## I-SEMESTER

<table>
<thead>
<tr>
<th>S. No</th>
<th>Subject Code</th>
<th>Name of the Subject</th>
<th>Contact hours/ week</th>
<th>Credits</th>
<th>Scheme of Valuation</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Internal (CIE)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>External (SEE)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>S239</td>
<td>English-I</td>
<td>4</td>
<td>3</td>
<td>25</td>
<td>100</td>
</tr>
<tr>
<td>2</td>
<td>S132</td>
<td>Applied Mathematics-I</td>
<td>4+1</td>
<td>3</td>
<td>25</td>
<td>100</td>
</tr>
<tr>
<td>3</td>
<td>S232</td>
<td>Engineering Chemistry</td>
<td>4</td>
<td>3</td>
<td>25</td>
<td>100</td>
</tr>
<tr>
<td>4</td>
<td>S170</td>
<td>Computer Programming</td>
<td>4+1</td>
<td>3</td>
<td>25</td>
<td>100</td>
</tr>
<tr>
<td>5</td>
<td>S235</td>
<td>Engineering Graphics</td>
<td>2</td>
<td>6</td>
<td>25</td>
<td>100</td>
</tr>
<tr>
<td>6</td>
<td>L144</td>
<td>English Communication Lab.</td>
<td>--</td>
<td>2</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>7</td>
<td>L126</td>
<td>Computer Programming Lab.</td>
<td>--</td>
<td>2</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>8</td>
<td>L140</td>
<td>Engineering Chemistry Lab.</td>
<td>--</td>
<td>2</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>9</td>
<td>L114</td>
<td>Basic Simulation Lab.</td>
<td>--</td>
<td>2</td>
<td>25</td>
<td>75</td>
</tr>
</tbody>
</table>

**TOTAL** 23 225 575 800

## II SEMESTER

<table>
<thead>
<tr>
<th>S. No</th>
<th>Subject Code</th>
<th>Name of the Subject</th>
<th>Contact hours/ week</th>
<th>Credits</th>
<th>Scheme of Valuation</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Internal (CIE)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>External (SEE)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>S240</td>
<td>English – II</td>
<td>4</td>
<td>3</td>
<td>25</td>
<td>100</td>
</tr>
<tr>
<td>2</td>
<td>S133</td>
<td>Applied Mathematics- II</td>
<td>4+1</td>
<td>3</td>
<td>25</td>
<td>100</td>
</tr>
<tr>
<td>3</td>
<td>S238</td>
<td>Engineering Physics</td>
<td>4+1</td>
<td>3</td>
<td>25</td>
<td>100</td>
</tr>
<tr>
<td>4</td>
<td>S147</td>
<td>Basic Mechanical Engineering</td>
<td>4+1</td>
<td>3</td>
<td>25</td>
<td>100</td>
</tr>
<tr>
<td>5</td>
<td>S237</td>
<td>Engineering Mechanics</td>
<td>4+1</td>
<td>3</td>
<td>25</td>
<td>100</td>
</tr>
<tr>
<td>6</td>
<td>L142</td>
<td>Engineering Physics Lab.</td>
<td>--</td>
<td>2</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>7</td>
<td>L124</td>
<td>Computer Aided Engineering Graphics Lab.</td>
<td>--</td>
<td>2</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>8</td>
<td>L143</td>
<td>Engineering Workshop.</td>
<td>--</td>
<td>2</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>9</td>
<td>L113</td>
<td>Basic Mechanical Engineering Lab.</td>
<td>--</td>
<td>2</td>
<td>25</td>
<td>75</td>
</tr>
</tbody>
</table>

**TOTAL** 23 225 575 800
### III-SEMESTER

<table>
<thead>
<tr>
<th>S. No</th>
<th>Subject Code</th>
<th>Name of the Subject</th>
<th>Contact hours/ week</th>
<th>Credits</th>
<th>Scheme of Valuation</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>L+T P</td>
<td></td>
<td>Internal</td>
<td>External</td>
</tr>
<tr>
<td>1</td>
<td>S134</td>
<td>Applied Mathematics- III</td>
<td>4+1 --</td>
<td>3</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>2</td>
<td>S408</td>
<td>Thermodynamics</td>
<td>4+1 --</td>
<td>3</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>3</td>
<td>S309</td>
<td>Metallurgy and Material Science</td>
<td>4+1 --</td>
<td>3</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>4</td>
<td>S305</td>
<td>Mechanics of Materials</td>
<td>4+1 --</td>
<td>3</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>5</td>
<td>S208</td>
<td>Electrical and Electronics Engineering</td>
<td>4+1 --</td>
<td>3</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>6</td>
<td>S293</td>
<td>Machine Drawing</td>
<td>- 6</td>
<td>3</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>7</td>
<td>S243</td>
<td>Environmental Studies</td>
<td>3</td>
<td></td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>8</td>
<td>L159</td>
<td>Material Testing and MetallurgyLab</td>
<td>-- 3</td>
<td>2</td>
<td>25</td>
<td>50</td>
</tr>
<tr>
<td>9</td>
<td>L133</td>
<td>Electrical and Electronics Engineering Lab</td>
<td>-- 3</td>
<td>2</td>
<td>25</td>
<td>50</td>
</tr>
</tbody>
</table>

**TOTAL**   22  225  625  850  

*Note: The Subject with Code S243 is Mandatory Course*

### IV SEMESTER

<table>
<thead>
<tr>
<th>S. No</th>
<th>Subject Code</th>
<th>Name of the Subject</th>
<th>Contact hours/ week</th>
<th>Credits</th>
<th>Scheme of Valuation</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>L+T P</td>
<td></td>
<td>Internal</td>
<td>External</td>
</tr>
<tr>
<td>1</td>
<td>S351</td>
<td>Probability and Statistics</td>
<td>4+1 --</td>
<td>3</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>2</td>
<td>S252</td>
<td>Fluid Mechanics and Hydraulic Machinery</td>
<td>4+1 --</td>
<td>3</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>3</td>
<td>S354</td>
<td>Production Technology</td>
<td>4+1 --</td>
<td>3</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>4</td>
<td>S286</td>
<td>Kinematics of Machines</td>
<td>4+1 --</td>
<td>3</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>5</td>
<td>S407</td>
<td>Thermal Engineering</td>
<td>4+1 --</td>
<td>3</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>6</td>
<td>S245</td>
<td>Estimation, Costing and Engineering Economics</td>
<td>4+1 --</td>
<td>3</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>7</td>
<td>S355</td>
<td>Professional Ethics and Human Values</td>
<td>3</td>
<td></td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>8</td>
<td>L146</td>
<td>Fluid Mechanics and Hydraulic MachineryLab</td>
<td>-- 3</td>
<td>2</td>
<td>25</td>
<td>50</td>
</tr>
<tr>
<td>9</td>
<td>L172</td>
<td>Production Technology and Modelling Lab</td>
<td>-- 3</td>
<td>2</td>
<td>25</td>
<td>50</td>
</tr>
</tbody>
</table>

**TOTAL**   22  225  625  850  

*Note: The Subject with Code S355 is Mandatory Course*
### V – SEMESTER

<table>
<thead>
<tr>
<th>S. No</th>
<th>Subject Code</th>
<th>Name of the Subject</th>
<th>Contact hours/ week</th>
<th>Credits</th>
<th>Scheme of Valuation</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>L+T P</td>
<td></td>
<td>Internal</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>S267</td>
<td>IC Engines and Gas Turbines</td>
<td>4+1 --</td>
<td>3</td>
<td>25 75 100</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>S291</td>
<td>Machine Design –I</td>
<td>4+1 --</td>
<td>3</td>
<td>25 75 100</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>S203</td>
<td>Dynamics of Machines</td>
<td>4+1 --</td>
<td>3</td>
<td>25 75 100</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>S270</td>
<td>Industrial Management</td>
<td>4 --</td>
<td>3</td>
<td>25 75 100</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>S308</td>
<td>Metal Cutting and Machine Tools</td>
<td>4 --</td>
<td>3</td>
<td>25 75 100</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>S329</td>
<td>Operations Research</td>
<td>4+1 -</td>
<td>3</td>
<td>25 75 100</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>L156</td>
<td>Machine Tools and Dynamics Lab</td>
<td>-- 3</td>
<td>2</td>
<td>25 50 75</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>L181</td>
<td>Thermal Engineering lab</td>
<td>-- 3</td>
<td>2</td>
<td>25 50 75</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>L176</td>
<td>Seminar</td>
<td>2 2</td>
<td>75</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td>24 275</td>
<td>550</td>
<td>825</td>
<td></td>
</tr>
</tbody>
</table>

### VI – SEMESTER

<table>
<thead>
<tr>
<th>S. No</th>
<th>Subject Code</th>
<th>Name of the Subject</th>
<th>Contact hours/ week</th>
<th>Credits</th>
<th>Scheme of Valuation</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>L+T P</td>
<td></td>
<td>Internal</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>S259</td>
<td>Heat Transfer</td>
<td>4+1 --</td>
<td>3</td>
<td>25 75 100</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>S292</td>
<td>Machine Design –II</td>
<td>4+1 --</td>
<td>3</td>
<td>25 75 100</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>S317</td>
<td>Modern Machining Processes</td>
<td>4 --</td>
<td>3</td>
<td>25 75 100</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>S372</td>
<td>Robotics</td>
<td>4+1 --</td>
<td>3</td>
<td>25 75 100</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>S302</td>
<td>Mechanical Vibrations</td>
<td>4 --</td>
<td>3</td>
<td>25 75 100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>S285</td>
<td>Jet and Rocket Propulsion</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>S414</td>
<td>Tribology</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>S174</td>
<td>Control Systems</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>PROGRAM ELECTIVE - I</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>S302</td>
<td>Mechanical Vibrations</td>
<td>4 --</td>
<td>3</td>
<td>25 75 100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>S285</td>
<td>Jet and Rocket Propulsion</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>S414</td>
<td>Tribology</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>S174</td>
<td>Control Systems</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>PROGRAM ELECTIVE – II</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>S402</td>
<td>Theory of Elasticity</td>
<td>4 --</td>
<td>3</td>
<td>25 75 100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>S141</td>
<td>Automobile Engineering</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>S294</td>
<td>Machine Tool Design</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>S427</td>
<td>Work Study and Ergonomics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>L150</td>
<td>Heat Transfer Lab.</td>
<td>-- 3</td>
<td>2</td>
<td>25 50 75</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>L119</td>
<td>Communication and Presentation Skills Lab.</td>
<td>-- 3</td>
<td>2</td>
<td>25 50 75</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>L164</td>
<td>Mini Project</td>
<td>-- 2</td>
<td>2</td>
<td>25 50 75</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td>24 225</td>
<td>600</td>
<td>825</td>
<td></td>
</tr>
</tbody>
</table>
## VII – SEMESTER

<table>
<thead>
<tr>
<th>S. No</th>
<th>Subject Code</th>
<th>Name of the Subject</th>
<th>Contact hours/week</th>
<th>Credits</th>
<th>Scheme of Valuation</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>L+T</td>
<td></td>
<td>Internal</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>P</td>
<td></td>
<td>External</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>S250</td>
<td>Finite Element Method</td>
<td>4+1</td>
<td>3</td>
<td>25  75</td>
<td>100</td>
</tr>
<tr>
<td>2</td>
<td>S154</td>
<td>CAD/CAM</td>
<td>4</td>
<td></td>
<td>25  75</td>
<td>100</td>
</tr>
<tr>
<td>3</td>
<td>S367</td>
<td>Refrigeration and Air Conditioning</td>
<td>4+1</td>
<td>3</td>
<td>25  75</td>
<td>100</td>
</tr>
<tr>
<td>4</td>
<td>S310</td>
<td>Metrology and Instrumentation</td>
<td>4</td>
<td>3</td>
<td>25  75</td>
<td>100</td>
</tr>
<tr>
<td>5</td>
<td>S303</td>
<td>Mechanics of Composites</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>S231</td>
<td>Energy Conservation and Management</td>
<td>4</td>
<td>3</td>
<td>25  75</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>S138</td>
<td>Automation in Manufacturing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>S331</td>
<td>Optimization Methods and Applications</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>S319</td>
<td>Nano Technology</td>
<td>4</td>
<td>3</td>
<td>25  75</td>
<td>100</td>
</tr>
<tr>
<td>7</td>
<td>L117</td>
<td>CAD/CAM Lab</td>
<td>--</td>
<td>2</td>
<td>25  50</td>
<td>75</td>
</tr>
<tr>
<td>8</td>
<td>L160</td>
<td>Metrology and Instrumentation Lab</td>
<td>--</td>
<td>2</td>
<td>25  50</td>
<td>75</td>
</tr>
<tr>
<td>9</td>
<td>L153</td>
<td>Internship</td>
<td>--</td>
<td>2</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# VIII – SEMESTER

<table>
<thead>
<tr>
<th>S. No</th>
<th>Subject Code</th>
<th>Name of the Subject</th>
<th>Contact hours/ week</th>
<th>Credits</th>
<th>Scheme of Valuation</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>L+T</td>
<td>P</td>
<td>Internal</td>
<td>External</td>
</tr>
<tr>
<td>1</td>
<td>S343</td>
<td>Power Plant Engineering</td>
<td>4</td>
<td>--</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>2</td>
<td>S109</td>
<td>Advanced Strength of Materials</td>
<td>4</td>
<td>3</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>2</td>
<td>S165</td>
<td>Computational Fluid Dynamics</td>
<td>4</td>
<td>3</td>
<td>25</td>
<td>75</td>
</tr>
<tr>
<td>2</td>
<td>S365</td>
<td>Rapid Prototyping</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>S353</td>
<td>Production Planning and Control</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>PROGRAM ELECTIVE – IV</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>S358</td>
<td>Cognitive Engineering</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>S306</td>
<td>Mechatronics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>S273</td>
<td>Innovation and Entrepreneurship</td>
<td></td>
<td></td>
<td>50</td>
<td>150</td>
</tr>
<tr>
<td>3</td>
<td>S409</td>
<td>Total Quality Management</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>L121</td>
<td>Comprehensive Viva voce</td>
<td></td>
<td>3</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td>5</td>
<td>L157</td>
<td>Main Project</td>
<td></td>
<td>8</td>
<td>50</td>
<td>150</td>
</tr>
</tbody>
</table>

Note: A few courses as notified in the respective departments are offered to the students on electives under Massive Open Online Courses (MOOCs).
S239 - ENGLISH – I
(Common to all branches)

Prerequisite: None

Course Educational Objectives
In this course, the students will learn
1. The standard vocabulary along with the meaning and usage of the words
2. The concepts of functional grammar and syntax for better writing and speaking skills
3. The concepts of skimming, scanning and critical reading for better comprehension abilities.
4. The effective pronunciation, language usage through extensive reading
5. The concepts of writing reports, resume, statement of purpose, memos and e-mails etc.

Course Outcomes
After the completion of this course, students will have the ability to
1. Read, write and understand what ever is written and spoken in English
2. Speak fluently with acceptable pronunciation and write using appropriate words, spellings, grammar and syntax
3. Read the lines, between lines and beyond lines excelling in comprehension skills
4. Speak grammatically error free English
5. Draft reports, memos, mails & letters as part of their work.

UNIT – I
ASTRONOMY (Learning English)
Grammar: Parts of Speech
Vocabulary: Antonyms
Analytical Writing: Unscrambling words in a sentence; Un-jumbling the sentences into a paragraph; Types of sentences; Paragraph writing

UNIT – II
TRAVEL AND TRANSPORT (Learning English)
The Trailblazers - Jagadis Chandra Bose (Masterminds)
Grammar: prepositions; word plurals; sentence completion
Vocabulary: Synonyms
Analytical Writing: Drafting E-Mails; Letter writing (Formal & Informal)

UNIT - III
HUMOUR (Learning English)
The Trailblazers – Prafulla Chandra Ray (Masterminds)
Grammar: Active & Passive Voices
Vocabulary: Pre-fixes & Suffixes
Analytical Writing: Note-making

UNIT - IV
HEALTH AND MEDICINE (Learning English)
The Trailblazers – Srinivasa Ramanujam (Masterminds)
Grammar: Tenses
Vocabulary: Deriving words
Analytical Writing: Abstract writing/Synopsis writing
UNIT - V
The World of Figures and Physics – **Chandra SekharaVenkataRaman** (Masterminds)
Grammar: Articles
Vocabulary: One-Word substitutes
Analytical Writing: Essay writing; Dialogue writing (Formal & Informal)

**TEXT BOOKS**
2. EnakshiChatterjee, “Masterminds”, Orient Longman Private Limited. 2002 (Reprint)

**REFERENCES**
S132 - APPLIED MATHEMATICS-I
(Common to AE, CE, CSE, EEE, EIE, IT, ME)

Prerequisite: None

Course Educational Objectives
In this course, the students will learn about
1. The concepts of Differential Equations and solving the first order and the first degree differential equations.
2. The concepts of Higher Order Differential Equations and solving such equations with constant and variable coefficients.
3. The concepts of theory of Matrices which are used to solve linear simultaneous equations.
4. The concept of Eigen Values and Eigen Vectors and solving an Eigen Value Problem.
5. The concepts of partial differentiation and formation of partial differential equations

Course Outcomes
After the completion of this course, students will able to:
1. Know fundamental mathematical skills required to form a necessary base to analyze first order differential equations.
2. Know the Higher Order Differential Equations, Procedures to solve them and their physical applications.
3. Find the solutions of System of Homogeneous and Non Homogeneous Linear equations using matrices for different physical applications.
4. Find Eigen values and Eigen vectors, higher powers and inverse of a given matrix, and can apply it in the concept of free vibrations of two-mass systems.
5. Find the solutions of linear partial differential equations.

UNIT – I
DIFFERENTIAL EQUATIONS OF FIRST ORDER AND FIRST DEGREE
Differential equations of first order and first degree – Exact, Linear and Bernoulli. Applications to Orthogonal trajectories, applications to LCR circuits.

UNIT – II
HIGHER ORDER DIFFERENTIAL EQUATIONS
Linear differential equations of second and higher order with constant coefficients and with variable coefficients, method of variation of parameters, Linear differential equations of second and higher order with variable coefficients – Cauchy’s Equation and Legendre’s Equations.

UNIT – III
FUNCTIONS OF SEVERAL VARIABLES
Generalized Mean Value Theorem (without proof), Maclaurin’s series, Functions of several variables, Jacobians (polar, cylindrical, spherical coordinates), Functional dependence, Maxima and Minima of functions of two variables with constraints and without constraints – Lagrangian Multiplier Method. Formation of Partial Differential Equations by the elimination of arbitrary constants and arbitrary functions. Solution of first order and first degree linear partial differential equation – Lagranze’s method.

UNIT – IV
SYSTEM OF LINEAR EQUATIONS.
UNIT – V
EIGEN VALUES AND EIGEN VECTORS

TEXT BOOKS

REFERENCES
S232 - ENGINEERING CHEMISTRY
(Common to all branches)

Prerequisite: None

Course Educational Objectives:
Through this course the student will learn
1. The concept of water technology with special focus on hardness & softness of water, methods of softening and desalination of brackish water.
2. The concept of conventional and alternative fuels and working of petrol and diesel engines.
3. The concept of corrosion and control measures.
4. The concept of polymers and polymerization.
5. The concept of green chemistry and applications of liquid crystals.

Course Outcomes:
After completion of the course the students will acquire the ability to:
1. Analyze the quality of water and its maintenance for industrial purposes.
2. Analyze issues related to fuels and their synthesis and able to understand working of IC and Diesel engines.
3. Realize the principles of corrosion and make use of the principles for maintenance of various equipments more effectively.
4. Get hands on experience in various processes like polymerization, preparation, properties and applications of plastics and rubbers.
5. Realize the use of liquid crystals in various technological applications.

UNIT - I
BOILER TROUBLES – scale & sludge formation, Caustic Embrittlement, boiler corrosion, priming & foaming (carryover).
INTERNAL TREATMENT - Colloidal Phosphate, Calgon, Carbonate, Sodium aluminate Conditioning of Water.
EXTERNAL TREATMENT - Lime-Soda Process, Zeolite process, Ion- Exchange Process merits and demerits. (Note- Problems on lime-soda process are not included)
DESALINATION OF BRACKISH WATER - Electrodialysis, reverse osmosis

UNIT - II
FUEL TECHNOLOGY: Definition and classification of Fuels, merits and demerits of solid liquid and gaseous fuels. Gross and net calorific values – (definition only).
SOLID FUELS - coal - analysis, Proximate and ultimate analyses of coal – significances.
LIQUID FUELS – petroleum-origin and refining of petroleum- cracking- fixed bed and moving bed methods, synthetic petrol – Bergius and Fischer Tropsch’s methods.
WORKING OF I.C AND C.I ENGINES – Knocking in I.C and C.I engines, antiknocking agents Octane number, Cetane number (Definitions only)
GASEOUS FUELS – Natural gas, CNG Advantages of CNG, Flue gas analysis – Orsat’s apparatus.

