of vibratory systems, degrees of freedom and equations of motions

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

CO5: Classify the governors and analyze its mechanisms and gyroscopes

TEXT BOOK:

REFERENCES:
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

TOTAL: 45 Hours

LIST OF EQUIPMENTS (For a batch of 30 students)

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Micrometer</td>
<td>- 5 Nos.</td>
</tr>
<tr>
<td>Vernier Caliper</td>
<td>- 5 Nos.</td>
</tr>
<tr>
<td>Vernier Height Gauge</td>
<td>- 2 Nos.</td>
</tr>
<tr>
<td>Vernier depth Gauge</td>
<td>- 2 Nos.</td>
</tr>
<tr>
<td>Slip Gauge Set</td>
<td>- 1 No.</td>
</tr>
<tr>
<td>Gear Tooth Vernier</td>
<td>- 1 No.</td>
</tr>
<tr>
<td>Sine Bar</td>
<td>- 1 No.</td>
</tr>
<tr>
<td>Sine Center</td>
<td>- 1 No.</td>
</tr>
<tr>
<td>Bevel Protractor</td>
<td>- 1 No.</td>
</tr>
<tr>
<td>Floating Carriage Micrometer</td>
<td>- 1 No.</td>
</tr>
<tr>
<td>Profile Projector / Tool Makers Microscope</td>
<td>- 1 No.</td>
</tr>
<tr>
<td>Mechanical / Electrical / Pneumatic Comparator</td>
<td>- 1 No.</td>
</tr>
<tr>
<td>Autocollimator</td>
<td>- 1 No.</td>
</tr>
<tr>
<td>Temperature Measuring Setup</td>
<td>- 1 No.</td>
</tr>
<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 supplement the principles learnt in kinematics and Dynamics of Machinery.
- To understand how certain measuring devices are used for dynamic testing.

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.
12. Transverse vibration –free- Beam. Determination of natural frequency and deflection of beam

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>
COURSE OBJECTIVE:

- Effectively communicate information on Health safety and environment facilitating collaboration with experts across various disciplines so as to create and execute safe methodology in complex engineering activities.
- Competent safety Engineer rendering expertise to the industrial and societal needs at national and global level.
- Provide knowledge on safety in various maintenance situations, personal protective equipment and fire safety.

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>

REFERENCES:

5. Indian Boiler acts and Regulations, Government of India.
COURSE 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


UNIT II
ONE DIMENSIONALFINITE ELEMENT ANALYSIS


UNIT III
TWO DIMENSIONALFINITE ELEMENT ANALYSIS


UNIT IV
DYNAMIC ANALYSIS USING FINITE ELEMENT METHOD


UNIT V
APPLICATIONS IN HEAT TRANSFER & FLUID MECHANICS

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:

REFERENCES:
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>Understanding and apply thermodynamic concepts</td>
<td>K3</td>
</tr>
<tr>
<td>CO2</td>
<td>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.</td>
<td>K5</td>
</tr>
<tr>
<td>CO3</td>
<td>Understand computational aspects of isentropic flow through variable area and Analyse gas turbine cycles and able to compare the operational aspects of jet engines</td>
<td>K5</td>
</tr>
<tr>
<td>CO4</td>
<td>Understand the different cycles used in thermal engineering and Get exposure on internal combustion engine and able to analyze their performance</td>
<td>K4</td>
</tr>
<tr>
<td>CO5</td>
<td>Estimate the cooling load calculation for vapor compression system</td>
<td>K6</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>CO</th>
<th>Course Outcome Statements</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Understand the principles and the procedure for the design of mechanical power transmissions components.</td>
</tr>
<tr>
<td>CO2</td>
<td>Analyse the gear terminology of spur gear and helical gear and its parallel axis.</td>
</tr>
<tr>
<td>CO3</td>
<td>Estimate the dimensions of bevel, worm and cross helical gears.</td>
</tr>
<tr>
<td>CO4</td>
<td>Construct the gear boxes</td>
</tr>
<tr>
<td>CO5</td>
<td>Design cams, clutches and brakes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Knowledge Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>K2</td>
</tr>
<tr>
<td>K4</td>
</tr>
<tr>
<td>K6</td>
</tr>
</tbody>
</table>

TEXT BOOKS:

REFERENCES:
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

- Valve Timing and Port Timing Diagrams
- Performance Test on 4-stroke Diesel Engine
- Heat Balance Test on 4-stroke Diesel Engine
- Morse Test on Multi cylinder Petrol Engine
- Determination of Viscosity – Red Wood Viscometer
- Determination of Flash Point and Fire Point
- Study of Steam Generators and Turbines

HEAT TRANSFER

- Thermal conductivity of pipe insulation using lagged pipe apparatus
- Natural convection heat transfer from a vertical cylinder
- Forced convection inside tube
- Determination of Stefan-Boltzmann constant
- Effectiveness of Parallel/counter flow heat exchanger

REFRIGERATION AND AIR CONDITIONING

- Determination of COP of a refrigeration/ air conditioning system
- 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 gain practical experience in handling 2D drafting and 3D modeling software systems.
- To study the features of CNC Machine Tool.
- To 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>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>
</tbody>
</table>

SOFTWARE

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Description of Equipment</th>
<th>Quantity Required</th>
</tr>
</thead>
<tbody>
<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 CAM 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 the Computer Aided Design concepts and Fundamentals of AutoCAD.</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Build the 3D modeling including Solids, Curves, Surfaces.</td>
<td>K3</td>
</tr>
<tr>
<td>CO3</td>
<td>Creation of Flange coupling, screw jack, Bushed bearing and stuffing box assembly using Solid Works.</td>
<td>K6</td>
</tr>
<tr>
<td>CO4</td>
<td>Understand the basic concepts of Tolerance Analysis, concept of Geometric dimensioning and Tolerance from 2D Drawings.</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 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 9