UNIT - III
CORROSION: Definition, Examples.
DRY CORROSION (Direct Chemical corrosion), Types of dry corrosion-oxidative corrosion, Pilling Bed worth rule, corrosion by other gases, liquid metal corrosion.
WET CORROSION (Electro Chemical corrosion) Mechanism- Oxygen absorption Hydrogen evolution type, Types of wet corrosion, Galvanic Corrosion, passivity, Galvanic Series Concentration Cell Corrosion, intergranular corrosion, stress corrosion, Soil corrosion.
FACTORS INFLUENCING CORROSION- Nature of metal and nature of environment.
CONTROL OF CORROSION - Proper Design, Use of pure metals and metal alloys, Cathodic Protection - Sacrificial anode and Impressed Current, Modifying the Environment and use of Inhibitors.

UNIT - IV
POLYMER SCIENCE AND TECHNOLOGY: Definition, classification of polymers, Functionality, Types of polymerization-addition, condensation, copolymerization
PLASTICS preparation, properties and engineering applications of PVC, Teflon, Bakelite, PMMA.
CONDUCTING POLYMERS: Polyacetylene, Polyaniline, conduction, doping, application.
RUBBERS Natural rubber and it’s processing, disadvantages of Natural rubber, Vulcanization and significance.
ELASTOMERS - preparation, properties and engineering applications of Buna S, Buna N, Thiokol.
FIBERS - preparation, properties and engineering applications of Polyester, fiber reinforced plastics (FRP).

UNIT – V
(a) GREEN CHEMISTRY - Goals and significance of green chemistry. Basic components (alternative starting materials, reagents, reaction conditions, final products) of green chemistry research.
(b) LIQUID CRYSTALS – Classification of liquid crystals (Thermotropic, lyotropic) and applications.

TEXT BOOKS

REFERENCES
Course Educational Objectives:
The Students will learn
1. The basic elements C programming structures like data types, expressions, control statements, various I/O functions and how to solve simple mathematical problems using control structures.
2. Modular programming using functions.
3. The derived data types like arrays, strings, various operations and Memory management using pointers.
4. User defined structures and various operations on it.
5. The basics of files and its i/o operations.

Course Outcomes:
After undergoing the training in this course the students will acquire the ability to:
- Identify basic elements of C programming structures like datatypes, expressions, control statements, various I/O functions and Evaluation of simple mathematical problems using control structures.
- Implementation of derived data types like arrays, strings and various operations.
- Understanding of memory management using pointers and designing of modular programming.
- Construct user defined structures and implements various applications.
- Create text & binary type files and understanding of various file I/O operations.

Pre Requisite: The students should have basic knowledge in Maths & computers

UNIT - I
Algorithm / pseudo code, flowchart, example flow charts, structure of C program, identifiers, basic data types and sizes, Constants, variables, Input-output statements, A sample c program, operators: arithmetic, relational and logical operators, increment and decrement operators, conditional operator, bit-wise operators, assignment operators, expressions, type conversions, conditional expressions, precedence of operators and order of evaluation. Conditional statements: if, ifelse, else if ladder and switch statements, continue, go to and labels. Loops: while, do-while and for statements, break, programming examples.

UNIT - II
ARRAYS- one dimensional arrays-concept, declaration, definition, accessing elements, storing elements, two dimensional and multi-dimensional arrays. CHARACTER STRINGS: declaration, initialization, reading, writing strings, arithmetic operations on characters, string handling functions programming examples

UNIT – III
POINTERs- concepts, declaring &initialization of pointer variables, pointer expressions, address arithmetic, pointers and arrays, pointers and character strings, pointers to pointers,Pre-processor Directives and macros. FUNCTIONS: basics, category of functions, parameter passing techniques, recursive functions, Functions with arrays, storage classes-extern, auto, and register, static, scope rules, Standard library functions., dynamic memory management functions, command line arguments, c program examples.

UNIT - IV
DERIVED TYPES- structures- declaration, definition and initialization of structures, accessing structures, nested structures, arrays of structures, structures and functions, pointers to structures, self-referential structures, unions, typedef, C program examples.
UNIT - V
FILES – concept of a file, text files and binary files, streams, standard I/O, Formatted I/O, file I/O operations, error handling, C program examples.

TEXT BOOKS
1. B.W. Kernighan, Dennis M. Ritchie; “The C Programming Language, PHI/Pearson Education.
2. N.B. Venkateswarlu and E.V. Prasad “C and Data Structures” PHI/Pearson Education.

REFERENCES
S235 - ENGINEERING GRAPHICS
(Common to AE, CE, ME)

Course Educational Objectives:
The main objectives of the course are
1. To understand the basics of engineering graphics and BIS conventions
2. To draw the various profiles/curves used in engineering practice
3. To understand the basics of orthographic projections in different axis.
4. To familiarize the basic concept of isometric views, lines and planes clearly.

Course Outcomes:
After completion of the course student will be able to:
1. Develop a simple engineering drawing in both First angle orthographic projections, BIS standards in engineering graphics.
2. Visualize the complex geometrical objects and the machine parts.
3. Visualize the solids clearly by sectioning
4. Conceptualize the ideas of isometric views and to make designs systematically.

UNIT - I
INTRODUCTION TO ENGINEERING DRAWING:
Curves:
a) Conic Sections- Ellipse, Parabola, Hyperbola and rectangular hyperbola- General method and other methods.
b) Cycloid, Epi-Cycloid and Hypo-Cycloid.
c) Involutes.

UNIT - II
ORTHOGRAPHIC PROJECTIONS:

UNIT – III
PROJECTIONS OF PLANES:
Planes parallel to one of the reference planes-Inclined to one reference plane and perpendicular to other-Oblique planes.

UNIT – IV
PROJECTIONS OF SOLIDS:
Projection of solids in simple position - Axis inclined to one of the reference planes and parallel to the other-Axis inclined to both H.P and V.P.

UNIT - V
ISOMETRIC PROJECTIONS:
Introduction-theory of isometric projection, isometric axes, scale, lines & planes-Isometric drawing of prisms, cylinders & cones-non isometric lines-conversion of isometric views to orthographic views and orthographic views to isometric views.

TEXT BOOK

REFERENCES
2. R.K.Dhawan, Engineering Drawing, S.Chand Company LTD.
3. Venugopal, Engineering Drawing and Graphics, New Age publishers
L144 - ENGLISH COMMUNICATION LAB
(Common to all branches)

Prerequisite: English-I

Course Educational Objectives
In this course, the students will learn to
1. Better pronunciation through emphasis on word accent.
2. Use language effectively to face interviews, group discussions and public Speaking
3. Possess Positive attitude and inculcate group behavior
4. Negotiate well with inter personal skills and intra personal skills
5. Speak spontaneously on any topic given

Course Outcomes
After the completion of this course, students will have the ability to
1. Withstand the global competition in the job market with proficiency in English communication.
2. Articulate English with good pronunciation.
3. Face competitive exams like GRE, TOEFL, IELTS etc.
4. Face interviews and skillfully manage themselves in group discussions
5. Communicate with the people effectively.

The following course content is prescribed for English Language Communication Skills Laboratory sessions:

1. Introduction to English Phonemes; Phonetic Transcription, Stress.
2. JAM
3. Role Play
4. Information Transfer
5. Group Discussions

SUGGESTED SOFTWARE

1. Digital Mentor: Globarena, Hyderabad, 2005
4. Dorling Kindersley Series of Grammar, Punctuation, Composition, USA, 2001
L126 - COMPUTER PROGRAMMING LAB
(Common to all branches)

Prerequisite Subject: COMPUTER PROGRAMMING

COURSE OBJECTIVES:

- To Learn the fundamentals of ANSI C programming and the standard C libraries
- To Get a solid understanding of C functions and data structures
- To Become familiar with the basic concepts of object-oriented programming
- To write programs using the C language.
- To Gain skills in C Programming Language.

COURSE OUTCOMES:

After completion of the course students..

- Can write programs in C language.
- Can use loops effectively in programming.
- Can use files concept in programming.
- Can gain skills in C programming

LIST OF LAB PROGRAMS:

I) Write a programme in ‘C’ language to cover the following problems.
   a) Example program which shows the usage of various preliminary Data types available in C Language.
   b) Example program which shows the usage of various Operators available in C Language.
   c) Example programs to illustrate the order of evaluation.
II) WRITE EXAMPLE PROGRAMS:

a) To check whether the given year is leap year (or) not

b) Roots of Quadratic Equation.

c) Finding smallest& biggest number from the given set of 4 numbers using ‘if’ statement.

d) Calculate the student grade in the examination – assume suitable constraints.

e) Prepare electricity bill for the consumed units – assume suitable Constraints.

f) Converting given two digit number into words using switch statement

g) To illustrate the usage of ‘goto’ statement.

III) EXAMPLE PROGRAMS:

a) To Display first N natural numbers

b) To find whether the given number is Armstrong (or) not

c) To find reverse of the given number and to check whether it is palindrome (or) not.

d) To find whether given number is strong number (or) not.

e) To check whether given number is Prime (or) not

f) To display prime numbers with in the given range(Nesting of Loops).

g) To display the following structure(Nesting of Loops)

i) 1

ii) 5 4 3 2

1 2

4 3 2 1

1 2 3 4

3 2 1

1 2 3 4 5

2 1

1

IV) Write example programs in C Language to perform following operations:

a) Finding the sum and average of given numbers using Arrays.

b) To display elements of array in reverse order

c) To search whether the given element is in the array (or) not using linear search & binary search.

d) Write a C program to perform the following operations

i) Addition, subtraction and multiplication of Matrices

ii) Transpose of given matrix

(The above operations are to be exercised using functions also by passing arguments)

e) Write a C program to find whether the given string is palindrome (or) not.

f) To accept line of text and find the number of characters, number of vowels and number of blank spaces in it.

g) Write an example program to illustrate the use of any 5 string handling functions.

V) a) Example program to bring clarity on pointer declaration & initialization and Pointer arithmetic.

b) Write an example program to describe the usage of call by reference.

c) Write a program to find sum of the elements of the array using
functions.

VI) Write example programs in C Language:
   a) To find factorial of a given number using functions.
   b) Swap two numbers using functions.
   c) To find GCD of two numbers using recursion
   d) Write a recursive function to solve Towers of Honai problem.
   e) Write an example program to illustrate use of external & static storage classes.

   f) Write an example program to illustrate the usage of command line arguments.
   g) Program to illustrate the usage of dynamic memory management functions.

VII) a) Write an example program using structures to process the student record. Assume suitable fields for student structures (Different kinds of initialization of structure variables are to be exercised).
   b) Write a program to read records of 10 employees and find their average salary (Exercise array of structures & Nested structures concepts through this program).
   c) Write a program to handle a structure variable using pointers and implement selfreferential structure (i.e. A structure variable having a pointer to itself)

VIII) Write an example program on file to perform following operations:
   a) Accessing content from files and writing content in to it.
   (Exercise different file operation modes)
   b) Copy the contents of one file into another (Exercise different file operation modes)
Prerequisite: None

Course Educational Objectives:
Through this course the student will learn
1. To analyze water for its quality and to determine the important parameters like alkalinity and hardness.
2. To distinguish types of titrations used in volumetric analysis.
3. To gain hands on experience in practical aspects of preparation of polymers.

Course Outcomes:
After undergoing the training in this course the students will acquire the ability to:
1. Assess quality of water based on the procedures given.
2. Distinguish different types of titrations in volumetric analysis after performing the experiments listed in the syllabus.
3. Acquire practical knowledge related to preparation of polymers.
4. Exhibit skills in performing experiments based on theoretical fundamentals.

MODEL EXPERIMENT
1. Estimation of sodium hydroxide by using hydrochloric acid.

WATER ANALYSIS
2. Determination of alkalinity of water sample
3. Determination of total Hardness of water by EDTA method
4. Determination of permanent hardness of water by EDTA method.
5. Determination of Dissolved Oxygen (D.O) content by Winkler’s method

PREPARATION OF POLYMERS
6. Preparation of Urea formaldehyde resin.
7. Preparation of Phenol formaldehyde resin.

REDOX TITRATIONS
8. Determination of amount of potassium dichromate in given solution by using sodium thiosulphate.
9. Determination of the amount of Oxalic acid and Sulphuric acid in 1 liter solution by Using given standard Sodium Hydroxide and Potassium Permanganate solution.
10. Estimation of Mohr’s salt by using potassium permanganate.
11. Estimation of Mohr’s salt by using potassium dichromate.
12. Estimation of Mohr’s salt by using Oxalic acid.

ESTIMATION OF VITAMIN CONTENT
13. Estimation of Vitamin-C

REFERENCES
Lab manual
L114 - BASIC SIMULATION LAB
(Common to AE, EEE, ME)

Any 10 experiments are to be conducted

Course Educational Objectives:

This lab gives the students

1. Overview to Lab VIEW and NI Software
2. A good background in what the Lab VIEW interface looks like.
3. Shows how to navigate the graphical programming language environment.
4. Introduces some of its analysis capabilities

Outcomes

After completion of the course student will be able to:

1. Understand the different parts of a Lab VIEW program
2. Learn simple debugging techniques
3. Learn how to make decisions in Lab VIEW
4. Learn how to create an executable file with Lab VIEW

LIST OF LAB PROGRAMS:

1. Perform basic arithmetic operations using Labview.
2. Debugging a VI.
3. Converting a VI into a Sub VI
4. Creating an executable file from VI.
5. Performing Boolean operations using Labview.
6. Finding the sum of ‘n’ numbers using FOR loop.
7. Performing the factorial of a given number using FOR loop.
8. Finding the sum of n natural numbers using while loop.
9. Performing the factorial of a given number using WHILE loop.
10. Sorting even numbers using WHILE loop in an array.
11. Searching and replacing a string.
12. Finding the maximum and minimum variable from an array.

REFERENCES:

Lab Manual
Prerequisite: ENGLISH-I

Course Educational Objectives
In this course, the students will learn
1. English with emphasis on LSRW skills.
2. To make decisions, while thinking logically analyzing situations carefully.
3. To read speedily and meaningfully.
4. Both active and passive vocabulary.
5. To write letters and reports effectively in formal and professional situations.

Course Outcomes
After the completion of this course, prospective engineers will have the ability to
1. Use English language effectively.
2. Express right ideas in right context
3. Manage the situation and negotiate business with good English communication
4. Think and analyze the situations and make good presentations of their work and decisions
5. prepare themselves to face interviews and also to participate in group discussions

UNIT - I
ENVIRONMENT (Learning English)
The World of Figures and Physics – Satyendranath Bose (Master Minds)
Grammar: Correction of sentences
Analytical Writing: Report Writing

UNIT - II
INSPIRATION (Learning English)
The Institution Builders – SantiSwarupBhatnagar (Masterminds)
Grammar: If-clause; Question tags
Vocabulary: Idioms and Phrases
Analytical Writing: Resume’; Statement of Purpose

UNIT - III
HUMAN INTEREST (Learning English)
The institution builders – MeghanadhSaha (Master Minds)
Grammar: Direct & Indirect Speeches
Vocabulary: Phrasal Verbs
Analytical Writing: Memo Drafting

UNIT – IV
MEDIA (Learning English)
The New Age – HomiJehangirBhabha (Master Minds)
Grammar: Concord
Vocabulary: Analogy
Analytical Writing: Information Transfer/ Data Interpretation (Tables, Pie charts, Bar graphs, Tree diagrams, Pictograms, etc.)

UNIT – V
The New Age – Vikram Sarabhai (Master Minds)
Grammar: Gerunds & Infinitives; Correction of Sentences
Vocabulary: Words often confused
Analytical writing – Comprehension, Expansions (of a given topic/ proverbs)
TEXT BOOKS

REFERENCES
Prerequisite: None

Course Educational Objectives:
In this course student will learn about
1. The basic concepts of Laplace Transforms and their applications in solving the Differential Equations.
2. The expansion of function in an infinite series of sine and cosines.
3. Fourier Integral Theorem, Fourier Integral Transforms along with their properties and applications.
5. The concepts of multiple integrals and changing of order of integration

Course outcomes:
At the end of this course student will be able to
1. Understand the importance of mathematics and its techniques to solve real life problems.
2. Apply the concepts of Laplace Transforms on Operational Calculus and solve Differential Equations of any order.
3. Express most of the single valued functions in the form of Fourier series and extend the ideas and techniques to non-periodic functions also.
4. Express a function as a continuous frequency resolution using Fourier Transforms.
5. Understand the analogy between Laplace Transform and Z-Transform and apply it wherever necessary & apply Multiple Integrals in various coordinate systems.

UNIT – I
 LAPLACE TRANSFORMS

UNIT – II
FOURIER SERIES
Determination of Fourier coefficients – Fourier series – even and odd functions – Fourier series in an arbitrary interval – Half-range sine and cosine series

UNIT – III
FOURIER TRANSFORMS

UNIT – IV
Z-TRANSFORMS
Z-transform – properties – Damping rule – Shifting rule – Initial and final value theorems - Inverse Z-transform - Convolution theorem – Solution of difference equation by z-transforms.

UNIT – V
MULTIPLE INTEGRALS
Multiple integrals - double and triple integrals (Cartesian, polar, spherical coordinates) – Changing of order of Integration and applications to areas and volumes.

TEXT BOOKS

REFERENCES
Pre-requisite course: NONE

Course Educational Objectives:
In this course student will learn about

- The basic concepts of Optics such as Interference, Diffraction and Polarization.
- The principle of quantum mechanics, dual nature of matter waves.
- The principle and working of different Lasers.
- The principle and classification of optical fibers
- Classification of magnetic materials and their properties.
- Concept of Superconductivity, types and their applications

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

CO1: Understand the nature of polarization, Diffraction and interference.
CO2: Understand the dual nature of particle and significance of the wave function.
CO3: Understand the principle of LASER and optical fibers. Types of lasers and optical fibers and their applications.
CO4: Understand the different types of magnetic materials and their uses.
CO5: Understand the phenomenon of superconductivity, critical parameters, types of superconductors and their applications

UNIT – I
INTERFERENCE, DIFFRACTION, POLARIZATION

INTERFERENCE: Introduction, super position principle, coherent sources, thin films, Newton’s rings (in reflected system only).

DIFFRACTION:
Introduction, Fresnel and Fraunhofer diffractions – comparsion between Fresnel’s and fraunhofer’s diffraction - Difference between interference and diffraction-Fraunhofer diffraction at single slit - Fraunhofer diffraction at Double slit - Diffraction Grating- Grating spectrum.

POLARIZATION:
Introduction-plane of vibration and plane of polarization - Polarization by reflection Brewster’s law – geometry of calcite crystal- Double refraction - nicol prism construction, Quarter wave plate- Half wave plate.

UNIT - II
PRINCIPLES OF QUANTUM MECHANICS:

UNIT – III
LASERS AND FIBER OPTICS

LASERS:

FIBER OPTICS
UNIT – IV
MAGNETIC MATERIALS:

UNIT – V
SUPER CONDUCTORS
Phenomenon, critical parameters, Meissner effect, Type-I, Type-II Super conductors, BCS theory of super conductivity, FluxQuantization, LondonEqs., Penetration depth, Josephson Effects- Applications of Super conductors.

TEXT BOOKS
2. Engineering Physics by P K PalaniSamy, Scitech Publications

REFERENCES
Prerequisite Subject: No prerequisite subject is required

Course Objectives:

The main objectives of this course are

1. To learn various manufacturing processes.
2. To understand basic concepts of centroid, center of gravity and moment of inertia.
3. To understand the basic concepts and laws of thermodynamics.
4. To learn types of fuels and lubricants.
5. To understand the working of IC engines, steam turbines and gas turbines.

Course Outcomes:

After completion of the course student will be able to:

1. Apply the knowledge of metal joining processes and to make simple product.
2. Locate centroid, center of gravity and moment of inertia of plane figures and bodies.
3. Analyze the concepts of Energy transformation, energy degradation.
4. Analyze the various fuels for combustion.
5. Analyze the concepts of IC engines, steam power plant and gas power plant.

UNIT-I
MANUFACTURING PROCESS: Introduction to manufacturing – Types of Manufacturing Processes
CASTING – Introduction, Green Sand Moulding, Patterns – Types of patterns
WELDING – Introduction, Types of welding processes – Principle of Arc Welding and Resistance Welding

UNIT-II
CENTROID AND CENTRE OF GRAVITY: Concept of Centroid and Centre of gravity, Centroid of simple figures from basic principles, Centre of gravity of simple bodies.
AREA MOMENT OF INERTIA: Theorems of Moment of Inertia – Determination of Moment of Inertia of Circle, Rectangle, Hollow Circle, Semi Circle, Triangle from basic principles.
MASS MOMENT OF INERTIA: Radius of gyration - Determination of Mass Moment of Inertia of Uniform Rod, Rectangular Plate, Circular Plate, Solid Cone, Solid Sphere, Solid Cylinder.

UNIT-III
SOURCES OF ENERGY: Introduction, classification of renewable and non-renewable energy sources - Simple solar energy power plant working principle - Simple wind energy power plant working principle.

UNIT-IV
FUELS: Definition, classification of fuels, merits and demerits of solid, liquid and gaseous fuels, gross and net calorific values - (Definitions only)
LUBRICANTS: Definition of lubricants, function of lubricants, types of lubricants, properties of lubricants – viscosity, flash and fire point, cloud and pour point, aniline point of neutralization number, selection of lubricants.
UNIT - V
HEAT ENGINES: Introduction to heat engines –Types of Heat Engines
STEAM TURBINES: Introduction, Classification of impulse and reaction turbines, comparison of impulse and reaction turbines and applications.
GAS TURBINES: Introduction, classification, constant pressure open cycle, constant pressure closed cycle gas turbines, difference between open and closed cycle gas turbines and applications (Theory questions only).

TEXT BOOKS

REFERENCES
S237 - ENGINEERING MECHANICS

Course Educational Objectives: The main objectives are to enable the students
1. To draw the free-body diagrams and to find the resultants & moments of system of forces and calculate reactions/contact forces to ensure equilibrium of bodies in contact.
2. To understand the mechanics problems associated with friction forces
3. To understand the motion of particles in terms of its position, velocity and acceleration & form the corresponding relations
4. To understand the concept of the projectile motion and motion of connected bodies
5. To understand the effect of gravitational and inertia forces on the moving bodies

Course Outcomes:
After completion of the course student will be able to:
1. Apply the principles of free body diagrams & equilibrium conditions in industries while designing any component
2. Solve the static equilibrium of rigid bodies
3. Estimate the trajectory and range of missiles in defense
4. Estimate the displacement, velocity and accelerations of moving bodies.
5. Analyze the work energy method and apply these methods to practical problems

UNIT – I
INTRODUCTION TO ENGINEERING MECHANICS – Basic Concepts of mechanics
EQUILIBRIUM OF SYSTEM OF FORCES: Equilibrium of a Body Subjected to Concurrent Forces - Free Body Diagrams - Lami’s Theorem - Equilibrium of Connected Bodies

UNIT - II

UNIT - III
KINEMATICS: Rectilinear Motion – Motion Curves – Motion with Uniform Velocity – Motion with Uniform Acceleration
PROJECTILES: Definitions – Motion of a Body Projected Horizontally – Inclined projection on Level Ground – Inclined Projection with Point of Projection and Point of Strike at Different Levels

UNIT – IV
KINETICS: Bodies in Rectilinear Translation - Bodies in Curvilinear Translation - Kinetics of Bodies Rotating about Fixed Axis- Kinetics of Rolling Bodies.

UNIT – V
WORK ENERGY METHOD: Equation for Translation – Motion of Connected Bodies – Kinetic Energy of Bodies in Fixed Axis Rotation

TEXT BOOKS

REFERENCES
L142 - ENGINEERING PHYSICS LAB
(Common to all branches)

Pre-requisite course: NONE

Course Educational Objectives:
In this course student will learn about
- The scientific method of experiments in the laboratory.
- The procedures and observational skills for appropriate use of simple and complex apparatus.
- Analytical techniques, statistical analysis and graphical analysis.
- The theoretical ideas and concepts covered in lecture by completing a host of experiments.
- The radius of curvature of a Plano-convex lens by forming Newton’s rings.

Course Outcomes:
At the end of this course, student will be able to
CO1: Understand to calculate the radius of curvature of a plano-convex lens by forming Newton’s Rings.
CO2: Understand the concept of diffraction and also find wavelengths of different spectral lines of the grating.
CO3: Estimate the wavelength of layer radiation.
CO4: Study the magnetic field along the axis of a current carrying coil and to verify Biot–savart’s law.
CO5: Estimate the Refractions index of the given prism
CO6: Find the thickness of a thin material using a wedge shaped film.
CO7: Estimate the width of the slit by forming diffraction pattern.
CO8: Understand the phenomenon of optical – activity
CO9: Study the characteristics of LCR circuit
CO10: Understand the Phenomenon of resonance
CO11: Determine the rigidity modules of given material
CO12: Understand the longitudinal and transverse vibrations of tuning fork.

LIST OF EXPERIMENTS: (Any 8 Experiments)
1. Determine the Radius of Curvature of Plano - Convex lens by forming Newton's Rings.
2. Determine the Wavelengths of various spectral lines using grating with the normal incidence method.
4. Study the magnetic field along the axis of a current carrying coil and to verify Biot–Savart’s law.
5. Determine the Refractive index of a given prism.
6. Determine the thickness of a thin material using wedge shaped film.
7. Determine the width of the slit by using laser source by forming diffraction pattern.
8. Determine the specific rotation of an optically active substance.
9. Study the characteristics of L.C.R Circuit.
10. Determine the frequency of AC supply by using Sonometer.
11. Determine the rigidity modulus of a given material using Torsional pendulum.
12. Determine the frequency of a vibrating bar or electrical tuning fork using Meldy's apparatus.

Reference Books:
Lab Manual prepared by the LBRCE.
Course Educational Objectives:
The main objectives of this course are
1. To learn the basic commands necessary for professional 2D drawings, design, and drafting using AutoCAD essentials.
2. To develop orthographic projections and isometric drawings using AutoCAD.
3. To draw the solids by developing the surfaces without any complexity.

Course Outcomes:
After completion of the course students are the able to:
1. Understand the Auto-CAD basics and apply to solve practical problems used in industries where the speed and accuracy can be achieved.
2. Apply this idea and make design and modifications as required.
3. Draw 2-dimensional drawings of conventional engineering objects using Auto-CAD

At least 10 Exercises are to be conducted using Auto Cad software:

BASIC AUTO CAD COMMANDS:
1. Basic drawing commands (line, circle, arc, ellipse, polygon, and rectangle).
2. Edit commands (copy, move, erase, zoom).
3. Array commands (polar array, rectangular array, P-edit, divide aline, offset).
4. Hatching &line commands (hatching with different angles& different types of lines).
5. Mirror & trim commands (mirror an object, trim, extend a line, chamfer &fillet, explode).
6. Dimensioning & text commands (linear, angular, radius, diameter& text).

PROJECTION OF POINTS AND LINES:
2. Projection of lines parallel to both reference planes.
3. Projection of lines parallel to one reference plane & inclined to other reference plane.

PROJECTION OF PLANES AND SOLIDS:
1. Projection of planes parallel to one reference plane & perpendicular to other reference plane.
2. Projection of planes inclined to one reference plane& perpendicular to other reference plane.
4. Projection of solids with axes inclined to one reference plane & parallel to other.

ORTHOGRAPHIC PROJECTIONS:
5. Conversion of plane figures.
7. Conversion of both combination of plane figures and circular figures.

ISOMETRIC PROJECTIONS:
8. Conversion of plane figures.
10. Conversion of both combination of plane figures and circular figures.

REFERENCES:
## CYCLE: 1

<table>
<thead>
<tr>
<th>SNO</th>
<th>SHEETS</th>
<th>EXERCISE</th>
<th>COMMANDS TO BE COVERED</th>
<th>REFERENCES</th>
<th>PAGE NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SHEET-1</td>
<td>Basic drawing commands</td>
<td>line, circle, arc, ellipse, polygon, and rectangle</td>
<td>PLATE 2.1 &amp; 2.2</td>
<td>26</td>
</tr>
<tr>
<td>2</td>
<td>SHEET-2</td>
<td>Edit commands</td>
<td>copy, move, erase, zoom, measure, divide, pan, change properties</td>
<td>PLATE 2.3 &amp; 2.4</td>
<td>27</td>
</tr>
<tr>
<td>3</td>
<td>SHEET-3</td>
<td>Array commands</td>
<td>polar array, rectangular array, P-edit, divide aline, offset</td>
<td>PLATE 2.5 &amp; 2.6</td>
<td>28 &amp; 29</td>
</tr>
<tr>
<td>4</td>
<td>SHEET-4</td>
<td>Hatching &amp; line commands</td>
<td>hatching with different angles &amp; different types of lines</td>
<td>PLATE 2.8 &amp; 2.9</td>
<td>31 &amp; 32</td>
</tr>
<tr>
<td>5</td>
<td>SHEET-5</td>
<td>Mirror &amp; trim commands</td>
<td>mirror an object, trim, extend a line, chamfer &amp; fillet, explode</td>
<td>PLATE 2.7 &amp; 2.13</td>
<td>30 &amp; 35</td>
</tr>
<tr>
<td>6</td>
<td>SHEET-6</td>
<td>Dimensioning &amp; text commands</td>
<td>linear, angular, radius, diameter &amp; text</td>
<td>PLATE 4.1</td>
<td>69</td>
</tr>
<tr>
<td>7</td>
<td>SHEET-7</td>
<td>Projection of points</td>
<td>Points &amp; lines</td>
<td>Case-1, 2, 3, 4</td>
<td>171</td>
</tr>
<tr>
<td>8</td>
<td>SHEET-8</td>
<td>Projection of lines (parallel to both reference planes)</td>
<td>Line</td>
<td>Fig: 9.4 (a &amp; b)</td>
<td>172 &amp; 173</td>
</tr>
<tr>
<td>9</td>
<td>SHEET-9</td>
<td>Projection of lines (parallel to one reference plane &amp; inclined to other reference plane)</td>
<td>Lines</td>
<td>Fig: 9.4 (c)</td>
<td>173</td>
</tr>
<tr>
<td>10</td>
<td>SHEET-10</td>
<td>Projection of planes (inclined to one plane)</td>
<td>Polygons</td>
<td>EX: 10.2 &amp; 10.3</td>
<td>198 &amp; 199</td>
</tr>
</tbody>
</table>

## CYCLE: 2

<table>
<thead>
<tr>
<th>SNO</th>
<th>SHEETS</th>
<th>EXERCISE</th>
<th>REFERENCE</th>
<th>PAGE NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Orthographic projections</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>SHEET-12</td>
<td>Conversion of plane figures</td>
<td>PLATE 5.1 &amp; 5.3</td>
<td>82 &amp; 83</td>
</tr>
<tr>
<td>13</td>
<td>SHEET-13</td>
<td>Conversion of circular figures</td>
<td>PLATE 5.9 &amp; 5.13</td>
<td>86 &amp; 88</td>
</tr>
<tr>
<td>14</td>
<td>SHEET-14</td>
<td>Conversion of both combination of plane figures and circular figures</td>
<td>PLATE 5.25 &amp; 5.26</td>
<td>94 &amp; 95</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Isometric projections</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>SHEET-15</td>
<td>Conversion of plane figures</td>
<td>PLATE 6.3</td>
<td>122</td>
</tr>
<tr>
<td>16</td>
<td>SHEET-16</td>
<td>Conversion of circular figures</td>
<td>PLATE 6.4</td>
<td>123</td>
</tr>
<tr>
<td>17</td>
<td>SHEET-17</td>
<td>Conversion of both combination of plane figures and circular figures</td>
<td>PLATE 6.8 &amp; 6.10</td>
<td>125 &amp; 126</td>
</tr>
</tbody>
</table>

Note: References and Page numbers have been given from below text books

Course Educational Objectives:
The objectives of the course are:

1. To get familiarize with various trades used in Engineering workshop.
2. The understand the concept of various tools used in different trades.
3. To learn the safety pre-cautions to be followed in the workshops, while working with the different tools.

Course outcomes:

After completion of the course students are able to:

1. Acquire manufacturing skills.

Use the tools effectively in making a product.
At least four trades with two exercises from each trade:

1. Carpentry
2. Fitting
3. House – Wiring
4. Plumbing
5. Tin - Smithy
6. Black - Smithy

REFERENCE

L113 - BASIC MECHANICAL ENGINEERING LAB

Course objectives:
The main objectives of this course are

1. To learn different types of Viscometers.
2. To learn the concept of Radius of Gyration
3. To understand valve timing and port timing diagrams in I.C engines.
4. To learn different welding techniques.
5. To study different types of machine tools.

Course outcomes:
After completion of course students are able to:

1. Find the Viscosity of different oils using Viscometers.
2. Find the Radius of Gyration using compound pendulum and Bifilar suspension.
3. Analyze valve and port timing diagrams in I.C engines.
4. Prepare the Butt joint by Arc welding.
5. Develop the skills to work on different machine tools.

List of Experiments

At least 10 experiments are to be conducted:

1. Verification of theoretical and experimental periodic times using simple pendulum
4. Determination of viscosity of given oil using Redwood viscometer
5. Determination of viscosity of given oil using Engler’s Viscometer.
6. Valve timing diagram for single cylinder, four stroke water cooled Diesel engine.
7. Port timing diagram for single cylinder, two stroke air cooled Diesel engine.
8. Determination of Flash and Fire points of a given oil using ABEL’S apparatus.
12. Demonstration on machine tools.

REFERENCES:

Lab. Manual
S134 - APPLIED MATHEMATICS – III
(Common to AE, CE, CSE, EEE, EIE, IT, ME)

Prerequisite: Applied Mathematics-II, Applied Mathematics-II

Course Educational Objectives:
In this course student will learn about
1. The methodology of interpolation and extrapolation to common problems using different formulae.
2. The application of Numerical Techniques in Integration; solving the algebraic and transcendental equations.
4. The concepts of Vector Calculus Vector Differentiation and Conservative Fields.
5. The concepts of line integrals, surface and volume integrals, vector integral theorems and their applications.

Course outcomes:
At the end of this course student will be able to
1. Apply the knowledge acquired to identify, formulate and solve problems in engineering using Numerical Techniques.
2. Apply the techniques of numerical interpolation and approximation of functions with ease.
3. Perform integration of functions when the actual function is not given and solve algebraic and transcendental equations.
4. Solve Ordinary Differential Equations with given initial conditions.
5. Apply Integration to find length, area and volume of any given surface.

UNIT – I
SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS AND NUMERICAL INTEGRATION

UNIT – II
INTERPOLATION AND FINITE DIFFERENCES

UNIT – III
NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS

UNIT – IV
VECTOR DIFFERENTIATION
UNIT – V
VECTOR INTEGRATION
Vector Integration - Line integral – work done –area - surface and volume integrals Vector integral theorems: Greens, Stokes and Gauss Divergence Theorems (Without proof) and related problems.

TEXT BOOKS

REFERENCES
Prerequisite Subject: Basic Mechanical Engineering

Course Educational Objectives:
To understand the basic concepts of energy conversions and fundamentals of thermodynamics and its application.

1. To acquire the knowledge of first law of thermodynamics and its analysis.
2. To learn the second law of thermodynamics and significance of entropy principles.
3. To learn the concepts of reactant, non-reactant gas mixtures and pure substance.
4. To understand the significance of various thermal cycles.

Course Outcomes:

After completion of the course students are able to:

1. Analyze the concepts of heat, work, and energy and temperature measurement.
2. Apply the first law of thermodynamics to various thermal systems for analysis.
3. Analyze the irreversibilities of various systems using second law of thermodynamics.
4. Demonstrate and analyze the different gas mixtures and pure substances.
5. Apply ideal cycle analysis to simple heat engines to estimate various performance parameters.

UNIT - I

UNIT - II

UNIT - III
UNIT - IV

PROPERTIES OF PURE SUBSTANCE: Introduction, Phases of Pure Substance, Properties of steam, dryness fraction, Phase Change Processes, Property Diagrams of (P-v, P-T, T-s.) Pure Substance, P-v-T Surface, , h-s Diagram or Mollier Diagram for a Pure Substance.

UNIT - V
GAS POWER CYCLES: Introduction, Analysis of Power Cycles- Carnot, Otto, Diesel, Dual, and Brayton Cycles
REFRIGERATION CYCLES: Reversed Carnot Cycle, Bell-Coleman Cycle, Simple Vapour Compression Cycle.

TEXT BOOKS

REFERENCES
Prerequisite Subject: Basic Mechanical Engineering

Course Educational Objectives:

The objectives of this course are:
1. To acquire knowledge on structure of metals and alloys.
2. To understand the concept of equilibrium diagrams.
3. To learn the basic concepts of ferrous materials.
4. To understand the concepts of mechanical working process and heat treatment.
5. To acquire the basic concepts on non-ferrous and composite materials.

Course Outcomes:

After completion of the course students will be able to:
1. Estimate the properties of the material based on crystal structures.
2. Develop the equilibrium diagram for any binary system.
3. Determine the properties of steels based on Fe-Fe₃C equilibrium diagram.
4. Apply the principle of heat treatment to get desired properties in materials.
5. Distinguish between non-ferrous metals and composite materials.

UNIT – I


UNIT - II


UNIT - III


STEEL: Classification of steels, structure, properties and applications of plain carbon steels-low carbon steel, medium carbon steel and high carbon steel.

CAST IRONS: structure, properties and applications of white cast iron, malleable cast iron, grey cast iron, spheroidal graphite cast iron.

UNIT - IV

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

HEAT TREATMENT OF ALLOYS: Annealing, normalizing and hardening. Construction of TTT diagram for eutectoid steel. Harden ability-determination of harden ability by jominy end quench test. Surface - hardening methods and age hardening treatment and application.
UNIT - V
NON-FERROUS METALS AND ALLOYS: structure, properties and applications of copper and its alloys, Aluminium and its alloys.
COMPOSITE MATERIALS: Classification of composites, various methods of component manufacture of fiber reinforced composites-Hand layup process, Filament winding process, SMC processes, Continuous pultrusion processes, Resin transfer moulding.
Introduction to metal ceramic mixtures, Metal – Matrix composites and C – C composites and applications

TEXT BOOK

REFERENCES
2. William and callister, Materials Science and engineering, Wiley India private Ltd., 2011.
S305 - MECHANICS OF MATERIALS

Prerequisite Subject: Basic Mechanical Engineering

Course Educational Objectives: The objectives of this course are
1. To understand basic concepts of stress, strain and relations based on linear elasticity.
2. To demonstrate the shear bending diagrams on beams & know the location & magnitude of the bending moment.
3. To understand theory of simple bending.
4. To understand the graphical and analytical methods to compute principal stresses and strains.
5. To familiarize the concepts of cylinders & shells subjected to internal & external pressures.

Course Outcomes:
After completion of the course students will be able to
1. Compute the stresses and deformations of a member due to an axial loading under uniform and non-uniform conditions.
2. Find the maximum bending stress in the beams from SFD and BMD diagrams.
3. Analyze and design the structural members subjected to tension, compression, bending & torsion.
4. Solve problems related to pure bending of beams and other simple structures.
5. Calculate combined stresses and strains at a point across any plane in a two dimensional system and principal stresses.
6. Apply the torsion equation to compute torsional stresses in solid and hollow shafts.

UNIT - I
SIMPLE STRESSES AND STRAINS: Stresses and strain due to axial force. Hooke’s law, Factor of safety, Stepped bars – Uniformly varying sections - Stresses in composite bars due to axial force and temperature - Strain energy due to axial force, Stresses due to sudden loads and impact - Lateral strain - Poisson’s ratio - Change in volume – Shear stress - Shear strain - Relationship between elastic constants

UNIT - II
SHEAR FORCE AND BENDING MOMENT: Relationship between loading, Shear force and Bending moment - Shear force and Bending moment diagrams for Cantilever, Simply supported and Overhanging beams subjected to Concentrated loads and Uniformly distributed loads only - Maximum bending moment and Point of contra flexure.

UNIT – III
STRESSES IN BEAMS: Theory of simple bending - Assumptions - Derivation of flexure equation – Section modulus - Normal stresses due to flexure application.
TORSION: Theory of Torsion - Assumptions - Derivation of torsion equation - Polar modulus, Power transmitted by a shaft, Stresses in solid and hollow circular shafts

UNIT - IV
ANALYSIS OF STRESSES IN TWO DIMENSIONS: State of stress at a point, Normal and Tangential stresses on inclined planes - Principal stresses and their planes - Plane of maximum shear - Mohr’s circle of stresses.
SHEAR STRESSES: Derivation of formula – Shear stress distribution across various beam cross sections like Rectangular, Circular, Triangular, I and T Sections.
UNIT - V
DEFLECTION OF BEAMS: Differential equation of elastic line - Deflection in statically determinate beams - Macaulay’s method for prismatic members
THIN, THICK AND SPHERICAL SHELLS: Hoop and longitudinal stress- Thin and Thick cylinders- Spherical shells-Changes in dimensions and volume.

TEXT BOOK

REFERENCES
S208 - ELECTRICAL AND ELECTRONICS ENGINEERING  
(Common to CE, ME)

Prerequisite: There are no prerequisites for this course.

Course Educational Objectives:
The aim of this course is to study the working principles of electrical circuits, provide knowledge and skills needed to calculate efficiency of different machines, basic working principles of different electronic circuits and also prepare the students to understand the working principles of different electrical and electronic measuring instruments.

Course outcomes:
After completion of the course students will be able to:
1. Identify a suitable machine for particular application.
2. Analyze different types of resistive networks.
3. Use the techniques to measure efficiency and regulation of AC Machines.
4. Understand the working of electrical and electronics measuring instruments.
5. Demonstrate the characteristics of different electronic devices.

UNIT – I
ELECTRICAL CIRCUITS
Basic definitions, Types of elements-active and passive, Ohm’s Law, Kirchhoff’s Laws- Network reduction techniques-series, parallel, star to delta ,delta to star transformations, source transformations(for resistive networks).

UNIT – II
TRANSFORMERS

UNIT – III
A.C MACHINES
ALTERNATORS: Fundamentals of Alternating Current-Principle of operation of alternators –Salient pole and Non-Salient pole rotors, Voltage Regulation by synchronous impedance method only.

UNIT – IV
DIODE AND TRANSISTORS
P-n junction diode, symbol, V-I Characteristics, Diode Applications, Rectifiers – Half wave, Full wave and Bridge rectifiers ,PNP and NPN Junction transistor & configurations, Application of transistor – amplifier.

UNIT – V
ELECTRICAL AND ELECTRONICS MEASURING INSTRUMENTS.
Basic Principles of indicating instruments – permanent magnet moving coil and moving iron instruments.Block diagram of CRO andCRT (Cathode Ray Tube), Applications of CRO - Voltage, Current and frequency measurements.