UNIT II ACTUATION SYSTEMS 9


UNIT III SYSTEM MODELS AND CONTROLLERS 9


UNIT IV PROGRAMMING LOGIC CONTROLLERS 9


UNIT V DESIGN OF MECHATRONICS SYSTEM 9


TOTAL: 45 Hours
COURSE OUTCOMES:
After successful completion of the Mechatronics 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>Function of various sensors and transducers</td>
<td>K4</td>
</tr>
<tr>
<td>CO2</td>
<td>Identify the various Actuation system</td>
<td>K3</td>
</tr>
<tr>
<td>CO3</td>
<td>Design and develop Mechatronics systems and primary actuating systems.</td>
<td>K6</td>
</tr>
<tr>
<td>CO4</td>
<td>Evaluate the performance Programmable Logic Controllers.</td>
<td>K5</td>
</tr>
<tr>
<td>CO5</td>
<td>Apply the mechatronics principles to engineering application.</td>
<td>K3</td>
</tr>
</tbody>
</table>

TEXT BOOKS:

REFERENCES:
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


UNIT IV   SHOP FLOOR CONTROL AND INTRODUCTION TO FMS


UNIT V   COMPUTER AIDED PLANNING AND CONTROL AND COMPUTER MONITORING


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:

REFERENCES:
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
Layout of Steam, Hydel, Diesel, MHD, Nuclear and Gas turbine Power Plants Combined Power cycles – comparison and selection, Load duration Curves Steam boilers and cycles – High pressure and Super Critical Boilers – Fluidized Bed Boilers

UNIT II  STEAM POWER PLANT  9

UNIT III  NUCLEAR AND HYDEL POWER PLANTS  9
Nuclear Energy-Fission, Fusion Reaction, Types of Reactors, Pressurized water reactor, Boiling water reactor, Waste disposal and safety Hydel Power plant - Essential elements, Selection of turbines, governing of Turbines- Micro hydel developments

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

<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 functions of the component of power plant, modern boilers &amp; subsystems of power plants</td>
<td>K4</td>
</tr>
<tr>
<td>CO2:</td>
<td>Solve problems based on rankine cycle and binary cycle and explain the subsystems of steam power plant</td>
<td>K3</td>
</tr>
<tr>
<td>CO3:</td>
<td>Evaluate the design layout and working of Nuclear and hydroelectric power plants.</td>
<td>K5</td>
</tr>
<tr>
<td>CO4:</td>
<td>Construct diesel and gas turbine power plant</td>
<td>K6</td>
</tr>
<tr>
<td>CO5:</td>
<td>Analyze other power plants and Evaluate economic feasibility and its implications on power generating units.</td>
<td>K5</td>
</tr>
</tbody>
</table>

TEXT BOOKS:


REFERENCES:

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

**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

<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 simple problems in vibration using MATLAB</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>analyze mechanism simulation using Multibody Dynamic software</td>
<td>K4</td>
</tr>
<tr>
<td>CO3</td>
<td>Solve stress analysis problems of link elements in Trusses, cables, beams, flat plates, simple shells and axisymmetric components.</td>
<td>K6</td>
</tr>
<tr>
<td>CO4</td>
<td>Solve thermal stress and heat transfer analysis of plates, cylindrical shells.</td>
<td>K6</td>
</tr>
<tr>
<td>CO5</td>
<td>Examine the model analysis of beams and harmonic, transient and spectrum analysis of simple systems.</td>
<td>K4</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 each</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>
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 and improve the presentation skill.

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 mini 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
15RBME81  
PROJECT WORK  
L T P C  
0 0 3 2

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>
SY LL A B U S

DISCIPLINE SPECIFIC ELECTIVE COURSES
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  9
Introduction to sand casting - Conventional mould and Core making - Need for special casting process – applications.

UNIT II  SHELL MOULDING  9

UNIT III  INVESTMENT CASTING  9
Process - Pattern and mould materials - Block mould and ceramic shell mould - Mercast and shaw process - Application.

UNIT IV  CENTRIFUGAL AND DIE-CASTING  9
Types of Centrifugal processes - calculation of rotating speed of the mould - Equipment - Application.

UNIT V  CONTINUOUS CASTING CO₂ SAND PROCESS AND FULL MOULD PROCESSES  9
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  9
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  9
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  9

UNIT IV  DYNAMIC AND TIME-DEPENDENT FRACTURE  9
Dynamic fracture, rapid loading of a stationary crack, rapid crack propagation, dynamic contour integral, creep crack growth-C Integral, viscoelastic fracture mechanics, viscoelastic 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  9
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, workholding 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  9
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  9
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  9
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  9
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  9
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 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  9

UNIT II  KINEMATICS OF LINKAGE MECHANISMS  9

UNIT III  KINEMATICS OF CAM MECHANISMS  9

UNIT IV  GEARS AND GEAR TRAINS  9

UNIT V  FRICTION  9

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:


REFERENCES:

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  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>CO</th>
<th>Course Outcome Statements</th>
<th>Knowledge Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1:</td>
<td>Understand the basic concepts of casting and molding and to create different new components using various patterns, materials and allowances.</td>
<td>K2</td>
</tr>
<tr>
<td>CO2:</td>
<td>Elaborate the working principle and basic equipment needed for metal joining process and to learn about fabrication techniques of different types of welding and forming process.</td>
<td>K6</td>
</tr>
<tr>
<td>CO3:</td>
<td>Understand the importance of metal forging and rolling processes.</td>
<td>K2</td>
</tr>
<tr>
<td>CO4:</td>
<td>Develop the sheet metal process and application of special forming processes.</td>
<td>K3</td>
</tr>
<tr>
<td>CO5:</td>
<td>Create appropriate moulding process based on plastic applications</td>
<td>K6</td>
</tr>
</tbody>
</table>

TEXT BOOKS:

REFERENCES:
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
Abrasive processes: grinding wheel – specifications and selection, types of grinding process – cylindrical grinding, surface grinding, centre less grinding – honing, lapping, super finishing, polishing and buffing, abrasive jet grinding

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:

REFERENCES:
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

UNIT II  HEAT TREATMENT

UNIT III  FERROUS AND NON-FERROUS METALS

UNIT IV  NON-METALLIC MATERIALS
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
Mechanisms of plastic deformation, slip and twinning – Types of fracture – Testing of materials under tension, compression and shear loads – Hardness tests (Brinell, Vickers and Rockwell), hardness tests, Impact test Izod and charpy, fatigue and creep failure mechanisms

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:**


**REFERENCES:**

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 internal and external flow.</td>
<td>K3</td>
</tr>
<tr>
<td>CO3:</td>
<td>Analyze the various sizing of heat exchangers and to learn the basic concepts of boiling and condensation</td>
<td>K4</td>
</tr>
<tr>
<td>CO4:</td>
<td>Estimate the radiation of heat transfer by using different analytical techniques</td>
<td>K6</td>
</tr>
<tr>
<td>CO5:</td>
<td>Ability to solve the problems in mass transfer and to be known about the basics concepts</td>
<td>K3</td>
</tr>
</tbody>
</table>

TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVE:

- The main aim of this course is to make the students to know and understand the cryogenic engineering’s 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>
<tr>
<td>CO5</td>
<td>Explain Liquefaction Cycle and Critical Components in Liquefaction Systems.</td>
<td>K2</td>
</tr>
</tbody>
</table>
TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVE:

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

UNIT I  INTRODUCTION  9

UNIT II  LIQUID BASED AND SOLID BASED RAPID PROTOTYPING SYSTEMS  9

UNIT III  POWDER BASED RAPID PROTOTYPING SYSTEMS  9

UNIT IV  MATERIALS FOR RAPID PROTOTYPING SYSTEMS  9

UNIT V  REVERSE ENGINEERING AND NEW TECHNOLOGIES  9
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 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

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 and alternative fuels and their conversion kits used in automobile.</td>
<td>K6</td>
</tr>
</tbody>
</table>

TEXT BOOKS:

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


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), unturned 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 turbo jet engines – thrust, thrust power, propulsive and overall efficiencies, thrust augmentation in turbo jet 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 concepts and laws of fluid mechanics and thermodynamics and classify the flows using Mach number and to understand the isentropic flow characteristics in nozzles and diffusers and also it’s off design operation.</td>
<td>K2</td>
</tr>
<tr>
<td>CO2:</td>
<td>Identify Isentropic flow through variable area ducts</td>
<td>K3</td>
</tr>
<tr>
<td>CO3:</td>
<td>Analyze the flow through ducts with friction (Fanno flow) and heat transfer (Rayleigh flow).</td>
<td>K4</td>
</tr>
<tr>
<td>CO4:</td>
<td>Analyze the flow with normal and oblique shocks.</td>
<td>K4</td>
</tr>
<tr>
<td>CO5:</td>
<td>Creating the concepts of gas dynamics principles in various rocket propulsion systems.</td>
<td>K6</td>
</tr>
</tbody>
</table>

TEXT BOOKS:


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

UNIT III ELECTRO – CHEMICAL PROCESSES

UNIT IV THERMAL METAL REMOVAL PROCESSES – I

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>
<tr>
<td>CO3:</td>
<td>Evaluate the various types of electro and chemical process.</td>
<td>K5</td>
</tr>
<tr>
<td>CO4:</td>
<td>Create and development of metal removal process with help of electric discharge machining and Wire cut electric discharge machining.</td>
<td>K6</td>
</tr>
<tr>
<td>CO5:</td>
<td>Classify the various types of thermal metal removal process.</td>
<td>K4</td>
</tr>
</tbody>
</table>

TEXT BOOKS:

REFERENCES:
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

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

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


UNIT IV  ROBOT DRIVE SYSTEMS AND END EFFECTORS


UNIT V  SENSORS AND MACHINE VISION


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>
<tr>
<td>CO3:</td>
<td>Design and development of robot anatomy model and its structure.</td>
<td>K6</td>
</tr>
<tr>
<td>CO4:</td>
<td>Construction of Robot End effectors and drive system.</td>
<td>K6</td>
</tr>
<tr>
<td>CO5:</td>
<td>Measure the sensors data and explain the machine vision system to robotics.</td>
<td>K5</td>
</tr>
</tbody>
</table>

TEXT BOOK:


REFERENCES:

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  8


UNIT II  JIGS AND FIXTURES  10

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  10


UNIT IV  BENDING AND DRAWING DIES  10


UNIT V  OTHER FORMING TECHNIQUES  7

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>
<tr>
<td>CO4</td>
<td>Understand the fixtures and press tools.</td>
<td>K6</td>
</tr>
<tr>
<td>CO5</td>
<td>Understand the press working terminologies and elements of cutting dies.</td>
<td>K4</td>
</tr>
</tbody>
</table>

TEXT BOOKS:

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

UNIT II MANUFACTURE OF CLUTCH, GEAR BOX AND PROPELLER SHAFT

UNIT III MANUFACTURE OF AXLES & SPRINGS AND BODY PANELS

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>
<tr>
<td>CO3:</td>
<td>Understand manufacturing methods for engine and engine components</td>
<td>K5</td>
</tr>
<tr>
<td>CO4:</td>
<td>Identify various manufacturing methods and materials used for the clutch.</td>
<td>K6</td>
</tr>
<tr>
<td>CO5:</td>
<td>Identify various manufacturing methods and materials used for the gear box.</td>
<td>K4</td>
</tr>
</tbody>
</table>

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 9
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 9
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 9
Thickness calculation, Tubessheet design using TEMA formula, concept of equivalent plate for analysing perforated analysis, flow induced vibration risks including acousticissues and remedies, tube to tube sheet joint design, buckling of tubes, thermal stresses.

UNIT IV COMPACT AND PLATE HEAT EXCHANGER 9
Types – Merits and Demerits – Design of compact heat exchangers, plate heatexchangers, performance influencing parameters, limitations.

UNIT V CONDENSORS AND COOLING TOWERS 9
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 stress the importance of NDT in engineering.
- To introduce all types of NDT and their applications in Engineering.

UNIT I OVERVIEW OF NDT

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


UNIT III THERMOGRAPHY AND EDDY CURRENT TESTING (ET)


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


UNIT V RADIOGRAPHY (RT)


TOTAL : 45 Hours
COURSE OUTCOMES:
After successful completion of the Non Destructive Testing and 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>Understand the NDT versus mechanical testing.</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Analyze Liquid Penetrant Testing and its properties and principles and methods of demagnetization</td>
<td>K4</td>
</tr>
<tr>
<td>CO3</td>
<td>Determine thermography principles and eddy current testing</td>
<td>K5</td>
</tr>
<tr>
<td>CO4</td>
<td>Classify ultrasonic testing principles and acoustic emission technique</td>
<td>K4</td>
</tr>
<tr>
<td>CO5</td>
<td>Discuss and understand the principle of radiography and film techniques.</td>
<td>K6</td>
</tr>
</tbody>
</table>

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:

REFERENCES:
COURSE OBJECTIVE:
- To study about MEMS and parts of MEMS
- To study the design methodology of MEMS for various mechanics.
- To study about actuators in MEMS.
- To study about MEMS based circuits.
- To study about optical and RF based MEMS.

UNIT I  INTRODUCTION TO MEMS  9
MEM Sand Micro systems, Miniaturization, Typical products, Micro Sensors, Micro actuation, MEMS with micro actuators, Micro accelerometers and Micro fluidics, MEMS materials, Micro Fabrication

UNIT II  MECHANICS FOR MEMS DESIGN  9
Elasticity, Stress, strain and material properties, Bending of thin plates, Spring configurations, tensional deflection, Mechanical vibration, Resonance, Thermo mechanics –actuators, force and response time, Fracture and thin film mechanics, material, physical aporode position(PVD), chemical mechanical polishing(CMP)

UNIT III  ELECTROSTATIC DESIGN  9
Electro statics: basic theory, electrostatic in stability, Surface tension, gap and finger pull up, Electro static actuators, Comb generators, gap closers, rotary motors, inchworms, Electromagnetic actuators, bi-stable actuators.

UNIT IV  CIRCUIT AND SYSTEM ISSUES  9
Electronic interfaces, Feedback systems, Noise, Circuit and system issues, Case studies – Capacitive accelerometer, Peizo electric pressure sensor, Thermal sensors, radiation sensors, mechanical sensors, bio-chemical sensors Modeling of MEMS systems, CAD for MEMS.

UNIT V  INTRODUCTION TO OPTICAL AND RF-MEMS  9
Optical MEMS, system design basics – Gaussian optics, matrix operations, Resolution, Case studies, MEMS scanners and retinal scanning, display, Digital Micro mirror devices, RF Memes– design basics, case study–Capacitive RFMEMS switch, Performance issue.

TOTAL: 45 Hours

COURSE OUTCOMES:
After successful completion of the Micro Electro Mechanical Systems 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 operational theory of common MEMS sensors and MEMS actuators.</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Identify situations where MEMS sensors and actuators would be ideal for applications to various products.</td>
<td>K3</td>
</tr>
<tr>
<td>CO3</td>
<td>Apply the scaling laws to determine that MEMS devices would perform better than existing Non micro scale devices.</td>
<td>K4</td>
</tr>
</tbody>
</table>
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 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


UNIT II CONCEPTS OF SOLID MECHANICS

- 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

- 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

- 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

- 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

<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 composite materials and its mechanical behavior.</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Analysis of fiber reinforced Laminate design for different combinations of plies with</td>
<td>K4</td>
</tr>
<tr>
<td></td>
<td>different orientations of the fiber.</td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>Examine Thermo-mechanical behavior and residual stresses in Laminates</td>
<td>K4</td>
</tr>
<tr>
<td>CO4</td>
<td>Apply Classical Laminate Theory (CLT) to study and analysis of residual stresses in an</td>
<td>K3</td>
</tr>
<tr>
<td></td>
<td>isotropic layered structure such as electronic chips.</td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>Develop the concepts of polymer, Graphite, ceramic and metal matrix composites</td>
<td>K6</td>
</tr>
</tbody>
</table>

TEXT BOOKS:
1. Carl T. Herakovich, Mechanics of Fibrous Composites, 1997,

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

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>
<tr>
<td>CO5:</td>
<td>Understand the powder based additive manufacturing system.</td>
<td>K5</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 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**