TEXT BOOKS

REFERENCES
S293 - MACHINE DRAWING

Course Educational Objectives: Engineering Graphics
The main objectives of the course are
1. To learn basic conventions adopted in machine drawing.
2. To familiarize the machine elements such as screw fasteners, couplings & bearings used in design.
3. To learn the mechanical components like cotter and knuckle joints used in design.
4. To understand the assembly drawings for engine parts, machine parts, valves etc.

Course Outcomes:
After completion of the course students are able to:
1. Develop and/or comprehend basic conventions needed for machine drawing
2. Apply the conventions of machine elements while designing standardized parts
3. Apply the ideas and make design calculations correctly.
4. Design the drawings of mechanical components and their assemblies along with their utility for design of components.
5. Develop the new product drawings for the industry needs.

I. MACHINE DRAWING CONVENTIONS
Need for drawing conventions – introduction to IS conventions
a) Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs and ribs.
b) Types of sections – selection of section planes and drawing of sections and auxiliary sectional views, Parts not usually sectioned.
c) Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and tapered features.
d) Title boxes, their size, location and details - common abbreviations & their liberal usage
e) Types of Drawings – working drawings for machine parts.

II. DRAWING OF MACHINE ELEMENTS AND SIMPLE PARTS
1. Sections of Solids : Introduction, Sections prisms, Pyramids, Cylinders and cones
2. Selection of views, additional views for the following machine elements and parts with every drawing proportion.
a) Popular forms of screw threads, bolts, nuts, stud bolts, tap bolts and set screws.
b) Keys, cottered joints and knuckle joint.
c) Riveted joints for plates
d) Shaft coupling, spigot and socket pipe joint.
e) Journal, pivot and collar and foot step bearings.

III. ASSEMBLY DRAWINGS
Drawings of assembled views for the part drawings of the following using conventions and easy drawing proportions.
a) Engine parts – Stuffing box, Cross head, Eccentric, Connecting rod, Piston assembly.
b) Other machine parts - Screws jack, Bench Vice, Pipe vice, Plummer block, Tailstock.

TEXT BOOKS

REFERENCES
Course Educational Objectives:

In this course the student will learn about
1. Environmental issues related to local, regional and global levels.
2. Concepts of ecosystems and threats to global biodiversity.
3. Environmental pollution problems.
4. Environmental issues in the society.
5. Problems associated with over population and burden on environment.

Course Outcomes:
After the completion of this course, the students will able to
1. Evaluate local, regional and global environmental issues related to resources and management.
2. Understand the implications of the ecosystems and identify the threats to global biodiversity
3. Address and prevent the problems related to pollution of air, water and soil.
4. Investigate and solve social issues of the environment.
5. Create awareness on the concept of sustainable population growth.

UNIT – I
NATURAL RESOURCES: Definition, Scope and importance of Environmental Studies – Need for Public Awareness. Renewable and non-renewable resources – Natural resources and associated problems – Forest resources, Water resources, Mineral resources, Food resources and Energy resources.

UNIT - II
Biodiversity and its conservation: Introduction – Definition & Levels of Measuring Biodiversity: Genetic, Species, Community and Ecosystem diversity.
Bio-geographical classification of India, India as a mega diversity nation, Values of Biodiversity: Direct and Indirect Values, Hot-spots of biodiversity, Threats to biodiversity, Man-wildlife conflicts, Endangered and endemic species of India. Conservation of biodiversity.

UNIT - III
ENVIRONMENTAL POLLUTION: Definition, Sources, Effects and Control measures of
a) Air pollution
b) Water pollution
c) Soil pollution
d) Noise pollution
e) Radioactive Pollution
SOLID WASTE MANAGEMENT: Sources of waste, Effects of improper handling of waste and measures to reduce the waste production and management methods of Municipal solid waste.
DISASTER MANAGEMENT: Floods, Earthquakes, Cyclones, Landslides and Tsunami.
UNIT - IV
SOCIAL ISSUES AND THE ENVIRONMENT: From Unsustainable to Sustainable development & Equitable use of resources for sustainable life style - Environment and human health - Resettlement and Rehabilitation of people, its problems and concern & Case Studies - Climate change: Global warming, Acid rains, Ozone layer depletion, Nuclear accidents and Holocaust & Case studies - Consumerism and waste products.

UNIT - V

TEXT BOOKS


REFERENCES
L159 - MATERIAL TESTING AND METALLURGY LAB

Prerequisite Subject: Metallurgy and Material Science

Course Educational Objectives:
The main objectives of the course are
1. To determine the various mechanical properties of materials under different loading conditions.
2. To predict the behavior & properties of various materials by observing the microstructure

Course Outcomes:

After completion of the course students are able to:
1. Analyze and design machine/structural members subjected to tension, compression, torsion by computing the allowable stresses
2. To select material for a practical application.
3. Estimate the properties from the microstructure of materials.

PART-A : MATERIAL TESTING
Any six experiments may be conducted

List of Experiments:
1. Compression test on helical spring.
2. Tension test on mild steel rod.
3. Double shear test on metals.
4. Torsion test on mild steel rod.
5. Impact test on metal specimen.
   (a) Izod Impact Test
   (b) Charpy Impact Test
6. Hardness test on metals.
   (a) Rockwell Hardness Test
   (b) Brinell Hardness Test
7. Deflection test on beams.
   (a) Cantilever Beam
   (b) Simply Supported beam
8. Compression test on brittle materials

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

REFERENCE BOOKS

Lab Manual
**L133 - ELECTRICAL AND ELECTRONICS ENGINEERING LAB**

**Prerequisite:** There are no prerequisites for this lab course.

**Course Educational Objectives:**

This lab course is intended to know the usage of electrical and electronics equipment, understand the characteristics of PN junction diode, transistor, and amplifiers and also understand the performance characteristics of transformers, induction motor and alternator

**Course outcomes:**

After undergoing this lab course, students will be able to:

A. Demonstrate the usage of various electronic components and test equipments like Multimeter, function generator, CRO
B. Decide the use of diode and transistor for various practical applications.
C. Design the circuits to verification of Kirchhoff’s laws.
D. Design amplifier circuit with different biasing techniques.
E. Identify the suitable method to find out the performance characteristics of AC machines

**LIST OF EXPERIMENTS**

Brake test on 3-phase Squirrel Cage Induction Motor.

1. Regulation of 3-phase Alternator by Synchronous Impedance Method.
2. OC and SC tests on 1-phase transformer.
4. Load test on 1-phase transformer.
5. Verification of Kirchhoff’s Laws (KCL and KVL.)
6. Measurement of peak, average, rms values, frequency and time period of a sinusoidal waveform.
7. V-I characteristics of p-n Diode.
8. Transistor Characteristics (Common Base)
9. Calculation of ripple factor for full wave rectifier.

**ADDITIONAL EXPERIMENTS**

1. CE amplifier.
2. Calculation of ripple factor for half wave rectifier.

**REFERENCES :**

Lab. Manual
S351 - PROBABILITY AND STATISTICS  
(Common to CSE, IT, ME)

Prerequisite Subject: Applied Mathematics-I,II

Course Educational Objectives:
The main objectives of this course are
1. To revise elementary concepts and techniques encountered in probability.
2. To extend and formalise knowledge of the theory of probability and random variables.
3. To introduce new techniques for carrying out probability calculations and identifying probability distributions.
4. To motivate the use of statistical inference in practical data analysis.
5. To study elementary concepts and techniques in statistical methodology.

Course Outcomes:
This course is intended to contribute to the following program outcomes:
1. An ability to apply the knowledge of mathematics, science and engineering.
2. An ability to design and conduct experiments, as well as to analyze and interpret data
3. An ability to identify, formulate and solve engineering problems.
4. An ability to use the techniques, skills and modern probabilistic and statistical tools necessary for engineering practice

UNIT - I
PROBABILITY AND RANDOM VARIABLES

UNIT - II
PROBABILITY DISTRIBUTIONS

UNIT - III
SAMPLING DISTRIBUTION AND ESTIMATION
Population and samples.Sampling distribution of mean (with known and unknown variance), proportion, variances. - Sampling distribution of sums and differences. Point and interval estimators for mean, variance and proportions.

UNIT - IV
TESTING OF HYPOTHESIS
Null and Alternative Hypothesis, One tail and two tailed tests,Type I and Type II errors. Testing of hypothesis concerning means, proportions and their differences using Z-test. Tests of hypothesis using Student’s t-test, F-test and $\chi^2$ test. Applications of decision making using the above tests.

UNIT - V
CORRELATION AND CURVE FITTING
Simple Bivariate Correlation and Regression lines.Curve fitting: Fitting a straight line – Second degree curve-exponential curve by method of least squares and goodness of fit.
TEXT BOOKS

REFERENCES
S252 - FLUID MECHANICS AND HYDRAULIC MACHINERY

Prerequisite Subject: Basic Mechanical Engineering

Course Educational Objectives:

1. To learn the properties of fluids and its measuring devices
2. To learn about the different types of fluid flows and forces behind the flow.
3. To learn the basics of turbo machinery.
4. To learn the working of hydraulic prime movers.
5. To know the working of different types of pumps

Course Outcomes:

After completion of the course students are able to:

1. Develop devices based on basic principles in fluid flows
2. Able to calculate velocity fields potentials and forces on bodies and realize the concepts of buoyant force, centre of buoyancy.
3. Design different types of flow systems that fulfill the needs of industry.
4. Develop an ability to design the simple hydraulic systems to cater the needs of society and industry.
5. Analyze different types of working pumps

UNIT-I

FLUID STATICS: Dimensions and Units: Physical Properties of Fluids- Specific Gravity-Viscosity, Surface Tension, Vapour Pressure and Their Influence on Fluid Motion-Atmospheric Gauge and Vacuum Pressure-Measurement of Pressure-Piezometer, U-Tube and Differential Manometers, Hydro-Static Forces on Submerged Bodies

UNIT-II


UNIT-III

BOUNDARY LAYER FLOW: Laminar & Turbulent Boundary Layer, Boundary Layer Thickness, Displacement Thickness, Energy Thickness, Momentum Thickness, Boundary Layer Separation.

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

UNIT-IV

HYDRAULIC TURBINES: Classification of Turbines, Pelton Wheel, work done and efficiencies of Pelton Wheel, Working proportions of Pelton Wheel, Francis Turbine, work done and efficiencies of Francis Turbine, Working proportions of Francis Turbine, Kaplan Turbine, work done, heads& efficiencies, Draft Tube, Draft Tube Theory, Types Of Draft Tubes, Governing of Turbines, Unit Quantities And Specific Quantities, Geometric Similarity, Cavitation In Turbines, Performance Characteristic Curves.
UNIT-V
CENTRIFUGAL PUMPS: Working of Centrifugal Pumps, Types of Centrifugal Pumps, Work done by The Impeller - Losses and Efficiencies, Specific Speed, Pumps In Series, Parallel-Performance Characteristics Curves, NPSH.
RECIPROCATING PUMPS: Main components and working of a Reciprocating Pumps, Types of Reciprocating Pumps, work done by Reciprocating Pump, Single, Double, Co-Efficient of Discharge, Percentage of Slip and Negative slip of pump, Indicator diagrams, Air vessels.

TEXT BOOKS

REFERENCES
S354 - PRODUCTION TECHNOLOGY

Prerequisite Subject: Work Shop

Course Educational Objectives:
The main objective of the course is to
1. Understand the various production or manufacturing processes which could be done in real time.
2. Get familiarize with various casting processes.
3. Demonstrate different types of welding processes and welding defects.
4. Understand the basic concepts of welding techniques.
5. Create awareness on the concepts of different metal forming processes.
6. Understand the concepts of extrusion and sheet metal forming processes.

Course Outcomes:
After completion of the course students are the able:
1. To work in manufacturing industries.
2. To optimize the production processes in industries.
3. To apply production processes to various engineering problems.
4. To analyze the various production processes used for different field of applicability with respect to consideration of various design aspects.

UNIT – I

UNIT - II
WELDING: Classification of welding process, Principle of gas welding, Oxy-acetylene welding equipment, Process and applications, Hydrogen welding, Gas cutting process and applications.
RESISTANCE WELDING- Principle and types of resistance welding and applications, Thermit welding, friction welding, explosive welding and induction welding.

UNIT - III
ELECTRIC ARC WELDING: Principle, equipment, electrodes and electrode polarities, Consumable and non consumable welding process. MIG welding, Sub-merged arc welding (SAW) processes and applications. Inert Gas welding, Tungsten Inert Gas Welding (TIG) process and applications, Carbon arc welding. Soldering & Brazing processes and applications. Welding defects, causes and remedies

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

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

TEXT BOOKS

REFERENCES
3. Lindberg, Process and materials of manufacturing, PE.
S286 - KINEMATICS OF MACHINES

Course Educational Objectives: The objectives of this course are
1. To understand the concepts of mechanisms and need in machines/systems
2. To understand kinematic analysis on mechanisms (reciprocating & rotary)
3. To understand the concepts of instantaneous centre and velocity and accelerations of
   the links of mechanism.
4. To study the various steering gears used in automobiles and power transmitting
   capacity of belt drives
5. To understand the kinematics of cam design
6. To know the kinematics of gears and gear trains.

Course Outcomes:
By the end of this course each student will be able to
1. Analyze the kinematics of linkages to determine position, velocity and acceleration
   variation throughout the range of motion.
2. Develop ability to come up with innovative ideas regarding mechanisms/machines
3. Determines the velocity & accelerations of various links of any mechanism
4. Design cams or gear trains to produce a desired motion.
5. Calculate the speeds of the gears of an automobile or machine tools

UNIT - I
MECHANISMS: Elements – Classification – Types of kinematic pairs – Types of motions –
Degree of freedom - Mechanism and Machines – Classification of machines – Kinematic
chain – Inversion of mechanism - Inversions of quadric cycle chain – Single and Double
slider crank chains
STRAIGHT LINE MOTION MECHANISMS: Exact and approximate copiers and
generated types – Peaucellier, Hart and Scott Russul – Grasshopper – Watt - Chebicheff and
Robert Mechanisms

UNIT - II
VELOCITY AND ACCELERATION ANALYSIS: Absolute and Relative motions -
Instantaneous centre - Kennedy’s theorem- Determination of angular velocity of points and
links for simple mechanisms - Relative velocity method – Velocity Polygon - Acceleration
Polygon- Velocity and acceleration diagrams for simple mechanisms - Klein’s construction-
Coriolis acceleration.
STEERING GEARS: Conditions for correct steering – Davis Steering gear- Ackerman
steering gear

UNIT - III
CAM: Classification of Cam and Follower mechanism-Terminology - Types of follower
motion - Uniform velocity – Simple harmonic motion and Uniform acceleration-
Displacement diagrams- Derivations of follower motion - Graphical layouts of cam profiles-
Introduction to tangent cams with straight flanks.

UNIT - IV
BELT AND ROPE DRIVES: Introduction - Selection of belt drive- Types of belt drives-
materials - Velocity ratio- Slip - Creep - Tensions for flat belt drive-Angle of contact-
Centrifugal tension- Maximum tension – Ropes drives
UNIT - V


TEXT BOOKS

REFERENCES
S407 - THERMAL ENGINEERING

Prerequisite Subject: Thermodynamics

Course Educational Objectives:

1. To learn main features of Rankine cycle and its performance improvement methods
2. To learn about components like boilers, super heater, economizer, reheater, feed water heaters and chimney.
3. To learn the construction, function and performance of a steam nozzle.
4. To learn the salient features of impulse, reaction turbines
5. To learn about different types of condensers and compressors.

Course Outcomes:

After completion of the course students are able to:

1. Identify all the essential components of a thermal power plant and develop methods of reducing losses in a vapor power cycle.
2. Develop the skill of simple design of heat exchange devices like super heater, economizer, reheater, boiler tubes and chimneys.
3. Analyze the significance of nozzles in a vapor power cycle.
4. Develop skills on energy conversions and work transfer from impulse and reaction turbines.
5. Design simple condenser units.

UNIT - I

COMBUSTION: Types of Fuels for power plant, Adiabatic flame temperature, Stoichiometry

UNIT - II

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

UNIT - III
STEAM NOZZLES: Introduction, Types of nozzle, Flow through nozzles- thermodynamic analysis– assumptions -velocity of nozzle at exit- condition for maximum discharge, critical pressure ratio, Ideal and actual expansion in nozzle, velocity coefficient, Supersaturated flow, degree of super saturation and degree of super cooling -Wilson line

STEAM CONDENSERS: Introduction, Function, Elements of a condenser, Types of Condensers- Jet condensers, Surface Condensers –working

UNIT - IV
STEAM TURBINES: Introduction, Classification, Impulse turbines and reaction turbines

IMPULSE TURBINES: Mechanical details, Working principle, Velocity diagram – effect of friction – power developed, axial thrust, blade or diagram efficiency – condition for maximum efficiency. De-Laval Turbine - its features. Methods to reduce rotor speed- Velocity compounding (Curtis Turbine) and Pressure compounding (Rateau Turbine), Combined velocity diagram for a velocity compounded impulse turbine,

REACTION TURBINE: Introduction, degree of reaction. Parsons reaction turbine.
UNIT - V
COMPRESSORS— Introduction, Classification – Reciprocating, Rotary, Centrifugal & Axial compressors

RECIROCATING: Principle of operation, Work required, Isothermal efficiency, Volumetric efficiency and Effect of clearance volume, Free Air Delivery, Multistage Compression-Condition for Minimum work

ROTARY: Roots Blower, Vane sealed compressor, principle of working.

CENTRIFUGAL: Principle of operation –Energy transfer-velocity diagram

AXIAL: Principle of operation – velocity triangles and energy transfer per stage, degree of reaction,

TEXT BOOKS

REFERENCES
S245 - ESTIMATION, COSTING AND ENGINEERING ECONOMICS

Course Educational Objectives:
1. To learn the basic principles of energy conservation and audit.
2. To learn the basic principles of waste heat recovery systems.
3. To learn about planning, organizing and implementing of energy conservation methods in a variety of engineering situations.
4. To learn energy auditing procedures especially used in power plants.
5. To learn the economic issues based on energy utilization in domestic, industrial and commercial sectors.

Course Outcomes:
After completion of the course student will be able to:
1. Develop enough exposure to energy audit and energy conservation methods.
2. Acquire the knowledge on cogeneration plant and its salient features.
3. Identify energy conservation opportunities and its implementation in devices like boilers and furnaces etc.,
4. Analyze significance and relevance of waste heat recovery in terms of plant economy and long term goals.
5. Apply the engineering economic principles for different thermal systems of a power plant.

UNIT - I
General energy problem, Energy uses patterns and scope of conversion.

ENERGY MANAGEMENT PRINCIPLE: Need, Organizing and managing an energy management program.

ENERGY AUDITING: Elements and concepts, Type of energy audits instruments used in energy auditing.

UNIT - II
ECONOMIC ANALYSIS: Cash flows, Time value of money, Formulae relating present and future cash flows- single amount, uniform series.

FINANCIAL APPRAISAL METHODS: Pay back periods, net present value, benefit cost ratio, internal rate of return and Life cycle cost / benefits.

UNIT - III
THERMODYNAMICS OF ENERGY CONSERVATION: Energy conservation in Boilers and furnace, Energy conservation in stream and condensate system.

COGENERATION: Concepts, type of cogeneration system, performance evaluation of a cogeneration system.

UNIT - IV

UNIT - V
ENERGY CONSERVATION IN ELECTRIC UTILITY AND INDUSTRY: Energy cost and two -part tariff, Energy conservation in utility by improving load factor, Load curve analysis, Energy efficient motors, Energy conservation in illuminating system, Importance of power factor in energy conservation - Power factor improvement methods, Energy conservation in industries.

TEXT BOOKS

REFERENCES
2. Industrial energy conservation Manuals: MIT Press.
S355 - PROFESSIONAL ETHICS AND HUMAN VALUES
(Common to all branches)

COURSE EDUCATIONAL OBJECTIVES:
1. To create an awareness on engineering ethics and human values.
2. To adumbrate the inevitability of different intellectual property rights like patents, copyrights, trademarks, and trade secret.
3. To give an impetus on achieving higher positions in profession, with ethical and human values as a base and support for the growth.
4. To explicate the professional and societal responsibilities of the engineers.
5. To make the student realize the sensitiveness associated with experimentation process

COURSE OUTCOMES:
At the end of the course, the student
1. Acquires the basic concepts of Professional ethics and human values & Students also gain the connotations of ethical theories.
2. Knows the duties and rights towards the society in an engineering profession
3. Would realize the importance and necessity of intellectual property rights.
4. Can take all the necessary precautions while conducting the experiments, which may reduce the risk.
5. Understands the importance of risk evacuation system in reality and takes the utmost responsibility while handling the risky situations

UNIT - I
ETHICS

UNIT - II
HUMAN VALUES

UNIT – III
ENGINEERING AS SOCIAL EXPERIMENTATION
Engineering as experimentation - Engineering Projects VS. Standard Experiments - Engineers as responsible experimenters – Codes of ethics - Industrial Standards - A balanced outlook on law- The challenger case study.

UNIT - IV
SAFETY, RESPONSIBILITIES AND RIGHTS
UNIT - V
GLOBAL ISSUES
Multinational Corporation’s -Environmental ethics-computer ethics -weapons development
Engineers as managers - consulting engineers-engineers as expert witnesses and advisors
Moral leadership - sample code of Ethics (Specific to a particular Engineering Discipline).