<table>
<thead>
<tr>
<th>Mixture requirements</th>
<th>Fuel injection systems</th>
<th>Mono point, Multipoint &amp; Direct injection</th>
<th>Stages of combustion</th>
<th>Normal and Abnormal combustion</th>
<th>Knock</th>
<th>Factors affecting knock</th>
<th>Combustion chambers</th>
</tr>
</thead>
</table>

**UNIT II COMPRESSION IGNITION ENGINES**

<table>
<thead>
<tr>
<th>Diesel Fuel Injection Systems</th>
<th>Stages of combustion</th>
<th>Knocking</th>
<th>Factors affecting knock</th>
<th>Direct and Indirect injection systems</th>
<th>Combustion chambers</th>
<th>Fuel Spray behavior</th>
<th>Spray structure and spray penetration</th>
<th>Air motion</th>
<th>Introduction to Turbocharging</th>
</tr>
</thead>
</table>

**UNIT III POLLUTANT FORMATION AND CONTROL**

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Sources</th>
<th>Formation of Carbon Monoxide, Unburnt hydrocarbon, Oxides of Nitrogen, Smoke and Particulate matter</th>
<th>Methods of controlling Emissions</th>
<th>Catalytic converters, Selective Catalytic Reduction and Particulate Traps</th>
<th>Methods of measurement</th>
<th>Emission norms and Driving cycles</th>
</tr>
</thead>
</table>

**UNIT IV ALTERNATIVE FUELS**

<table>
<thead>
<tr>
<th>Alcohol, Hydrogen, Compressed Natural Gas, Liquefied Petroleum Gas and Bio Diesel</th>
<th>Properties</th>
<th>Suitability, Merits and Demerits</th>
<th>Engine Modifications</th>
</tr>
</thead>
</table>

**UNIT V RECENT TRENDS**

<table>
<thead>
<tr>
<th>Air assisted Combustion, Homogeneous charge compression ignition engines</th>
<th>Variable Geometry turbochargers</th>
<th>Common Rail Direct Injection Systems</th>
<th>Hybrid Electric Vehicles</th>
<th>NOx Adsorbers</th>
<th>Onboard Diagnostics</th>
</tr>
</thead>
</table>

**TOTAL: 45 Hours**
COURSE OUTCOMES:

After successful completion of the Advanced I.C Engine 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 understand the reasons for differences among operating characteristics of different engine types and designs.</td>
<td>K4</td>
</tr>
<tr>
<td>CO2</td>
<td>Predict the concentration of Primary exhaust pollutants based on an in-depth analysis of the combustion process.</td>
<td>K6</td>
</tr>
<tr>
<td>CO3</td>
<td>Analyze the skills to run engine dynamometer experiments and alternative fuels</td>
<td>K4</td>
</tr>
<tr>
<td>CO4</td>
<td>Compare and contrast experimental results with theoretical trends.</td>
<td>K4</td>
</tr>
<tr>
<td>CO5</td>
<td>Develop the ability to optimize future engine designs for specific sets of constraints fuel economy, performance and emissions.</td>
<td>K3</td>
</tr>
</tbody>
</table>

TEXT BOOKS:


REFERENCES:

COURSE OBJECTIVE:
- To learn the basic thermal analysis on various parts of the heat exchangers and learn the waste heat recovery.
- To analyze the sizing and rating of the heat exchangers for various applications with co-generation.

UNIT I  INTRODUCTION  9

UNIT II  DESIGN OF WASTE HEAT RECOVERY SYSTEMS  9

UNIT III  COGENERATION PRINCIPLES  9
Cogeneration principles and thermodynamics power cycle analysis, combined for power generation and process heat.

UNIT IV  APPLICATIONS OF COGENERATION  9
Applications in sugar mills rice mills, textile factories, and other process and engineering industries.

UNIT V  COST ANALYSIS OF COGENERATION SYSTEMS  9
Financial considerations, operating and maintenance cost, investment costs of waste heat recovery and Cogeneration system, environmental and air quality consideration.

TOTAL: 45 Hours
COURSE OUTCOMES:
After successful completion of the waste heat recovery and co-generation 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 waste heat recovery systems.</td>
<td>K4</td>
</tr>
<tr>
<td>CO2</td>
<td>Understand basic thermal analysis on various parts of the heat exchangers and learn the waste heat recovery.</td>
<td>K6</td>
</tr>
<tr>
<td>CO3</td>
<td>Analyze the heat exchangers for various applications.</td>
<td>K4</td>
</tr>
<tr>
<td>CO4</td>
<td>Discuss the theory and design of organic fluid systems.</td>
<td>K4</td>
</tr>
<tr>
<td>CO5</td>
<td>Sizing and rating the heat exchangers for various applications with co-generation.</td>
<td>K3</td>
</tr>
</tbody>
</table>

TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVE:

- To understand the different types of stresses and their effects in pressure vessels.
- 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, MOCVD.

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 toxichazards, 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>
<tr>
<td>CO4</td>
<td>Gain the knowledge in the field of nanotechnology.</td>
<td>K4</td>
</tr>
<tr>
<td>CO5</td>
<td>Understand the current nanotechnology solutions in design, engineering and Manufacturing.</td>
<td>K3</td>
</tr>
</tbody>
</table>

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  9
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  9

UNIT III  PRODUCT ARCHITECTURE  9
Concept selection- Screening – scoring, Product architecture – Implication of architecture – Establishing the architecture – Related system level design issues.