TEXT BOOKS

REFERENCES
2. Charles D. Fleddermann, "Engineering Ethics", Pearson Education/ Prentice Hall, New Jersey,2004 ( Indian Reprint now available )
L146 - FLUID MECHANICS AND HYDRAULIC MACHINERY LAB  
(Common to CE, ME)

Prerequisite Subject: Fluid Mechanics and Hydraulic Machinery

Course Educational Objectives:
1. To learn the fundamental physical and analytical principles of fluid mechanics
2. To learn the essence of conservation of mass, conservation of energy, and the conservation of momentum equations in fluid mechanics while doing experiments.
3. To learn the concepts of Bernoulli’s theorem, conservation principles, ideal incompressible flow, and flow of a real fluid practically.
4. To learn the concepts of impulse-momentum equation applied to jets, functioning and performance of hydraulic turbines.

Course Outcomes:
After completion of the course student will be able to:
1. Apply basic principles, governing equations and the dynamics of non-viscous fluids
2. Apply the Bernoulli equation to solve problems in fluid mechanics, and application on control volume analysis problems in fluid mechanics.
3. Apply the laminar and turbulent boundary layer fundamentals in fluid flow problems.
4. Develop the capability to apply conservation principles to turbo machines i.e., in hydraulic turbines.

LIST OF EXPERIMENTS
At least 10 Experiments are required to be conducted
1. Verification of Bernoulli’s Theorem
2. Calibration of Venturi meter
4. Determination of friction factor for a given pipe line
5. Determination of loss of head due to sudden contraction in a pipeline
6. Impact of jets on Vanes.
7. Performance Test on Pelton Wheel.
8. Performance Test on Kaplan Turbine.
10. Performance Test on Multi Stage Centrifugal Pump.
11. Performance Test on Reciprocating Pump.
12. Turbine flow meter.
13. Calibration of low speed wind tunnel.
15. Potential Flow Study Using Hele-Shaw Apparatus
16. Flow Visualization study using Water Flow Channel

REFERENCES

Lab Manuals
L172 - PRODUCTION TECHNOLOGY AND MODELLING LAB

Prerequisite Subject: Production Technology

PART-A

Course Educational Objectives:
The objectives of the course are to
1. Provide hands-on laboratory experience in the area of production.
2. Provide basic knowledge about casting and tools used in casting.
3. Get familiarize with welding equipment and various welding processes.
4. Acquire practical knowledge in mechanical press working.
5. Get equip with injection moulding.

Course Outcomes:
After completion of the course students are able to:

1. Apply the principles of production technology in manufacturing industries.
2. Choose a suitable production process for a product.

At least 10 Experiments should be conducted from PART A & PART B.

PART A : PRODUCTION TECHNOLOGY

I. METAL CASTING LAB
1. Pattern Design and making - for one casting drawing – 1 Exercise.
2. Sand properties testing - Exercise -for strengths, and Permeability - 1 Exercise.
3. Moulding, Melting and Casting - 1 Exercise

II WELDING LAB
1. ARC Welding Lap & Butt Joint - 2 Exercises.
2. Spot Welding - 2 Exercises.
3. TIG Welding - 1 Exercise.

III MECHANICAL PRESS WORKING
3. Bending and other operations

IV PROCESSING OF PLASTICS
1. Injection Moulding

PART-B : MODELLING LAB

1. Introduction to a modelling package:
2. PartModeling:(Two examples)
   Generation of various 3D models through protrusion, revolve, shell, sweep etc.
   Creation of various features
3. Assembly modeling of machine parts.(Two examples)
   Ex: knuckle joint, universal joint, IC engine piston and rod end assembly etc
4. Wireframe modelling (One example)
5. Surface modelling (One example)

SOFTWARE PACKAGES
ProE / CATIA / Unigraphics.

REFERENCES
Lab Manuals
Prerequisite Subject: Thermodynamics

Course Education Objectives:
1. To understand the engine terminology and working principles of I.C Engines.
2. To learn analytical techniques to the engineering problems and performance analysis of internal combustion engines.
3. To learn the design and operating characteristics of modern internal combustion engines.
4. To know the environmental and fuel economy challenges facing the internal combustion engine.
5. To understand the gas turbine and jet propulsion and rocket theory.

Course Outcomes:
After completion of the course students are able to:
1. Differentiate among different internal combustion engine designs.
2. Recognize and understand reasons for differences among operating characteristics of different engine types and designs.
3. Develop skills to run engines and do experiments and validate the theoretical results.
4. Develop an ability to optimize engine designs for specific sets of constraints.
5. Identify and apply the concepts of gas turbines for power generation & aviation purpose.

UNIT - I
INTRODUCTION: Heat engine, Classification of IC Engines, Basic Engine Components and Nomenclature, Working principles of 4-Stroke and 2-Stroke Spark Ignition and Compression Ignition Engines, Valve and Port timing diagrams, Applications of I.C. Engines.

ENGINE SYSTEMS: Introduction, Layout of Fuel supply system for SI Engine-Simple Carburettor, Fuel supply system for CI Engine-Solid Injection-Individual pump type-Common rail type only.

UNIT - II
ENGINE SYSTEMS: Cooling systems, Air cooling, Water cooling, Comparison, Radiators and cooling fans, Lubricating systems, Mist lubrication, Wet sump lubrication, and Dry sump lubrication system, Ignition systems, Battery, Magneto and Electronic ignition system.


UNIT - III
COMBUSTION IN SI ENGINES: Introduction, Homogeneous and Heterogeneous mixture, stages of combustion in SI engines, flame front propagation, factors influencing the flame speed, Abnormal combustion, phenomenon of knock in SI engines, effect of engine variables on knock, combustion chambers for SI engines- Fuel requirement and fuel rating.

COMBUSTION IN CI ENGINES: Introduction, stages of combustion in CI engines, factors affecting the delay period, phenomenon of knock in CI engines, comparison of knock in SI and CI engines, Combustion Chambers for CI engines, Fuel requirement and fuel rating.
UNIT - IV

UNIT - V
JET PROPULSION SYSTEMS: Introduction-Qualitative treatment of Turbojet, Turbo Fan, Turboprop, Ramjet, applications.

TEXT BOOKS

REFERENCES
S291 - MACHINE DESIGN - I

Prerequisite Subject: Kinematics of Machines

Course Educational Objectives: The objectives of this course are
1. To illustrate the integration of design principles, materials selection and fundamentals of design concepts.
2. To study the effects of stress concentration in various machine elements
3. To understand threaded fasteners, welded connections and riveted joints with respect to axial and eccentric loads.
4. To understand various joints subjected to axial loading
5. To apply various theories for the design of shafts subject to combined static and dynamic load and familiarize with the shaft couplings

Course Outcomes:
At the end of this course students will be able to
1. Formulate and analyze stresses and strains in machine elements and structures subjected to different loads.
2. Evaluate the stress distribution and analyze the failure criterion of mechanical parts under static and fatigue loads
3. Design temporary and permanent joints.
4. Analyze and design power transmission shafts supporting various elements in industry
5. Design shaft couplings for various engineering applications.

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

UNIT – II

UNIT – III
RIVETED JOINTS: Types of riveted joints - efficiency of riveted joint - eccentrically loaded riveted joints
WELDED JOINTS: Butt joints-Fillet joints-Strength of butt welds - Strength of parallel fillet welds-Strength of transverse fillet welds-Maximum shear stress in parallel fillet and transverse fillet welds-Axially loaded unsymmetrical welded joints-Welded joint subjected to bending moment
UNIT – IV
THREADED JOINTS: Threaded joints-Terminology of screw threads- Bolted joint - Eccentrically loaded bolted joints in shear - Eccentric load perpendicular to axis of bolt - Bolts of uniform strength
KEYS, COTTER AND KNUCKLE JOINTS: Types of keys- Design of square and flat keys-Cotter joints-Socket and Spigot cotter joint-Knuckle joint-Failures

UNIT – V
SHAFTS: Transmission shafts- Shaft design on strength basis-Shaft design on torsional rigidity basis-ASME code for shaft design-Design of hollow shaft on strength and torsional rigidity basis
SHAFT COUPLINGS: Requirements – Rigid couplings-Muff coupling-Clamp coupling-Flange coupling-Bushed pin flexible coupling

TEXT BOOKS

REFERENCES
S203 - DYNAMICS OF MACHINES

Prerequisite Subject: Kinematics of Machines

Course Educational Objectives:
The main objective of this course is to
1. Understand the effect of frictional force on clutches and brakes under various conditions.
2. Gain the knowledge of kinematic synthesis and dynamics of different applications of gyroscopic and precessional motion
3. Understand the concept of energy stored in the fly wheels and speed regulations of various governors
4. Understand the concepts of static and dynamic mass balancing of rotating and reciprocating masses to minimize vibrations and noise.
5. Understand the concepts of free and damped vibrations

Course Outcomes:
After completion of the course students are able to:
1. Solve the practical problems on clutches and brakes under various conditions.
2. Recognize the needs of various principles of dynamics of machines and apply to practical situations
3. Analyze the energy storage in the flywheels and speed regulations of various Governors
4. Balance the unbalanced forces developed in the rotating and reciprocating masses.
5. Analyze the concepts of vibrations & take measures to minimize vibration and noise

UNIT - I
CLUTCHES, BRAKES AND DYNAMOMETERS: Friction clutches- Single plate clutch- Multiple plate clutch- Cone clutch-Centrifugal Clutch - Block brake- Band brake - Block & band brake - Internal expanding shoe brake- Dynamometers – Absorption and Transmission types- General description and method of operations
PRECESSION: Gyroscopes- Effect of precession – Aeroplanes and Ships - Motion on the stability of moving vehicles - Motor car and Motor cycle

UNIT - II
TURNING MOMENT DIAGRAMS AND FLY WHEELS: Turning moment – Angular velocity and acceleration of connecting rod – Crank effort and torque diagrams - Inertia torque of connecting rod - Fluctuation of energy – Fly wheels and their design.

UNIT - III

UNIT - IV
BALANCING : Introduction – Balancing of Rotating Masses – Single and Multiple – Single and different planes - Primary and Secondary balancing of reciprocating masses -Analytical method - Unbalanced forces and couples - Locomotive balancing – Hammer blow- Variation of Tractive efforts - Swaying couple
UNIT - V
VIBRATIONS: Types of vibrations-Degrees of freedom-Free longitudinal vibrations-Displacement, velocity and acceleration-Inertia effect of the mass of spring-Damped vibrations- Forced vibrations- Forced damped vibrations-Vibration isolation and transmissibility-Whirling of shafts

TEXT BOOK

REFERENCES
Prerequisite: None
Course Educational Objectives (CEOs):
In this course student will learn about
1. The fundamental concepts and contributions of Management.
2. Human Resource Practices, Quality controls and Project Management which plays a vital role in the organization.
3. Study techniques for increased productivity.
5. Various network analysis techniques.

Course Outcomes:
After completion of the course, students will be able to
1. Apply the conceptual knowledge of management and organization in work environment.
2. Take decisions relating to location of plant and layout of plant.
3. Conduct work study techniques for increased productivity and also able to control quality of products.
4. Manage human resources efficiently and effectively with best HR practices.
5. Plan and control projects through network analysis techniques.

UNIT - I

UNIT - II
OPERATIONS MANAGEMENT: Plant location, Factors influencing location, Principles and types of plant layouts - Methods of production (job, batch and mass production), Work study - Basic procedure involved in method study and Work measurement

UNIT - III
QUALITY AND MATERIALS MANAGEMENT: Statistical quality control – Meaning- Variables and attributes - X chart, R Chart, C Chart, P Chart, (simple Problems) Acceptance sampling, Sampling plans, Deming’s contribution to quality. Materials management – objectives, Need for inventory control, Purchase procedure, Store records, EOQ, ABC analysis, Stock levels

UNIT - IV
HUMAN RESOURCE MANAGEMENT (HRM): Concepts of HRM, Basic functions of HR manager: Man power planning, Recruitment, Selection, Training and development, Placement, Wage and salary administration, Promotion, Transfers Separation, performance appraisal, Job evaluation and merit rating.

UNIT - V
PROJECT MANAGEMENT: Early techniques in project management - Network analysis: Programme evaluation and review technique (PERT), Critical path method (CPM), Identifying critical path, Probability of completing project within given time, Project cost analysis, project crashing (simple problems)

TEXT BOOKS

REFERENCES
2. Stoner, Freeman, Gilbert, Management, 6th edition Pearson education, New Delhi, 2004
3. O.P. Khana, Industrial engineering and ManagementL.S.Srinath, PERT & CPM
Prerequisite Subject: Production Technology

Course Educational Objectives:
The main objectives of the course are to
1. Understand the concepts of metal cutting theory and single point cutting tool.
2. Get familiarize with operations performed on lathe.
3. Understand the principles of shaping, drilling, planning, boring machines and their operations
4. Study the concepts of milling machines and their operations.
5. Understand the concepts of finishing operations like grinding, lapping, honing and broaching

Course Outcomes:
After completion of the course student will be able to:
1. Apply the knowledge of various machine tools in development of a product.
2. Decide proper machining processes for components
3. Schedule job operations in chronological sequence in which parts would be produced in manufacturing in an industry.
4. Apply the knowledge of work holders, tool holders, hand tools and jigs and fixtures in manufacturing industries.

UNIT - I
ELEMENTARY TREATMENT OF METAL CUTTING THEORY: Elements of cutting process – Methods of Metal Cutting – Classification of Cutting Tools- Geometry of Single Point Cutting Tool. Chip formation, mechanism and types of chips- chip breakers. Merchant’s Force diagram, measurement of cutting forces, work done in cutting. Metal cutting theories. Machining parameters-Tool Life, Tool Failure-Cutting Tool Materials, Cutting Fluids

UNIT - II
TURRET AND CAPSTAN LATHES: Principle of working -Collet chucks – Other work and tool holding devices – Box and tool layout.

UNIT - III
SHAPING, SLOTTING AND PLANING MACHINES: Principles of working – Principal parts – Specification, classification, operations performed, machining time calculations.

UNIT - IV
MILLING MACHINES:– Principle of working – Specifications – Classifications of milling machines – Principal features of horizontal, vertical and universal milling machines – Machining operations-Types -Geometry of milling cutters –Millling cutters – Methods of indexing – Accessories to milling machines.
UNIT - V

LAPPING, HONING AND BROACHING MACHINES: Comparison to grinding – lapping and honing. Constructional features of speed and feed units, machining time calculations


TEXT BOOK

REFERENCES
S329 - OPERATIONS RESEARCH
(Common to AE, CSE, IT, ME)

Prerequisite Subject: Estimation, Costing and Engineering Economics

Course Educational Objectives:
The objective of this course is to:
1. Underline the applications of operations research techniques in Industries.
2. Discuss the difference between deterministic and stochastic models.
3. Familiarize the concepts of simulation and dynamic programming.
4. Describe the concept of feasible region, optimal solution.
5. Illustrate the applications of Transportation and Assignment models.

Course Outcomes:
After completion of the course student will be able to:
1. Develop mathematical models for real engineering problems.
2. Demonstrate the familiarity in identifying the key parameters influencing the production cost.
3. Exhibit knowledge in solving inventory control problems.
4. Choose optimal strategy using OR techniques.

UNIT - I
INTRODUCTION: Operations Research, operations research models, applications, Linear Programming Problem Formulation, Graphical solution, Simplex method, Two Phase simplex

UNIT - II

UNIT - III
THEORY OF GAMES: Minimax (maximin) Criterion and optimal strategy, Solution of games with saddle points, Rectangular games without saddle points, 2 X 2 games – dominance principle – m X 2 & 2 X n games, and graphical method.

INVENTORY CONTROL: EOQ model, Shortages not allowed, Deterministic models, Probabilistic models, Price breaks

UNIT - IV
THEORY OF REPLACEMENT: Introduction, Replacement of Equipment that Deteriorates Gradually, Replacement of Equipment that fails suddenly, Group Replacement.

WAITING LINES: Single Channel – Poisson arrivals – exponential service times – with infinite population and finite population models– Multichannel – Poisson arrivals – exponential service times with infinite population single channel Poisson arrivals.

UNIT - V
DYNAMIC PROGRAMMING: Bellman’s Principle of optimality, Applications of dynamic programming, capital budgeting problem, linear programming problem.


TEXT BOOKS

REFERENCES
Course Educational Objectives:
The objectives of the course are to
1. Understand the various machining processes.
2. Familiarize with the tools used in machine shop.
3. Understand basic operations of lathe, milling, drilling, shaping and planning machines.
4. Study the static and dynamic behavior of Mechanisms & Machines.
5. To know the kinematic concepts of mechanisms such as cams, governors, gyroscopes etc
6. Understand the concepts of vibrations.

Course Outcomes:
After completion of the course students are able to:
1. Exhibit the ability in developing sequence of machining operations required for in industry.
2. Capable of manufacturing components according to given working drawings
3. Apply the knowledge of cams, governors, gyroscopes in developing machines.
4. Overcome the typical problems faced by engineers in industries.

MACHINE TOOLS

PART-A
LIST OF EXPERIMENTS:
1. Introduction to Lathe.
2. Step turning and taper turning on lathe machine
3. Thread cutting and knurling on -lathe machine.
4. Drilling and Tapping
5. Shaping and Planning
6. Slotting
7. Milling
8. Grinding of Tool angles

PART-B
DYNAMICS LAB LIST OF EXPERIMENTS
Any of the 6 Experiments are required to be conducted
1.a) To determine gyroscopic couple on Motorized Gyroscope
b) Determination of transmission efficiency of gear reducers
2.a) To find the stability and sensitivity of Watt governor
b) To find the stability and sensitivity of Porter governor
3. To find the transverse vibrations of free-free beam
4.a) Balancing of rotating masses
b) Balancing of reciprocating masses
5. Determination of damping coefficient of single degree of freedom system using spring mass system
6. Determination of critical speed of shaft with concentration loads
7.a) Determine the moment of inertial of connecting rod by compound pendulum method
b) Determine the moment of inertial of flywheel by oscillation

STUDY EXPERIMENTS:
1. To study various types of cam and follower mechanisms
2. To study inversions of four bar mechanisms, single and double slider crank mechanisms
3. To study various types of gear trains- simple, compound, reverted, epicyclic and differential.
4. To study the working of screw jack and determine its efficiency

REFERENCES
Lab Manual
L181 - THERMAL ENGINEERING LAB

Prerequisite Subject: THERMAL ENGINEERING

Course Education Objectives:

1. To learn the construction and working principle of I.C. Engines practically.
2. To understand the working principle and performance of air compressor practically.
3. To learn the heat balance test of an I.C. Engine.
4. To acquire the priorities given to the efficient use of energy and the minimization of environmental pollution.
5. To understand the usage of data acquisition systems.
6. To learn the concepts of Psychrometry terms

Course Outcomes:

After completion of the course students are able to:

1. Find the efficiency and performance of an engine system for a given set of conditions.
2. Analyze the Volumetric efficiency of air compressor.
3. Develop skills in data acquisition systems.
4. Evaluate the engine performance and explore the ways to improve the efficiency of engines.
5. Realize the need to minimize the losses in engines.
6. Realize the need for developing the less polluting engines by adopting alternate fuels and engine modifications.

LIST OF EXPERIMENTS

At least 10 Experiments are required to be conducted

1. I.C. Engines Valve & Port Timing Diagrams
2. Performance Test on Variable Compression Ratio single cylinder 4-Stroke petrol Engine By using Eddy Current Dynamometer
3. Performance Test on single cylinder 4-Stroke Diesel Engine by using Mechanical Dynamometer
4. Performance test on twin cylinder 4-stroke diesel engine.
5. Performance Test on single cylinder 2-Stroke Petrol Engine.
6. Evaluation of Engine friction power by conducting Morse test on Multi cylinder 4-Stroke Petrol Engine.
7. Evaluation of Engine friction by conducting Retardation test on 4-stroke Diesel Engine.
11. Performance Test on Reciprocating Air – Compressor.
12. Performance Test on Vapour Compression Refrigeration Unit.
13. Performance Test on Air Conditioning Unit.
15. Viscosity of lubricants by using Redwood/ Say bolt viscometer Apparatus
16. Flash and Fire Point of fuels by using pesky Martin Apparatus
17. Carbon Residue test
18. Determination of calorific value of fuel using calorimeter

REFERENCES

Lab Manual
Prerequisite Subject: Applied Mathematics- I, II, Thermodynamics, Thermal Engineering

Course Educational Objectives:
1. To learn the basic differential equations of heat transfer in conduction, convection and radiation.
2. To acquire the phenomenon of critical thickness of Insulation, Heat Transfer in Fins.
3. To understand the significance of Non Dimensional Numbers in Heat Transfer, Natural and Forced Convection Mechanisms and correlations.
4. To learn the basics of phase change processes of boiling and condensation in thermal systems and laws of radiation.
5. To learn about the LMTD, NTU concepts used in heat exchangers.

Course Outcomes:
After completion of the course students are able to:
1. Analyze the basic heat transfer concepts and their practical relevance in Planes, Cylinders and Spherical components.
2. To solve practical problems of steady and unsteady state heat transfer.
3. Develop skills to identify suitable Nusselt number empirical correlation for Planes, Cylinders.
4. To formulate the radiation heat exchange between two surfaces.
5. Design simple heat exchanger units of moderate capacity.