UNIT IV  INDUSTRIAL DESIGN  9
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  9

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

REFERENCES:
SYLLABUS
GENERIC ELECTIVE COURSES
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

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


UNIT III SPEED CONTROL OF AC MACHINES

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


UNIT V HEATING AND POWER RATING OF DRIVE MOTORS

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.</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:

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>CO</th>
<th>Course Outcome Statements</th>
<th>Knowledge Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>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</td>
<td>Analyze the issues associated with securing and managing financial resources in new and established organizations.</td>
<td>K4</td>
</tr>
<tr>
<td>CO3</td>
<td>Develop the distinct entrepreneurial, assess opportunities and constraints for new business ideas</td>
<td>K6</td>
</tr>
<tr>
<td>CO4</td>
<td>Understanding of new knowledge or new technology with her/his insights for the business.</td>
<td>K2</td>
</tr>
<tr>
<td>CO5</td>
<td>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**:


**REFERENCES**:

COURSE OBJECTIVES:

- 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.
- 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 OVERVIEW OF MANAGEMENT 9

UNIT II PLANNING & ORGANIZING 9

UNIT III DIRECTING & CONTROLLING 9

UNIT IV ENGINEERING ETHICS & HUMAN VALUES 9

UNIT V SAFETY RESPONSIBILITIES AND RIGHTS 9

TOTAL: 45 Hours
COURSE OUTCOMES:
After successful completion of the Principles of Management and Professional Ethics 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 management roles and skills and evolution of the management.</td>
<td>K6</td>
</tr>
<tr>
<td>CO2:</td>
<td>Analyze the planning and organizing system of the management.</td>
<td>K4</td>
</tr>
<tr>
<td>CO3:</td>
<td>Discuss directing and controlling system of the management</td>
<td>K6</td>
</tr>
<tr>
<td>CO4:</td>
<td>Develop engineering ethics and improve human values</td>
<td>K6</td>
</tr>
<tr>
<td>CO5:</td>
<td>Explain safety responsibilities and environmental ethics</td>
<td>K5</td>
</tr>
</tbody>
</table>

TEXT BOOKS:

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

UNIT I  LINEAR MODELS  9

UNIT II  TRANSPORTATION MODELS AND NETWORK MODELS  9

UNIT III  INVENTORY MODELS  9
- Inventory models – Economic order quantity models – Quantity discount models – Stochastic inventory models – Multi product models – Inventory control models in practice.

UNIT IV  QUEUEING MODELS  9

UNIT V  DECISION MODELS  9

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 BOOK:

REFERENCES:
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  9
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  9

UNIT III  MARKET RESEARCH  9

UNIT IV  TECHNIQUES  9

UNIT V  Implementation  9
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:

REFERENCES:
3. RamanujMajumdar, “Marketing Research-Text, Applications and Case Studies”.
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</td>
<td></td>
</tr>
<tr>
<td></td>
<td>the Product and eliminate the unwanted functionality to reducing the overall cost.</td>
<td>K6</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:

REFERENCES:
COURSE OBJECTIVE:

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

UNIT I ENERGY AND ENVIRONMENT 9
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 9
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 9
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 9
Energy management principles - energy resource management - energy management information Systems - instrumentation and measurement - computerized energy management - energy Auditing.

UNIT V ECONOMICS AND FINANCE 9
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>CO</th>
<th>Course Outcome Statements</th>
<th>Knowledge Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>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</td>
<td>Understanding the basics of energy auditing with application on different sectors.</td>
<td>K6</td>
</tr>
<tr>
<td>CO3</td>
<td>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</td>
<td>Acquired the skills needed for the energy monitoring, auditing and management.</td>
<td>K3</td>
</tr>
<tr>
<td>CO5</td>
<td>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 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
Supply chain coordination - Bullwhip effect – Effect of lack of co-ordination and obstacles – IT and SCM - supply chain IT frame work, E Business & SCM, Metrics for SC performance – Case Analysis

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:

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  9
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  9
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  9

UNIT IV  LIFE TESTING – RELIABILITY  9

UNIT V  QUALITY AND RELIABILITY  9

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>
<tr>
<td>CO4</td>
<td>Draw and explain the Mean Chart Limits (x-Charts) and Setting the Range Chart Limits (R-Charts)</td>
<td>K6</td>
</tr>
<tr>
<td>CO5</td>
<td>Understand the Mean and Range Charts and acceptance sampling.</td>
<td>K5</td>
</tr>
</tbody>
</table>

**TEXT BOOKS:**


**REFERENCES:**

SYLLABUS
SKILL ENHANCEMENT ELECTIVE COURSES
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

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

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


UNIT IV SELF AWARENESS AND SELF ESTEEM

Definitions-Components of self awareness-Developing Self awareness-Self esteem-meaning-Steps to improve self esteem

UNIT V SELF MOTIVATION


Total: 30 Hours

COURSE OUTCOMES:

After successful completion of 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:
1. Personality Development And Soft Skills---Barun K Mitra, Oxford Publication
2. Seven habits of Higly Effective people – Stephen R. covey
3. Emotion, motivation and Self regulation - Nathan C. Hall, McGill University, Canada, Thomas Goetz, University of Konstanz, Germany
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 6
Basic Etiquette – Email etiquette – Business etiquette – Telephone etiquette – Meeting etiquette – Adjustment of Role & Leadership – Team Management & Development

UNIT II QUANTITATIVE APTITUDE I 6

UNIT III QUANTITATIVE APTITUDE II 6
Mensuration Clocks and Calendars- Boats-Simple Interest –Compound Interest- Fractions and Decimals – Square roots – Functions.