UNIT - I


UNIT - II

ONE DIMENSIONAL TRANSIENT HEAT CONDUCTION: Systems with negligible internal resistance-Lumped Heat analysis--Significance of Biot and Fourier Numbers-Plane wall with finite surface and internal resistance using Heisler Chart-Applications.

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

UNIT - IV

UNIT - V
DATA HAND BOOK

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

TEXT BOOKS:

REFERENCES
Prerequisite Subject: Machine Design –I
Course Educational Objectives: The objectives of this course are
1. To understand the hydrodynamic lubrication in bearings
2. To understand the concepts related to journal bearings and rolling contact bearings
3. To understand the design considerations of the engine components.
4. To gain the knowledge on the principles and procedure for the design of power transmission elements
5. To understand the gears with respect to tooth bending strength and surface strength specifications and fatigue consideration
Course Outcomes: At the end of this course students will be able to
1. Design hydrodynamic journal bearings and evaluate the life of the antifriction bearings
2. Design the internal combustion engine components for safe and continuous operation
3. Select the wire ropes for elevators, cranes and hoisting machinery
4. Design the springs with respect to static and dynamic loads
5. Apply the design concepts to evaluate the strength of the gear
6. Design the gear box for machine tools and automobiles

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

UNIT – II
PISTON: Forces acting on piston – Construction – Design and proportions of piston
CONNECTING ROD: Thrust in connecting rod –Rankine’s formula - Stress due to whipping action on connecting rod ends
CRANK SHAFT: Strength and proportions of center crank shaft – Crank pins
CYLINDER: Design and proportions of Cylinder- Cylinder liners.

UNIT - III

UNIT - IV

UNIT - V
GEAR BOX: Introduction – Functions – Progression ratio – Speed diagram – Kinematic arrangement – Design of gear box
TEXT BOOKS

REFERENCES

HAND BOOKS TO BE ALLOWED IN SEMESTER EXAMINATION:
1. P.S.G. College of Technology
2. Mahadevan
S317 - MODERN MACHINING PROCESSES

Prerequisite Subject: Metal cutting & Machine Tools

Course Educational Objectives:
The objectives of the course are

1. To understand the concepts of various unconventional machining processes.
2. To familiarize the use of electrical energy in unconventional machining process.
4. To understand basic concepts of Rapid Prototyping.
5. Familiarize with the various Rapid Prototyping Process.

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

1. Apply fundamental principles in machining special materials.
2. Solve most relevant industrial solutions pertaining to machining of hard materials.
3. Design soft tools for machining hard materials.
4. Apply the concepts of Rapid Prototyping to engineering objects
5. Analyze various Rapid Prototyping processes

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

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

UNIT - II
ELECTROCHEMICAL PROCESSES: Process, principles, equipment and material removal rate in electrochemical machining, electrochemical grinding, electrochemical deburring and electrochemical honing.
CHEMICAL MACHINING - principle- maskants –etchants- advantages and applications.

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

UNIT – IV

UNIT-V

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

REFERENCES
2. VK Jain, Advanced Machining Processes/ / Allied publishers.
S372 – ROBOTICS  
(Common to AE, ME)

Prerequisite Subject: Machine Design –I, II, KOM, DOM
Course Educational Objectives: To familiarize the students with
1. Basics of robots and various types of gripper
2. Rotation matrices and D-H representation
3. Fundamentals of robot dynamics
4. Path and trajectory planning of robots
5. various sensors used in robots and industrial applications of robots

Course Outcomes:
After completion of the course students are able to:
1. Apply robot fundamentals in designing various types of end effectors
2. Design the end effectors required for different applications.
4. Determine the robot trajectory to robotic motion & Basics of Robot Language
5. Select the sensors depending upon robotic application & its uses in various areas.

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

UNIT - II

UNIT - III

UNIT - IV
TRAJECTORY PLANNING: Introduction – considerations on trajectory planning – joint Interpolated trajectory – Cartesian path trajectory – problems

UNIT - V
SENSORS: Position sensors: Potentiometers, resolvers, encoders – velocity sensors
ROBOT APPLICATION IN MANUFACTURING: Material transfer and machine loading/ unloading applications – Processing operations – Assembly and inspection – Future applications.
TEXT BOOKS


REFERENCES

2. Saeed B. Niku, Introduction to robotics analysis systems Application, PHI learning private limited, New Delhi, 2002
S302 - MECHANICAL VIBRATIONS

Prerequisite Subject: Machine Design –I, II, DOM

Course Educational Objectives:
1. To enable the student to learn the process of reducing the physical systems (any number of degrees of freedom) to mathematical models.
2. To enable the student to learn the process of formulating the equations with regards to mathematical models.
3. To enable the student to learn the process of finding the solutions and subsequently analyzing the physical systems for stability.
4. To enable the student to develop the concept of infinite number of degrees of freedom through practical examples.
5. To enable the student to learn the process of preparing corresponding electrical circuits for physical systems and apply the concepts of electrical and mechanical analogy to ascertain their stability.

Course Outcomes:
At the end of this course each student will be able to
1. Learn how to develop mathematical models for mechanical systems using mass, spring and dampers.
2. Gain experience in deriving governing equations.
3. Model a vibrating mechanical system, develop and solve its governing equations in order to obtain the response of the system under various types of excitation conditions.
4. Learn how to interpret the response of a mechanical system and use the response information in its design and testing in both time and frequency domains.
5. Understand 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 for smooth operation.

UNIT - I

UNIT - II

UNIT - III

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

TEXT BOOKS

REFERENCES
Prerequisite Subject: Thermal Engineering, ICGT

Course Educational Objectives:

1. To learn the basics of air breathing engines and principles of jet propulsion.
2. To understand the working principles of combustors and nozzles used in aerodynamics.
3. To learn the different types of rocket propulsion systems.
4. To understand the Turbo machinery used for solid and liquid engines
5. To learn the fundamentals of solid and liquid propellants used in rockets.

Course Outcomes:

At the end of the course students are able to

1. Analyze the basic principles of air breathing engines and jet propulsion.
2. Acquires the knowledge on function, performance and efficiency of different combustors and nozzles used in rockets.
3. Analyze the performance of jet and rocket engines
4. Get acquainted with Turbo machinery used for solid and liquid engines
5. Identify the fundamental knowledge of solid and liquid propellants used in rockets

UNIT-I

**PRINCIPLES OF JET PROPULSION:** Introduction, Fundamentals of jet propulsion

**AIR-BREATHING ENGINES:** Introduction, Thermodynamics of Aircraft Jet Engines-Turbo jet, Turbo fan, Turbo prop, and Ramjet engines, Typical Engine Performance – Applications of Jet Propulsion.

UNIT-II

**AEROTHERMODYNAMICS OF COMBUSTORS AND NOZZLES:** Introduction, Subsonic Inlets, Supersonic Inlets, Gas Turbine Combustors, after burners and Ram jet Combustors, Supersonic Combustion, Exhaust Nozzles- Applications of combustors and nozzles.

UNIT-III


UNIT-IV

**LIQUID ENGINES**
Propellant Feed systems and engine cycles (gas-pressure feed and turbo pump feed, gas-generator cycle, staged combustion, cycle, expander cycle, typical examples) – Centrifugal pumps – Inducers and axial pumps (inducers, Cavitation, axial pumps) – Axial turbines, Applications

**ELECTRICAL ROCKET PROPULSION**
Introduction – Electrostatic propellant accelerator – Bombardment ionization – The plane diode - Electrostatic thruster performance – The arc jet – Pulsed-magneto plasma accelerators, Applications
UNIT-V
LIQUID PROPELLANTS: Propellant Properties, Liquid Oxidizers, Liquid Fuels, Liquid Monopropellants, Gelled Propellants, Gaseous Propellants, Safety and Environmental Concerns - Applications
SOLID PROPELLANTS: Classification, Propellant Characteristics, Hazards, Propellant Ingredients, Other Propellant Categories, Liners, Insulators, and Inhibitors, Propellant Processing and Manufacture - Applications

TEXT BOOKS

REFERENCES
Prerequisite Subject: Machine Design –I, II

Course Educational Objectives:
The main objectives of the course are:
1. To learn the basic concepts of Tribology and its significance
2. To understand the nature of engineering surfaces, their topography and learn about surface characterization techniques
3. To understand the principle of lubrication, theories of hydrodynamic and mixed boundary lubrication.
4. To learn about consequences of wear, wear mechanisms, wear theories and analysis of wear problems
5. To understand the principles of bearing selection, its arrangement in machines

Course Outcomes:
After completion of the course students are able to:
1. Apply the concepts of principles of Tribology with particular emphasis on lubricated systems.
2. Analyze the various design parameters of bearings under different loads, temperature conditions.
3. Calculate the wear percentage by using different wear theories
4. Identify the wear mechanisms on rubbing surfaces.
5. Design the various types of antifriction bearings, and general requirements of bearing materials

UNIT - I
INTRODUCTION TO TRIBOLOGY: Tribology and their characteristic feature, analysis and assessment of surface, Topography, Deterministic and Stochastic, Tribo models for asperity contacts, Techniques of surface examination, and Technological properties of surfaces.

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

UNIT - II
VISCOSITY AND LUBRICANTS: Viscosity, flow of fluids, viscosity and its variation - absolute and kinematic viscosity, temperature variation, viscosity index determination of viscosity, different viscometers used, Viscosity standards, Lubricants and their physical properties, Various theories of lubrication

UNIT - III
THEORY OF HYDRODYNAMIC LUBRICATION: Petroffs equation, Reynolds’s equation in two dimensions, bearing modulus, Somerfield number, Effects of side leakage, pressure, flow, load capacity and friction calculations, heat balance, minimum oil film thickness, oil whip and whirl.

UNIT – IV
THEORY OF HYDROSTATIC LUBRICATION: Hydrostatic step bearing, pivoted pad thrust bearing, hydrostatic lifts, hydrostatic squeeze films, pressure, flow, load capacity and friction calculations, oil rings, pressure feed bearing, partial bearings, externally pressurized bearings, Air lubricated bearing, Advantages and disadvantages
UNIT - V
ANTI-FRICTION BEARINGS AND BEARING MATERIALS: Anti-friction bearings, types, Advantages and disadvantages, General requirements of bearing materials, types of bearing materials, General bearing design considerations.

TEXT BOOK

REFERENCE BOOKS
1. Sushil Kumar Srivatsava, Tribology in Industry, S. Chand &Co.
2. B.C. Majumdar, Tribology, S.Chand & Co
S174 - CONTROL SYSTEMS  
(Common to ECE, EEE, ME)

Prerequisite Subject: Applied Mathematics –I, II

Course Education Objectives:
The main objectives of the course are:
1. To learn the open loop and closed loop control systems and its block digrams
2. To demonstrate the time response analysis of standard test signals
3. To identify the differences between the time response and frequency response analysis of standard test signals
4. To teach linear systems for steady state errors, absolute stability and relative stability

Course Outcomes:
After completion of the course students are able to:
1. Analyze electromechanical systems by mathematical modeling.
2. Determine Transient and Steady State behavior of systems using standard test signals.
3. Analyze linear systems for steady state errors, absolute stability and relative stability
4. Identify and design a control system to satisfy given requirements.

UNIT – I
INTRODUCTION

UNIT – II
TIME RESPONSE ANALYSIS

UNIT – III
FREQUENCY RESPONSE ANALYSIS
Introduction, Frequency domain specifications Polar Plots -Bode diagrams-Determination of Frequency domain specifications and Transfer function from the Bode Diagram-Phase margin and Gain margin- Nyquist Plots.

UNIT – IV
STABILITY ANALYSIS
UNIT – V
STATE SPACE ANALYSIS OF CONTINUOUS SYSTEMS
Concepts of state, state variables and state model, derivation of state models from block diagrams, Diagonalization- Solving the Time invariant state Equations- State Transition Matrix and it’s Properties – Concepts of Controllability and Observability.

TEXT BOOKS

REFERENCES
S402– THEORY OF ELASTICITY
(Common to AE, ME)

Prerequisite Subject: Mechanics of Materials

Course Educational Objectives:
The objective of this course is
1. To understand the principles of elasticity theory and to find of stress in elastic stress analysis
2. To understand the displacement of simple beams
3. To acquire the knowledge analysis of linear elastic solids under mechanical loads.
4. To learn the Airy stress functions for 2-D plane stress and plane strain problems in Cartesian and cylindrical coordinate systems
5. To understand the stress functions for rectangular and circular cross-sectional cantilever beams.

Course Outcomes:
After completion of the course student will be able to:
1. Analyze the equations of compatibility by using plane stress and plane strain conditions.
2. Apply Saint Venant's principles to determine the displacements of simple beams.
3. Analyze the stresses and strains in 3-Dimensional problems.
4. Solve the linear elasticity problems using various analytical techniques.
5. Analyze the vectors and tensors to enhance the theory of elasticity where ever necessary

UNIT - I
ELASTICITY: Two dimensional stress analysis - Plane stress - Plane strain - Equations of Compatibility - Stress function - Boundary conditions.
PROBLEM IN RECTANGULAR COORDINATES - Solution by polynomials - Saint Venant's principles - Determination of displacement - Simple beam problems.

UNIT - II
PROBLEMS IN POLAR COORDINATES - General equations in polar coordinates - Stress distribution symmetrical about axis - Strain components in polar coordinates - Simple and symmetric problems.

UNIT - III
ANALYSIS OF STRESS AND STRAIN IN THREE DIMENSIONS - Principle stresses – Homogeneous deformations – Strain at a point – Principal axes of strain - Rotation.

UNIT - IV

UNIT - V
BENDING OF PRISMATIC BARS - Stress function - Bending of cantilever beam - Beam of rectangular cross-section - Beams of circular cross-section.

TEXT BOOKS

REFERENCES
1. Dr.Sadhu Singh, Applied stress analysis, Khanna Publishers
2. Dally and Riley, Experimental stress analysis, McGraw-Hill
3. LOVE .A.H, A treatise on Mathematical theory of Elasticity, Dover publications Inc
4. A.Meceri, Theory of Elasticity, Springer
S141 - AUTOMOBILE ENGINEERING

Prerequisite Subject: ICGT, Thermal Engineering

Course Educational Objectives:
1) To understand components of an automobile and functions of each component.
2) To learn working of fuel injection pumps and advanced injection systems used.
3) To understand detailed study of sensors and modern Ignition systems.
4) To understand the working of transmission system components.
5) To acquire knowledge about suspension and braking systems in automobiles and concept of steering geometry related to Vehicle dynamics applications.

Course Outcomes:
After completion of the course student will be able to:
1) Develop different components of an automobile.
2) Develop the fuel feed systems in SI and CI engines, Sensors and Ignition systems.
3) Design various transmission systems.
4) Analyze the simple design oriented problems related to suspension systems, steering systems and braking systems

UNIT - I
INTRODUCTION: Components of Automobile-The Basic Structure-Power Unit-Chassis and Frame-Rear Wheel Drive- Front Wheel Drive- Four Wheel Drive
ENGINE: Basic Terminology of engines- Scavenging process- firing order- Engine Construction Details-Cylinder block and crank case, Cylinder head, Oil pan, manifolds, Gaskets, Cylinder Liners, Types of Pistons and Piston rings, Connecting rod, Engine valves.

UNIT - II
FUEL SUPPLY SYSTEMS IN DIESEL ENGINES: Requirements of Diesel Injection System-Types of Injection Systems- Fuel Feed Pump- Fuel Injection Pump, Jerk type fuel Injection pump, Distribution type of pump-Fuel Injector-Types of Nozzles

UNIT - III
IGNITION SYSTEM: Functions-Battery Ignition system- Components of battery ignition system- Spark plug defects- Magneto coil Ignition System- Electronic Ignition- capacitive discharge ignition system (CDI).
ELECTRONICS SYSTEMS: Sensors-Electromagnetic sensors, Optical sensors, Combustion knock sensors, Variable resistance type sensors, Temperature sensors, Manifold absolute pressure (MAP) sensors, Exhaust gas oxygen sensors, Air-flow measurement, Traction control, Stability control.

UNIT - IV
UNIT - V

SUSPENSION SYSTEMS: Objectives of Suspension systems- Types of suspension springs, Leaf springs, Coil springs, Torsion bar, Shock absorbers- Independent suspension-Air Suspension.

BRAKING SYSTEMS: Principle- Braking requirement- Differences between Drum and Disc brakes- Hydraulic Brake operating systems, Air brakes, Antilock Braking system

TEXT BOOKS

REFERENCES
S294 - MACHINE TOOL DESIGN

Prerequisite Subject: Metal cutting & Machine Tools

Course Educational Objectives:
The objectives of the course are to
1. Understand the basic mechanisms in machine tools.
2. Familiarize with speed and feed used in machine tools.
3. Understand the design concepts of gear box, bed, frames, columns and machine tool.
4. Acquire basic knowledge in hydraulic controls.

Course Outcomes:
After completion of the course student will be able to:
1. Develop a suitable mechanism for a particular machine tool.
2. Develop skills for designing machine components and machine tools
3. Design gear box, bed frames, columns of machine tools.
4. Perform machine tool alignment test.
5. Analyze hydraulic and pneumatic systems of various machine tools.

UNIT- I

UNIT-II

UNIT-III

UNIT-IV
SPINDLE UNITS; Spindles of lathe, Drilling, Milling and Grinding machines materials for spindles. Spindle design. Effect of clearance on the rigidity of spindle. Hydro-dynamic and Hydro-static bearings; Requirements of spindle bearings.

MACHINE TOOL ALIGNMENT TESTS: Requirements of Machine Tool Alignment Tests, Alignment tests on lathe, milling, drilling machine tools.

UNIT-V
TEXT BOOKS

REFERENCES
2. S.K. Basu, Design of machine tools, Allied Publishers
Prerequisite Subject: Operations Research, Industrial Management

Course Educational Objectives:
The objective of this course is to:
1. Underline the importance of Human Factors in engineering design.
2. Create awareness about the need of concepts of Ergonomics in systems design.
3. Describe application of Ergonomics principles to design industrial work places.
4. Illustrate about various work measurement techniques.
5. Discuss the principles of physical ergonomics.

Course Outcomes:
After completion of this course, student will be able to:
1. Determine time standards with allowances for appropriate work tasks.
2. Apply concepts of ergonomics in evaluation of a real world system.
3. Exhibit the ability to design or redesign of workstations using ergonomically knowledge.
4. Design effective man-machine systems.
5. Apply physical ergonomic techniques to improve worker safety.

UNIT- I
WORK STUDY: Definition, Objective and Scope of work study, Human factor in work study. Work study and management, work study and supervision, work study and worker.

METHOD STUDY: Definition, objective and scope of method study, activity recording and exam aids. Charts to record moments in shop operation – process charts, flow process charts, travel chart and multiple activity charts.

UNIT -II
WORK MEASUREMENT: Definition, objective and benefit of work measurement. Work measurement techniques. Work sampling: need, confidence levels, sample size determinations, random observation, conducting study with the simple problems.

UNIT- III
ERGONOMICS: Introduction, areas of study under ergonomics, system approach to ergonomics model, man-machine system. Components of man-machine system and their functions – work capabilities of industrial worker, study of development of stress in human body and their consequences. Computer based ergonomics

UNIT- IV
METHODS OF ANALYSIS: Introduction to Physical Methods, Musculoskeletal Discomfort Surveys Used at NIOSH, the Dutch Musculoskeletal Questionnaire (DMQ), Rapid Upper Limb Assessment (RULA), Rapid Entire Body Assessment,

ANTHROPOMETRIC PRINCIPLES IN WORKSPACE AND EQUIPMENT DESIGN: Designing for a population of users Sources of human variability, Anthropometry and its uses in ergonomics, Principles of applied anthropometry in ergonomics, Application of anthropometry in design

UNIT- V
HUMAN FACTOR ENGINEERING: Definition, history and development of human factors engineering, types & characteristics of man-machine-system, relative capabilities of human being and machines; development and use of human factor data; information input and processing.

TEXT BOOK
1. R.S.Bridger, Introduction to Ergonomics; Taylor & Francis group, 3rd Edition 2008

REFERENCES
2. Khan MI; Industrial Ergonomics; PHI Learning
3. ILO; work-study; International Labour Organization
Prerequisite Subject: HEAT TRANSFER

Course Educational Objectives
1. To learn the concepts of conduction, convection and radiation in practically by conducting experiments.
2. To understand the performance of fins, Heat Pipes.
3. To learn the physical mechanism of Natural Convection and Forced Convection
4. To learn the basic knowledge of radiation mechanism by conduction the experiments of emissivity apparatus and Stefan Boltzmann apparatus.
5. To learn the LMTD and Effectiveness of Heat Exchangers.

Course Outcomes:
After completion of the course students are able to:
1. Analyze the modes of heat transfer problems in the practical perspective.
2. Develop knowledge in making calculations for thermal conductivity of insulating materials and solids of various heat transfer equipment.
3. Acquires the real time steady state and transient heat conduction problems,
4. Apply the concepts of heat transfer in the simple design of various types of fins for different geometry
5. Design and develop the simple heat exchanger systems.