UNIT IV ANALYTICAL PROBLEMS 6

UNIT V LOGICAL PROBLEMS 6

TOTAL: 30 Hours

After successful completion of 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>

REFERENCES:
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
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
Singular/plural-present tense/past tense—genders - Prepositions-conjunctions-Choice of words—simple sentences—compound sentences— summarising phrases—Synonyms—Antonyms— Analogies—Similar Words

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

After successful completion of 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:

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
- Assertiveness—Meaning—Importance of assertiveness- Characteristics of assertive communication—Merits—forms of assertion—Causes of misunderstanding

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

UNIT V CHANGE MANAGEMENT

TOTAL: 30 Hours

After successful completion of Personality Development IV 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 Assertiveness, Meaning, Importance of assertiveness, Characteristics of assertive communication, Merits, forms of assertion, Causes of misunderstanding</td>
<td>K2</td>
</tr>
<tr>
<td>CO2:</td>
<td>Build Elements of communication, Functions of communication, Principles of communication, Formal and Informal communication, Barriers in Communication, Characteristics of good communication, Feedback, communication systems</td>
<td>K6</td>
</tr>
<tr>
<td>CO3:</td>
<td>Understand Importance of Presentation, Concept of 5 w’s and one H, understanding the audience, Types of presentations, How to make effective presentation</td>
<td>K5</td>
</tr>
<tr>
<td>CO4:</td>
<td>Utilize the power point slide to visuals presentation, Rules for slide presentation, precautions, seminars and conferences—Steps to eliminate Stage fear.</td>
<td>K3</td>
</tr>
<tr>
<td>CO5:</td>
<td>Explain the necessity, Resistance towards Change, 10 Principles of Change Management, Leaders approach, Effective Change management.</td>
<td>K5</td>
</tr>
</tbody>
</table>
REFERENCES

2. Who Moved My Cheese by Spencer Johnson published by Vermilion first edition
UNIT I INTRODUCTION AND BASIC CONCEPTS OF NSS

UNIT II NSS PROGRAMS AND ACTIVITIES
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
Youth: Definition, profile of youth, categories – youth: Issues, challenges and opportunities - Youth as an agent of social change.

UNIT IV COMMUNITY MOBILIZATION
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
Indian Tradition of volunteerism-Needs& Importance of volunteerism- Motivation and constraints of volunteerism-Shramdan as a part of volunteerism.

TOTAL: 30 Hours

After successful completion of NSS – 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>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 responsibility 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>
UNIT I IMPORTANCE AND ROLE OF YOUTH LEADERSHIP
Meaning and types of leadership- Qualities of good leaders; traits of leadership- Importance and role of youth leadership

UNIT II LIFE COMPETENCIES
Definition and importance of life competencies- Communication- Inter personal- Problem solving and decision-making

UNIT III SOCIAL HARMONY AND NATIONAL INTEGRATION
Indian history and culture- Role of youth in peace building and conflict resolution- Role of youth in Nation building

UNIT IV YOUTH DEVELOPMENT PROGRAMMES IN INDIA
National youth policy- Youth development programmes at the National level, state level and voluntary sector- Youth focused and youth-led organization

Conducting surveys on special theme and preparing a report thereof.

TOTAL: 30 Hours

After successful completion of NSS – 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>Identify the importance and role of youth leadership and learn the qualities of good leaders.</td>
<td>K3</td>
</tr>
<tr>
<td>CO2</td>
<td>Understand the importance of life competencies, communication, Inter personal, Problem solving and decision-making.</td>
<td>K2</td>
</tr>
<tr>
<td>CO3</td>
<td>Understand the Indian history and culture- Role of youth in peace, and learn role of youth in building of the nation.</td>
<td>K2</td>
</tr>
<tr>
<td>CO4</td>
<td>Understand the NATIONAL youth policy and youth development programmes at the National level.</td>
<td>K2</td>
</tr>
<tr>
<td>CO5</td>
<td>Understand the youth focused and youth-led organization by state level.</td>
<td>K2</td>
</tr>
</tbody>
</table>
UNIT I  CITIZENSHIP
Basic features of constitution of India-Fundamental Rights and duties- Human rights- Consumer awareness and the legal rights of consumer- RTI

UNIT II  FAMILY AND SOCIETY
Concept of family-community(PRIs and community-based organization) and society-Growing up in the family-dynamics and impact-Human values-Gender justice

UNIT III  HEALTH, HYGIENE & SANITATION
Health Education Definition, needs and scope-Food and nutrition- Safe drinking water- water born diseases and sanitation(Swachh Bharath Abhiyan)-National Health Programme- Reproductive health

UNIT IV  YOUTH HEALTH
Healthy Lifestyles-HIV AIDS, Drugs and substance abuse- Home nursing- First aid.

UNIT V  YOUTH AND YOGA
Yoga: History, philosophy and concept-Myths and misconceptions about yoga- Different yoga traditions and their impact-Yoga as a preventive, promotive and curative method- Yoga as a tool for healthy lifestyle

Preparation of research project report.