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

REFERENCES:
LAB MANUALS
L119 - COMMUNICATION AND PRESENTATION SKILLS LAB
(Common to all branches)

Prerequisite: English -I, English - II

Course Educational Objectives
In this course, the students will learn to
1. Gather information and to organize ideas relevantly and coherently
2. Participate in group discussions and debates, Face interviews
3. Write project/research reports/technical reports/ formal letters
4. Make oral presentations
5. Transfer information from non-verbal to verbal texts and vice versa

Course Outcomes
After the completion of this course, prospective engineers will have the ability to
1. Make power point presentations and oral presentations
2. Articulate English with good pronunciation
3. Face competitive exams like GRE, TOEFL, IELTS etc.
4. Face interviews and skillfully manage through group discussions
5. Negotiate skillfully for better placement

The following course content is prescribed for the Communication and presentations Lab:
• Vocabulary building – synonyms and antonyms, one-word substitutes, analogy, idioms and phrases, verbal & alphabet series.
• Oral Presentations – JAM
• Functional English - starting a conversation – responding appropriately and relevantly – using the right body language – role play in different situations.
• Group Discussion – dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and coherence.
• Making power point presentations.
• Interview Skills – concept and process, pre-interview planning, opening strategies, answering strategies, practicing mock-interviews.
• Resume’ writing – structure and presentation, planning, defining the career objective, projecting ones strengths and skill-sets, summary, formats and styles, letter-writing.
• Reading comprehension – reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, and critical reading.

MINIMUM REQUIREMENT:
THE ENGLISH LANGUAGE LAB SHALL HAVE TWO PARTS:
   i. THE COMPUTER AIDED LANGUAGE LAB for 60 students with 60 systems, one master console, LAN facility and English language software for self-study by learners.
   ii. THE COMMUNICATION SKILLS LAB with movable chairs and audio-visual aids with a P.A System, a T. V., a digital stereo –audio & video system and camcorder etc.
SYSTEM REQUIREMENT (HARDWARE COMPONENT):
Computer network with LAN with minimum 60 multimedia systems with the following specifications:
  i. P – IV Processor
    1. Speed – 2.8 GHZ
    2. RAM – 512 MB Minimum
    3. Hard Disk – 80 GB
  ii. Headphones of High quality

SUGGESTED SOFTWARE:
  • Glob arena’s software, 2002
  • Young India’s Clarity software, 2005

REFERENCES:
3. DELTA’s key to the Next Generation TOEFL Test: Advanced Skill Practice, New Age International (P) Ltd., Publishers, New Delhi, 2007

Course Educational Objectives: The objectives of this course are to
1. Understand the concepts such as discretization, natural co-ordinates, interpolation functions, stiffness matrix, force vectors, nodal displacements, boundary conditions etc.
2. Understand the beams subjected to different loads
3. Understand the concepts of axisymmetric solids subjected to axisymmetric loading and the importance of isoparametric elements
4. Understand the steady state heat transfer through plane walls and fin
5. Understand the Eigen value and Eigen vectors for dynamic problems

Course Outcomes: At the end of this course each student will be able to
1. Identify mathematical model for solution of common engineering problems
2. Determine the design quantities (deformation, strain, stress) for engineering structures under different loading conditions.
3. Formulate the design and heat transfer problems with application of FEM.
4. Create new solutions for the existing problems using FEM approaches.
5. Evaluate the natural frequencies of bar and beam structures

UNIT - I
INTRODUCTION TO FINITE ELEMENT METHOD FOR SOLVING FIELD PROBLEMS:
Stress and Equilibrium - Strain – Displacement relations- Stress – strain relations
ONE DIMENSIONAL PROBLEM: Finite element modeling coordinates and shape functions- Potential Energy approach - Assembly of Global stiffness matrix and load vector-Finite element equations- Treatment of boundary conditions

UNIT - II
ANALYSIS OF BEAMS: Hermite shape functions - Element stiffness matrix for two nodes, two degrees of freedom per node beam element – Treatment of boundary conditions
Finite element modeling of two dimensional stress analysis with Constant Strain Triangles and treatment of boundary conditions.

UNIT - III
AXISYMMETRIC LOADING AND NUMERICAL INTEGRATION :
Finite element modeling of axisymmetric solids subjected to axisymmetric loading with triangular elements.Two dimensional four nodedisoparametric elements, problems on isoperimetric formulation of four node quadrilateral elementNumerical integration-Gauss quadrature

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

UNIT - V
TEXT BOOKS

REFERENCES
S154 - CAD/CAM  
(Common to AE, ME)

Prerequisite Subject: Machine Tools  
Course Educational Objectives: To familiarize the students about:  
1. Appraisal of computers in design and manufacturing fields.  
2. Modelling of geometry using various entities and methodology.  
3. Principles and different aspects of Numerical control and part programming.  
4. Requisition for Group technology and FMS for advanced manufacturing firms.  
5. Distinctive CAQC techniques and implementation of CIM in manufacturing.

Course Outcomes:  
After completion of the course students are able to:  
1. Apply CAD/CAM principles for geometric modelling, design and manufacturing  
2. Generate codes for part profiles and can accomplish machining.  
3. Codify the part using GT codes and can apply GT system in automated manufacturing firm.  
4. Be cognizant of CAQC techniques that are to be applied in manufacturing.  
5. Comprehend the applications of Computer Integrated Manufacturing.

UNIT - I  
FUNDAMENTALS OF CAD: Introduction – The design process – The application of computers for design- Engineering data management– Benefits of CAD.

COMPUTER GRAPHICS: Raster scan graphics-Coordinate systems-Database structure for graphics modeling-Transformation of geometry: Translation, scaling, reflection, rotation, homogeneous transformations Concatenated transformations.

UNIT – II  
GEOMETRIC MODELING: REPRESENTATION OF CURVES: Introduction, wireframe models, wireframe entities, curve representation, parametric representation of analytical curves, parametric representation of Bezier and B-Spline curves.  
REPRESENTATION OF SURFACES AND SOLIDS: Introduction to surfaces, surface models surface entities. Introduction to solids, solid models, solid entities, Fundamentals of solid modeling, Boundary representation, CSG representation, sweep representation.

UNIT – III  

UNIT - IV  

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

REFERENCES
S367 - REFRIGERATION AND AIR CONDITIONING

Prerequisite Subjects: Thermodynamics, Thermal Engineering, Heat Transfer

Course Educational Objectives:
1. To understand and acquire the terminology used in refrigeration and air-conditioning.
2. To acquire the knowledge on VCR system.
3. To learn the performance and cycle analysis pertaining to VAR systems.
4. To understand the psychometric processes of air-conditioning systems.
5. To know the concepts of A/C systems and its load estimation procedures for different Air conditioning systems.

Course Outcomes:
After completion of the course, students are able to:
1. Demonstrate the basic concepts of refrigeration and related performance parameters.
2. Analyze the performance of VCR and VAR systems and differentiate with one another.
3. Design and develop the refrigerators using the VCR principles.
4. Demonstrate of psychometric properties and processes used in Air Conditioning.
5. Design and develop the Air-conditioning systems for thermal comfort conditions.

UNIT - I
REFRIGERANTS: Classification of refrigerants- Desirable properties-Nomenclature-Commonly used refrigerants- Alternate refrigerants –Green house effect, global warming
AIR REFRIGERATION SYSTEM: Introduction-Air refrigeration system working on Reversed Carnot cycle – Air refrigeration system working on Bell Coleman cycle- COP-Open and Dense air systems, Applications.

UNIT - II
VAPOUR COMPRESSION REFRIGERATION SYSTEM: Working principle-Simple vapour compression refrigeration cycle – COP- Representation of cycle on T-s and P-h charts- Effect of Sub cooling and Superheating --Actual Vapour compression cycle and its applications.

UNIT - III
VAPOUR ABSORPTION REFRIGERATION SYSTEM: Description and working of Aqua-Ammonia system- Calculation of maximum COP- Lithium Bromide- Water system-Principle of operation of Three fluid absorption system, Applications.
STEAM JET REFRIGERATION SYSTEM: Principle of working –Analysis-Applications.
NON CONVENTIONAL REFRIGERATION SYSTEMS- Thermo electric Refrigeration, Vortex tube refrigeration, Adiabatic demagnetization Refrigeration.

UNIT - IV
PSYCHROMETRY: Introduction - Psychrometric properties and relations- Psychrometric chart Psychrometric processes-Sensible, Latent and Total heat–Sensible Heat Factor and Bypass Factor.
HUMAN COMFORT: Thermodynamics of Human body-Effective temperature – Comfort chart.
UNIT - V
AIR CONDITIONING SYSTEMS: Introduction-Components of Air conditioning system-Classification of Air conditioning systems-Central and Unitary systems- Summer, Winter and Year round systems- Cooling load estimation.

DESIGN OF AIR CONDITION SYSTEMS: Summer air conditioning –ADP-System with Ventilated and re-circulated air with and without bypass factor- RSHF, GSHF and ESHF.

NOTE: Refrigerants & Psychrometric properties- by M.L. Mathur & F.S. Mehta data book will be supplied in the exam hall.

TEXT BOOKS

REFERENCES
S310 - METROLOGY AND INSTRUMENTION

Prerequisite Subject: Modern Machining Processes

Course Educational Objectives:
The objectives of this course are to:
1. Learn the basics of measurement system and experimental errors.
2. Learn about linear, angular and optical measuring instruments.
3. Familiarize with surface roughness measurement and limits and fits.
4. Learn about measurement of Displacement, Stress and Strain, and Force and Torque.
5. Learn about measurement of Pressure, Fluid flow and Temperature.

Course Outcomes:
After completion of the course student will be able to:
1. Apply different measuring techniques in quality control departments of industries and to ensure quality of products.
2. Design and use effectively the instruments for measure linear, angular and optical.
3. Analyze measuring systems of surface roughness and perform alignment/acceptance test effectively.
4. Design and use effectively the instruments for measuring stress, strain, force, torque etc.
5. Analyze measuring systems of Pressure, Fluid flow and Temperature.

UNIT – I
ANALYSIS OF EXPERIMENTAL DATA: Causes and types of experimental errors, Treatment of experimental data, Method of least squares, Graphical analysis and curve fitting.

UNIT - II
LINEAR MEASUREMENT: Standards of measurements- line and end standard. Basic principle and applications of slip gauges, dial indicator and micrometers.
ANGULAR MEASUREMENTS: Bevel protractor – angle slip gauges – sine bar, rollers and spheres used to determine the tapers, Applications of angular measurement.
OPTICAL MEASURING INSTRUMENTS: Tool maker’s microscope and its uses – collimators, optical projector – optical flats and their uses, interferometer, and those applications.

UNIT – III
LIMITS AND FITS: Introduction, Normal size, Tolerance limits, Deviations, Allowance, Fits and their types – unilateral and bilateral tolerance system, hole and shaft basis systems – interchangeability and selective assembly. Indian standard Institution system
UNIT – IV
MEASUREMENT OF DISPLACEMENT: Introduction, Classification, Dimensional measurement, Gauge blocks, Optical methods, Pneumatic gauge, Applications of displacement measurement.


MEASUREMENT OF FORCE AND TORQUE: Introduction, Elastic Transducer, Strain Gage Load Cells, Dynamometers- Mechanical, Hydraulic, Electrical, Applications of force and torque measurement.

UNIT – V
MEASUREMENT OF PRESSURE: Introduction, Manometers, Dial type pressure gauge, Pressure Transducers, Pitot, Static, and Pitot-Static Tube and Its characteristics, Low Pressure Measurement Gauges, Applications of pressure measurement.

MEASUREMENT OF FLUID FLOW: Introduction, Rotameter, Turbine flow meter, Laser Doppler Anemometer, Hot-wire Anemometer, Applications of fluid flow measurement.

MEASUREMENT OF TEMPERATURE: Introduction, Types of thermometers, Thermocouples, RTD, Thermisters, Pyrometers, Applications of temperature measurement.

TEXT BOOKS

REFERENCES
5. I C Gupta, Engineering Metrology, DhanpathRai
S303 - MECHANICS OF COMPOSITES
(Common to AE, ME)

Prerequisite Subject: Mechanics of Materials
Course Educational Objectives:
The objectives of this course are to:
1. To teach the differences between the stress strain relations
2. To know the different properties of composite materials
3. To teach the symmetric and Anti symmetric laminates
4. To illustrate materials used for sandwich construction

Course Outcomes:
After completion of the course student will be able to:
1. Understand the composition of FRP composites, their classification, advantages, applications and manufacturing methods.
2. Observe for the number of independent elastic constants required to solve a structural problem depending on the type of anisotropy in the material
3. Transform the material properties from material coordinates to geometric coordinates
4. Understand the different failure theories of FRP composites
5. Understand the interactions of constituents at micro level and estimate the aggregate properties of composite
6. Analyze laminate by extending lamina analysis.

UNIT - I
STRESS STRAIN RELATION:
Introduction- Definition of composites-classification

UNIT - II
METHODS OF ANALYSIS:
Micro mechanics – Mechanics of materials approach, elasticity approach to determine material properties – Macro Mechanics – Stress-strain relations with respect to on axis, off axis

UNIT - III
MULTI DIRECTIONAL COMPOSITES:
Governing differential equation for a general laminate, Classical Lamination Theory- Symmetric, Antisymmetric laminates, angle ply and cross ply laminates. Failure criteria for composites.

UNIT - IV
SANDWICH CONSTRUCTIONS:
Basic design concepts of sandwich construction - Materials used for sandwich construction - Failure modes of sandwich panels.

UNIT - V
FABRICATION PROCESSES:
Open and closed mould processes, lay-up, Vacuum bagging, Pultrusion, ResinTransfer Molding - Auto Clave-Filament Winding

TEXT BOOKS

REFERENCES
S231 - ENERGY CONSERVATION AND MANAGEMENT

Prerequisite Subject: Thermodynamics, Thermal Engineering

Course Educational Objectives:
1. To learn the basics of energy conservation and audit.
2. To learn the basics of waste heat recovery systems.
3. To learn the aspects of energy conservation methods in a variety of engineering situations.
4. To learn energy auditing procedures used in power plants.
5. To learn the economic issues based on energy utilization related to industries.

Course Outcomes:
After completion of the course students are able to:
1. Acquire knowledge on energy audit and energy conservation methods.
2. Acquire knowledge on cogeneration plant and other plants
3. Identify energy conservation opportunities and its implementation
4. Analyze practical relevance of waste heat recovery for plant economy and long term goals.
5. Apply economic methods for different thermal systems of a power plant.

UNIT - I
General energy problem, Energy uses patterns and scope of conversion.

ENERGY MANAGEMENT PRINCIPLE: Need, Organizing and managing an energy management program.

ENERGY AUDITING: Elements and concepts, Type of energy audits instruments used in energy auditing.

UNIT – II
ECONOMIC ANALYSIS: Cash flows, Time value of money, Formulae relating present and future cash flows- single amount, uniform series.

FINANCIAL APPRAISAL METHODS: Pay back periods, net present value, benefit cost ratio, internal rate of return and Life cycle cost / benefits.

UNIT – III
THERMODYNAMICS OF ENERGY CONSERVATION: Energy conservation in Boilers and furnace, Energy conservation in stream and condensate system.

COGENERATION: Concepts, type of cogeneration system, performance evaluation of a cogeneration system.

UNIT – IV

UNIT – V
ENERGY CONSERVATION IN ELECTRIC UTILITY AND INDUSTRY: Energy cost and two -part tariff, Energy conservation in utility by improving load factor, Load curve analysis, Energy efficient motors, Energy conservation in illuminating system, Importance of power factor in energy conservation - Power factor improvement methods, Energy conservation in industries.

TEXT BOOKS

REFERENCES
2. Industrial energy conservation Manuals: MIT Press.
Prerequisite Subject: Production Technology

Course Educational Objectives: To familiarize the students about:
1. Emphasis of Automation and Production systems in manufacturing area.
2. Automation in Material handling systems, transport systems, storage systems.
5. Optimization in Adaptive Control systems and applications of Adaptive Control systems.

Course Outcomes:
After completion of the course students are able to:
1. Accomplish automation in manufacturing industry.
2. Apply the techniques of Automation material handling and storage equipments depending upon the application.
3. Analyze progress functions of manufacturing systems.
4. Apply various algorithms to solve manual and automated flow lines.
5. Apply the optimized Adaptive Control System in automation.

UNIT – I
INTRODUCTION TO AUTOMATION: Basic elements of automated system, advanced automation functions, levels of automation.

UNIT – II
AUTOMATED MATERIAL HANDLING: Types of equipment, considerations in material system design, the ten principles of material handling.
MATERIAL TRANSPORT SYSTEMS: Industrial trucks, automated guided vehicle systems, rail guided vehicles, conveyor systems, cranes and hoists.
STORAGE SYSTEMS: Storage system performance, storage location strategies, conventional storage methods and equipment, automated storage systems.

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

UNIT – IV
MANUAL ASSEMBLY LINES: fundamentals, alternative assembly systems, design for assembly, analysis of single model assembly lines, line balancing algorithms, mixed model assembly lines.
AUTOMATED FLOW LINES: Fundamentals of automated production lines, applications of automated production lines, analysis of transfer lines with no internal storage, analysis of transfer lines with storage buffers.
UNIT – V

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

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

TEXT BOOKS

REFERENCES
Prerequisite Subject: Operation Research

Course Educational Objectives:
The objective of this course is to:
1. Classify various optimization algorithms required for engineering systems.
2. Illustrate engineering design problem as a mathematical optimization problem.
3. Use mathematical software for the solution of engineering problem.
4. Enhance logical thinking required for problem solving.
5. Describe engineering problems as mathematical models.

Course Outcomes:
After completion of the course students are able to:
1. Apply concepts of optimization techniques to solve engineering problems.
2. Develop mathematical optimization models for a range of practical problems.
3. Design large-scale Linear and Integer Programming problems and then solve the problem.

UNIT -I

UNIT -II

UNIT -III

UNIT -IV

UNIT- V
ADVANCES IN SIMULATION: Introduction, Simulations Models, Monte-Carlo Simulation, Simulation of Inventory Problems.Genetic algorithms – simulated annealing – Neural Network and Fuzzy systems,Applications

TEXT BOOKS

REFERENCES
S319 - NANO TECHNOLOGY  
(Common to AE, EIE, ME)

Course Educational Objectives:
In this course student will learn about
1. The basics of Nanoscience and Technology.
2. Various process techniques available for the processing of Nanostructured materials.
3. The exotic properties of nanostructured materials at their nanoscale lengths.
4. Different nanoparticles synthesis methods and their skills.
5. The reactive merits of various process techniques.

Course Outcomes:
At the end of this course student will be able to
1. Have a sound grounding and expert knowledge in multidisciplinary areas of nanoscience
2. Understand the basic scientific concepts underpinning nanoscience
3. Understand the properties of materials at the atomic/molecular level and the scaling laws governing their properties
4. Understand the relationships and connections across the sciences and non-science disciplines that are core to nanotechnology
5. Understand the current frontier developments in nanotechnology.

UNIT – I
INTRODUCTION TO NANOTECHNOLOGY
Definition of Nano-Science and Nano Technology, Applications of Nano-Technology. Introduction to Physics of Solid State: Structure: Size dependence of properties; crystal structures, face centred cubic nanoparticles; Tetrehedrally bounded semiconductor structures; lattice vibrations. Energy Bands: Insulators, semiconductor and conductors; Reciprocal space; Energy bands and gaps of semiconductors; effective masses; Fermi Surfaces.

UNIT – II
SYNTHESIS METHODS & METHODS OF MEASURING PROPERTIES
Various nanomaterial synthesis approaches, RF plasma, sputtering, chemical methods, thermolysis, Pulsed Laser Methods.

UNIT – III
CARBON NANOSTRUCTURES
Carbon molecules, nature of the carbon bond, new carbon structures, Carbon nanotubes, fabrication, types, electrical, vibrational and mechanical properties, Applications of carbon nanotubes: computers, fuel cells, chemical sensors.

UNIT- IV
QUANTUM WELLS, WIRES AND DOTS
Preparation of quantum nanostructures, size and dimensionality effects, size effects, conduction electrons and dimensionality, fermi gas and density of states, potential wells, particle confinement, Properties dependent on density of states, Excitons, Single electron tunneling, Applications: Infrared detectors, Quantum dot lasers.
UNIT – V
NANOMACHINES AND NANODEVICES
Micro-electro-mechanical systems (MEMS), characteristics, Nano-electro-mechanical systems (NEMS), fabrication techniques, nanodevices and nanomachines, Molecular and supramolecular switches.

TEXT BOOKS

REFERENCES
Course Educational Objectives:
In this course student will learn about
2. The benefits of miniaturization and the advantages of MEMS devices
5. The application of MEMS in various fields, example Biomedical Sensors, Chemical sensors, Optical Sensors, Pressure Sensors, Thermal Sensors, Micro grippers, Micro motors, Micro gears, Micro pumps.

Course Outcomes:
At the end of this course student will be able to
1. Think in a unified way about interdisciplinary Microsystems.
2. Understand the operation of a wide range of sensors and actuators appropriate for micro scale systems encompassing different energy domains.
3. Explain the technological and economical requirements that can make a micro system a commercial success and list successful examples.
4. Choose micro fabrication methods suited for the fabrication of a given micro system and explain how the various processes can be integrated.
5. Evaluate and choose transduction principles (e.g., electrostatic or magnetic) for actuation in a micro system and perform analytical calculations for a simple actuator based on them.
6. Describe, analyze and solve a concrete problem involving micro technology

UNIT – I
OVERVIEW OF MEMS:
MEMS and Microsystems definitions and examples, Difference between Microsystems and Microelectronics, Benefits of miniaturization, Applications: Industrial/automotives sensors, Medical systems, aircraft sensors, Structural health monitoring, Telecommunication etc, Materials for MEMS.