TOTAL: 30 Hours

After successful completion of NSS – 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 knowledge among the students fundamental rights and duties,</td>
<td>K6</td>
</tr>
<tr>
<td></td>
<td>Human rights and the legal rights of consumer.</td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>Understand the concept of family-community and society with growing up in the family.</td>
<td>K2</td>
</tr>
<tr>
<td>CO3</td>
<td>Understand the health education awareness and scope; educate the students the importance</td>
<td>K2</td>
</tr>
<tr>
<td></td>
<td>of Food nutrition, Safe drinking water and water born diseases.</td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>Develop the knowledge among the students about Healthy Lifestyles, HIV AIDS, Drugs and</td>
<td>K6</td>
</tr>
<tr>
<td></td>
<td>substance abuse.</td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>Explain the importance of Yoga and their history, philosophy and concept. Teach the</td>
<td>K5</td>
</tr>
<tr>
<td></td>
<td>different yoga traditions and their impact in healthy lifestyle.</td>
<td></td>
</tr>
</tbody>
</table>
UNIT I ENVIRONMENT ISSUES 7
Environment: conservation, enrichment and sustainability- Climate change- Waste management-
Natural resource management (Rainwater harvesting, energy conservation, wasteland development,
soil conservations and afforestation)

UNIT II DISASTER MANAGEMENT 7
Introduction to Disaster management-classification of disasters-Role of youth in disaster management

UNIT III PROJECT CYCLE MANAGEMENT 8
Project planning-Project implementation- Project monitoring- Project evaluation-Impact Assessment

UNIT IV DOCUMENTATION AND REPORTING 8
Collection and analysis of data- Preparation of Documentation/Reports- Dissemination of
documents/Reports Workshops/seminars on personality development and improvement of
communication skills.

TOTAL: 30 Hours

After successful completion of NSS – IV 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 environmental issues and importance of rainwater harvesting, energy conservation, wasteland development, soil conservations and afforestation</td>
<td>K2</td>
</tr>
<tr>
<td>CO2</td>
<td>Explain the disaster management and understand the classification of disasters, role of youth in disaster management.</td>
<td>K5</td>
</tr>
<tr>
<td>CO3</td>
<td>Develop the project planning ideas among the students, Implementation, monitoring- and evaluation of the project.</td>
<td>K6</td>
</tr>
<tr>
<td>CO4</td>
<td>Explain the Collection and analysis of data, Preparation of documentation and dissemination of documents.</td>
<td>K5</td>
</tr>
<tr>
<td>CO5</td>
<td>Explain the preparation of the project reports Workshops / seminars on personality development and improvement of communication skills.</td>
<td>K5</td>
</tr>
</tbody>
</table>
UNIT I  VOCATIONAL SKILL DEVELOPMENT
This unit will aim to enhance the employment potential of the NSS volunteers - alternately to help them to set up small business enterprises. For this purpose, a list of 12-15 vocational skills will be drawn up, based on local conditions and opportunities - Each volunteer will have the option to select two skill-areas out of this list-one such skill in each semester-The education institution (or the university) will make arrangements for developing these skills in collaboration with established agencies that possess the necessary expertise in the related vocational skills.

UNIT II  ENTREPRENEURSHIP DEVELOPMENT
Definitions & meaning- Qualities of good Entrepreneur- Steps/ways in opening an enterprise- Role of financial and support service Institutions.

UNIT III  YOUTH AND CRIME
Sociological and Psychological Factors influencing youth crime- Peer monitoring in preventing crimes Awareness about Anti-Ragging -Cyber Crime and its prevention- Juvenile justice

TOTAL: 30 Hours

After successful completion of NSS – V 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 employment potential of the NSS volunteers, alternately to help them to set up small business enterprises.</td>
<td>K6</td>
</tr>
<tr>
<td>CO2</td>
<td>Developing the skills in collaboration with established agencies that possess the necessary expertise in the related vocational skills.</td>
<td>K6</td>
</tr>
<tr>
<td>CO3</td>
<td>Definitions &amp; meaning- Qualities of good Entrepreneur- Steps/ways in opening an enterprise- Role of financial and support service Institutions.</td>
<td>K1</td>
</tr>
<tr>
<td>CO4</td>
<td>Creating awareness Sociological and Psychological Factors influencing youth crime.</td>
<td>K6</td>
</tr>
<tr>
<td>CO5</td>
<td>Creating awareness on Cyber Crime and its prevention.</td>
<td>K6</td>
</tr>
</tbody>
</table>
UNIT I  VOCATIONAL SKILL DEVELOPMENT  15
This unit will aim to enhance the employment potential of the NSS volunteers alternately to help them to set up small business enterprises. For this purpose, a list of 12-15 vocational skills will be drawn up, based on local conditions and opportunities. Each volunteer will have the option to select two skill-areas out of this list-one such skill in each semester. The education institution (or the university) will make arrangements for developing these skills in collaboration with established agencies that possess the necessary expertise in the related vocational skills.

UNIT II  CIVIL/SELF DEFENSE  5
Civil defense services-aims and objectives of civil defense - Needs for Self defense training

UNIT III  RESOURCE MOBILISATION  3
Writing a project proposal- Establishment of SFUs

UNIT IV  ADDITIONAL LIFE SKILLS  7
Positive thinking- Self-confidence and self esteem- Setting life goals and working to achieve them- Management of stress including time management

TOTAL: 30 Hours

After successful completion of NSS – VI 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 employment potential of the NSS volunteers alternately to help them to set up small business enterprises.</td>
<td>K6</td>
</tr>
<tr>
<td>CO2:</td>
<td>Develop the skills in collaboration with established agencies that possess the necessary expertise in the related vocational skills.</td>
<td>K6</td>
</tr>
<tr>
<td>CO3:</td>
<td>Create awareness of civil defense services.</td>
<td>K6</td>
</tr>
<tr>
<td>CO4:</td>
<td>Develop the knowledge to write a project proposal.</td>
<td>K6</td>
</tr>
<tr>
<td>CO5:</td>
<td>Develop the positive thinking, Self-confidence and self-esteem.</td>
<td>K6</td>
</tr>
</tbody>
</table>