UNIT – II
SCALING LAWS IN MINIATURIZATION:
Introduction to Scaling, Scaling in Geometry, Scaling in Electrostatic forces.MEMS Design Considerations.

UNIT – III
MICRO FABRICATION – I:
Introduction, Photolithography, Photo resists and Application, Light Sources, Photo resist Removal, Ion Implantation, Diffusion, Oxidation, Chemical Vapour Deposition (CVD), Sputtering, Deposition by Epitaxy, Etching.

UNIT – IV
MICRO FABRICATION – II
Bulk Micromachining: Etching-Isotropic and Anisotropic, Wet Etching and Dry Etching (Plasma, Deep reactive ion) Comparison.
Surface Micromachining: Process, associated Mechanical problems (Adhesion, Interfacial stresses, Stiction), LIGA process, MEMS Packaging.
UNIT – V
MEMS DEVICES AND STRUCTURES

TEXT BOOK
Tai-Ran Hsu, MEMS & Microsystems Design and Manufacture, Tata McGraw Hill.

REFERENCES
3. G.K. Anantha Suresh, “Micro and Smart Systems.”, Wiley India
S370 - RENEWABLE ENERGY SOURCES  
(Common to EIE, IT, ME) 

Course Educational Objectives:
1. To learn the Potential importance of renewable energy sources.
2. To learn the geothermal, Wind Energy systems.
3. To learn Critical issues related to the OTEC and Tidal Energy systems.
4. To learn power generation from Bio mass plants.
5. To learn the Direct Energy Conversion system principles.

Course Outcomes:
After the completion of course, students are able to
1. Design the various types of solar systems.
2. Develop the skills to operate and analyze geothermal energy plant.
3. Analyze the power generating capacities of Tidal, Ocean and Thermal Energy Conversion systems.
4. Design and Develop simple bio gas plants
5. Design and Develop the Direct Energy conversion systems.

UNIT - I

UNIT - II

UNIT - III

UNIT - IV

UNIT - V
TEXTBOOKS

REFERENCES
S357 - PROJECT MANAGEMENT
(Common to EEE, ME)

Prerequisite Subject: Estimation, Costing and Engineering Economics
Course Educational Objectives:
The objective of this course is to:
1. Create awareness about project management concepts.
2. Discuss the various methods and approaches for project management.
3. Discuss the concepts of PERT, CPM techniques.
4. Discuss various factors involved in risk management.
5. Illustrate various costs - estimating & budget tools

Course Outcomes:
After completion of the course student will be able to:
1. Apply concepts of PM in managing the product life cycle.
2. Formulate, plan, schedule and control the projects effectively.
3. Manage risks while handling the projects.
4. Perform financial planning of the project.
5. Design effective projects using PERT & CPM techniques.

UNIT – I
INTRODUCTION TO PROJECT MANAGEMENT
Definition, functions, evolution of Project Management, classification of projects, Project Management in different environments
THE PROJECT MANAGEMENT SYSTEMS, METHODOLOGIES & SYSTEMS DEVELOPMENT CYCLE: Systems approach, systems analysis, systems development, project feasibility, project life cycle, project appraisal, project contracting, the phases of systems development cycle.

UNIT – II
PROJECT FEASIBILITY STUDY
Developing a project plan, market & technical analysis, financial analysis, evaluation of project proposals, risk analysis, sensitivity analysis, social cost benefit analysis; Project Planning: Planning fundamentals, project master plan, work breakdown structure & other tools of project planning, work packages project organization structure & responsibilities.

UNIT – III
PROJECT SCHEDULING
Use of Gantt Charts & network diagrams, activity of node diagrams, activity on arrow diagrams, the critical path, time based networks PERT, CPM, Resource Allocation & GERT: Tools & techniques for scheduling development, crashing of networks, time cost relationship, resource leveling multiple project scheduling, GERT

UNIT – IV
COST ESTIMATING & BUDGETING
Cost estimating process elements of budgeting, project cost accounting & management information systems, cost schedules & forecast

UNIT – V
MANAGING RISKS IN PROJECTS
Risk concept & identification, risk assessment, risk priority, risk response planning, risk management methods; Project Control: Information monitoring, internal & external project control, cost accounting systems for project control, control process, performance analysis, variance limits, and issues in project control.
TEXT BOOK
1. Nicholas, John M., “Project Management for Business & Technology (Principles & Practice)”, Pearson Education

REFERENCES
2. Shtub, Bard and Globerson, “PROJECT MANAGEMENT, Engineering, Technology and Implementation”, Prentice Hall, India
L117 - CAD / CAM LAB

Prerequisite Subject: CAD/CAM

Course Educational Objectives: To familiarize the students with

1. Modeling and assembly of part bodies using graphic packages.
2. Analysis of modeled parts.
3. Finite element analysis of given continuum.
4. Part programming and machining on CNC Machines.
5. Robotic programming, simulation and execution.

Course Outcomes:
After completion of the lab students are able to:

1. Design and assemble of the parts using geometric modeling.
2. Perform kinematic and interference analysis.
3. Apply FEA principles in designing of components.
4. Develop NC code for different part profiles and perform machining on CNC Machines.
5. Manipulate the robot by writing programs and executing them.

LIST OF EXPERIMENTS

1. AssemblyModeling (At least three examples)
2. Analysis of trusses
3. Analysis of Beams
4. Plane stress, plane strain analysis
5. Analysis of Axi-symmetric solids
6. Analysis of 3D solids
7. Estimation of natural frequencies and mode shapes for simple problems
8. Steady state heat transfer Analysis
9. Development of NC code using CAM packages
10. Machining of simple components on NC lathe and Mill by transferring NC Code /from a CAM package
11. Machining of Simple components on NC-Mill by transferring NC Code/from a CAM Package
12. Robot programming, simulation and execution.

SOFTWARE PACKAGES
ANSYS/NASTRAN/CATIA /ProE/ Iron CAD etc.

REFERENCE
Lab Manuals
L160 - METROLOGY AND INSTRUMENTATION LAB

Prerequisite Subject: METROLOGY & INSTRUMENTATION
Course Educational Objectives:
The objectives of this course are to:
1. Learn the main principle on which different instruments operate and provide hands on experience on them.
2. Generate knowledge and skill in use of precision instruments.
3. Learn a basic understanding of various instruments used in linear and angular measurements.
4. Get familiarize with usage of tool makers microscope.
5. Learn a basic understanding of the instruments used for measurement of pressure, temperature, flow etc.

Course Outcomes:
After completion of the course student will be able to:
1. Develop quality standards of engineering products in industries.
2. Demonstrate work in quality control departments of industries and to ensure quality of products.
3. Analyze the measurement of the surface roughness and perform alignment tests.
4. Develop the ability to apply the principles in instruments and measuring techniques.
5. Demonstrate work in designing the instrumentation for a particular purpose and special purpose devices.

PART-A: METROLOGY
At least five experiments may be conducted.
1. Measurement of lengths, heights, diameters by vernier calipers and micrometers.
3. Taper measurement by using balls and rollers.
4. Use of gear teeth vernier calipers and checking the chordal addendum and chordal height of spur gear.
5. Machine tool alignment of test on the lathe or milling machine.
7. Angle and taper measurements by Bevel protractor, Sine bars, etc.
8. Thread measurement by three wire method.
9. Surface roughness measurement by Taly Surf.

PART-B: INSTRUMENTATION
At least five experiments may be conducted.
1. Calibration of Pressure Gauges
2. Study and calibration of LVDT transducer for displacement measurement.
3. Calibration of strain gauge for load measurement.
5. Study and calibration of photo and magnetic speed pickups for the measurement of speed.
6. Study and calibration of a rotameter for flow measurement.
7. Study of Piezo-electric transducer.
8. Study and use of a Seismic pickup for the measurement of vibration amplitude of an engine bed at various loads.
9. Study and calibration of McLeod gauge for low pressure.

REFERENCE
LAB MANUALS
Prerequisite Subject: Thermal Engineering and ICGT

Course Educational Objectives:
1. To learn about features and performance of a thermal power plant cycle
2. To learn about diesel engine and gas turbine power plants.
3. To learn about the hydroelectric and nuclear power plants.
4. To learn about nonconventional power plants.
5. To learn the procedure of power tariff calculations and economics of power generations.

Course Outcomes:
After completion of the course students are able to:
1. Develop awareness on different types of power generation systems.
2. Differentiate conventional and nonconventional power plants.
3. Distinguish between polluting and nonpolluting power plants.
4. Acquire knowledge on the economic viability of various power generation systems.
5. Apply the power plant engineering concepts practically in developing low cost systems.

UNIT - I
INTRODUCTION: Various Energy sources-Types of power plants-Resources and Development of Power in India.


UNIT - II

GAS TURBINE PLANT: Introduction-Classification-Layout with auxiliaries-Principles of working of Closed and Open cycle gas turbines-Combined cycle power plants and comparison.

UNIT - III


UNIT - IV
POWER FROM NON-CONVENTIONAL SOURCES: Solar power plants-Utilization of Solar collectors-Principle of working of Wind energy-Types- Tidal Energy.

DIRECT ENERGY CONVERSION SYSTEM: Solar cell- Fuel cell-Thermo Electric and Thermo ionic conversion system-MHD generation.
UNIT - V
POLLUTION AND CONTROL: Introduction- Particulate and gaseous pollutants-Air and Water pollution by Thermal plants and its control—Acid rains-Methods to control pollution.

TEXT BOOKS

REFERENCES
Prerequisite Subject: Mechanics of Materials

Course Educational Objectives:
The objective of the course is to
1. Familiarize the concepts of shear center and unsymmetrical bending
2. Learn the continuous beam problems and curved beams
3. Familiarize the concept of torsion and rotating disc of uniform strength
4. Acquire the knowledge columns subjected to eccentric axial loads
5. Learn concept of contact stresses.

Course Outcomes:
After completion of the course student will be able to:
1. Develop an approximate solution for the location of shear centre.
2. Analyze the torsion problems of circular cross section.
3. Analyze the local buckling of thin wall flanges of elastic columns
4. Apply the knowledge of curved beams in the field of engineering.
5. Analyze the maximum principle and shear contact stresses between two ideal elastic bodies

UNIT - I
SHEAR CENTER AND UNSYMMETRICAL BENDING: Bending axis and shear center – Shear center for axi-symmetric and unsymmetrical sections – Bending stresses in beams subjected to non-symmetrical bending – Deflection of straight beams due to non-symmetrical bending.

UNIT - II
CONTINUOUS BEAMS: Clapeyron’s theorem of three moments – Beams with constant and varying moment of inertia.

UNIT - III
TORSION: St.Venant’s approach - Prandtl approach – Membrane analogy – Torsion of thin walled open and closed sections.

UNIT - IV
COLUMNS: Buckling and stability – Columns with pinned ends – Columns with other support conditions -Limitations of Euler’s formula – Rankin’s formula – Columns with eccentric axial loads – Secant formula.

UNIT - V
THIN WALLED PRESSURE VESSELS: Circumferential and longitudinal stresses – Riveted cylindrical boilers –Wire bound thin pipes – Cylinder with hemispherical ends.
CONTACT STRESSES: Methods of computing stress – Deflection of bodies in point and line contact applications.

TEXT BOOKS

REFERENCES
1. Dr. Sadhu Singh, Strength of Materials, Khanna Publishers
2. Gere and Timoshenko, Mechanics of Materials, CBS Publishers & Distributers
S165 - COMPUTATIONAL FLUID DYNAMICS

Prerequisite Subject: Fluid Mechanics and Heat Transfer

Course Educational Objectives:
1. To learn the elements of computational methods of fluid flow
2. To learn about the application of CFD to different fields of engineering
3. To learn the flow fields and the behaviour of fluid, combustion etc.,
4. To learn to get the solutions to the complicated problems by using the techniques of CFD
5. To learn the Finite difference equations in Heat Transfer

Course Outcomes:
After completion of the course student will be able to:
1. Acquire the ability to visualize the CFD techniques for the fluid flow fields of combustion chamber of IC engines and consequently analyze the behaviour of fluid.
2. Know the effects of important parameters on the performance and efficiency of the system.
3. Carry out the simulation studies for various thermal systems.
4. Know the importance of the simulation studies where there is no scope for carrying out the experimental work.
5. Attempt to improve the performance and efficiency of thermal systems based on the simulation results.

UNIT - I
INTRODUCTION: Computational Fluid Dynamics as a Research and Design Tool, Applications of Computational Fluid Dynamics

GOVERNING EQUATIONS OF FLUID DYNAMICS: Introduction, Control Volume, Substantial Derivative, Divergence of Velocity, Continuity Equation, Momentum Equation and Energy Equation

UNIT - II
MATHEMATICAL BEHAVIOR OF PARTIAL DIFFERENTIAL EQUATIONS: Introduction, Classification of Quasi-Linear Partial Differential Equations, Eigen Value Method, Hyperbolic Equations, Parabolic Equations, Elliptic Equations

UNIT - III
BASICS ASPECTS OF DISCRETIZATION: Introduction, Introduction of Finite Differences, Difference Equations, Explicit and Implicit Approaches, Errors and Stability Analysis, Grid Generation

UNIT - IV
INCOMPRESSIBLE FLUID FLOW: Introduction, Implicit Crank-Nicholson Technique, Pressure Correction Method, Computation of Boundary Layer Flow

UNIT - V

TEXT BOOK

REFERENCES
2. Suhas V. Patankar, Numerical heat transfer and fluid flow - Butter-worth Publishers
Prerequisite Subject: CAD/CAM

Course Objective: The objectives of the course are:
1. To familiarize students with principles and application of rapid prototyping.
2. Understand the concepts of solid based and powder based rapid prototyping systems.
3. Learn the basic concepts of rapid tooling elements.
4. Get familiarized with data formats and software.
5. Understand the basic concept of reverse engineering.

Course Outcomes:
After completion of the course student will be able to:
1. Apply rapid prototyping techniques in developing various products.
2. Differentiate between solid based and powder based rapid prototyping.
3. Suggest a particular rapid tool for a product.
4. Use the software in designing the product.
5. Apply reverse engineering concepts for developing products.

UNIT-I

LIQUID BASED RAPID PROTOTYPING SYSTEMS:
Principle of operation, process details, data preparation, data files, machine details and applications - Stereo lithography Apparatus (SLA), Solid Ground Curing (SGC)

UNIT-II
SOLID BASED RAPID PROTOTYPING SYSTEMS: Principle of operation, process details, data preparation, data files, machine details and applications - Laminated Object Manufacturing (LOM), Fused Deposition Modeling (FDM), Paper Lamination Technology (PLT)

POWDER-BASED RAPID PROTOTYPING SYSTEMS: Principle of operation, process details, data preparation, data files, machine details and applications - Selective Laser Sintering (SLS), Three-Dimensional Printing (3DP), Laser Engineered Net Shaping (LENS), Direct Shell Production Casting (DSPC).

UNIT-III
RAPID TOOLING: Indirect Rapid tooling - Silicon rubber tooling - Aluminium filled epoxy tooling Spray metal tooling, Cast kirkite, 3D keltool; Direct Rapid Tooling - AIM, Quick cast process, Copper Polyamide, Rapid Tool, DMILS, Pro Metal, Sand casting tooling, Laminate tooling soft Tooling vs. hard tooling.

UNIT-IV
RAPID PROTOTYPING DATA FORMATS AND SOFTWARE:
UNIT-V
REVERSE ENGINEERING:
Meaning and uses of RE, Relationship between Reverse Engineering and Rapid Prototyping, Legal Aspects of Reverse Engineering. The generic processes of RE, Phase 1–scanning, Contact Scanners, Noncontact Scanners, Phase 2–Point Processing, Phase 3–Application Geometric Model Development, Reverse Engineering–Hardware and Software. METHODOLOGIES and Techniques for Reverse Engineering: Computer Vision and Reverse Engineering, Coordinate Measuring Machines, Active Illumination 3-D Stereo, Data Collection, Mesh Reconstruction, Surface Fitting. Integration of reverse engineering and rapid prototyping.

TEXT BOOKS

REFERENCES
S353 - PRODUCTION PLANNING AND CONTROL

Prerequisite Subject: Industrial Management and Operation Research

Course Educational Objectives:
The objectives of the course are to
1. Understand the basic concepts of production planning and control.
2. Familiarize with different forecasting techniques.
3. Familiarize the concepts of inventory management.
4. Understand the concepts of routing and scheduling.
5. Acquire basic knowledge in aggregate planning, expediting and follow up.

Course Outcomes:
After completion of the course student will be able to:
1. Exhibit the ability in developing production planning for operating economy, effectiveness and cost control.
2. Apply the forecasting techniques in estimating the number of products.
3. Use the inventory management techniques to determine the optimum quantity of material.
4. To develop the route sheet required for a production process/activities.
5. To decide the dispatch procedure required for a production processes and other activities.

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

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

UNIT - III
INVENTORY MANAGEMENT – purpose of inventories – relevant inventory costs, EOQ model and assumptions in EOQ.ABC analysis – VED analysis.Inventory control systems – P–Systems and Q-Systems. Introduction to MRP, inputs to MRP, Bill of material, JIT inventory-Kanban system.

UNIT - IV

UNIT - V

TEXT BOOKS

REFERENCES
2. SamuelEilon, Elements of Production Planning and Control, Universal Publishing Corporation, 2004
3. Seetharama L.N, Production Planning and Inventory Control, PHI, 2nd Edition1995
S158 - COGNITIVE ENGINEERING

Prerequisite Subject: Work Study and Ergonomics

Course Educational Objectives:
The objective of this course is to:
1. Underline the importance of Cognitive usability concepts.
2. Discuss the application of scientific research in system and product design.
3. Create awareness about concepts of Cognitive Engineering.
4. Illustrate various stages in product design.
5. Describe the concepts of human centered design.

Course Outcomes:
After completion of the course students are able to:
1. Differentiate between human perceptual and cognitive limitations.
2. Apply quantitative models of perception and cognition to analyse human performance.
3. Design equipment, products, and tasks that address human perceptual and cognitive limitations.
4. Design appropriate experiments to determine human perceptual limitations.
5. Distinguish the cognitive limitations and capabilities required for designing a product or process.

UNIT - I
INTRODUCTION

UNIT - II
MEMORY MODELS
Three Stage memory model, Sensory memory: the sperling experiment, short-term memory: Jacob’s experiment, Chucks, Long term memory; Ebbing Hans Forgetting Curve; Tulvings long term memory model, memory retrieval.

UNIT - III
STAGES IN DESIGN
The seven stages of action, Gulf of Exec ution and Gulf of Evaluation, Basic design principles, Visibility, A good conceptual model, good mapping, feedback.

UNIT - IV
MENTAL MAPPING
Physical constraints, semantic constraints, cultural constraints, logical constraints affordances, Natural Mapping, The problem with switches, grouping problem, mapping problem, Visibility and feedback, the structure of tasks, simplifying the structure of tasks.

UNIT - V
USER- CENTRED DESIGN
Use of both knowledge in the world and the head; simplifying the structure of tasks, make things visible, bridge the gulf of execution and the gulf of evaluation, get the mapping right, exploit the power of constraints, Design for errors, Case studies of Cognitive Engineering.

TEXT BOOK

REFERENCES
Prerequisite Subject: Robotics

Course Educational Objectives: To familiarize the students about:
1. Frame of reference on mechatronic systems and system response.
2. Emphasis of signal conditioning in manipulation of analog signals.
3. Distinctive mechanical sensors for the measurement of physical quantities.
4. Overview of Distinctive actuating systems Microcontrollers.
5. Performance of Programmable Motion Controllers in Various fields

Course Outcomes:
After completion of the course students are able to:
1. Implement the mechatronic systems in various industrial fields.
2. Apply Signal conditioning in sensors for more accurate measurements.
3. Measure various physical quantities using sensors.
4. Implement actuators and Microcontrollers in Automobile engine control systems and robotics.
5. Integrate programmable motion controllers with Automation, Aerospace and Robotic fields.

UNIT-I
INTRODUCTION TO MECHATRONICS: Definition of mechatronics-components of mechatronics-example of mechatronic system-elements of measurement systems.
SYSTEM RESPONSE: System response-measurement system input-output-dynamic characteristics of systems: zero order system-first order system – second order system-step response of second order system (Under damped, critically damped and over damped).

UNIT-II
SYSTEM MODELLING: System modelling and analogies: Relationship between Mechanical system-Translational and rotational-Electrical (current and voltage)-Electromechanical systems-hydraulic mechanical system.
SIGNAL CONDITIONING & DAQ: Signal Conditioning-OPAMP-filtering-Wheatstone bridge-Quantizing theory-Analog to Digital Conversions (ADC)-Digital to Analog Conversions (DAC)-Virtual Instrumentation, DAQ and control.

UNIT-III
STRESS AND STRAIN MEASUREMENT: Measurement of Resistance with Wheatstone bridge-measurement of stress with strain gauges-load cells.

UNIT-IV
INTRODUCTION TO MICROCONTROLLERS: Difference between Micro Processors and microcontrollers –Intel 8051 block diagram and pin diagram-applications –languages used in MC.
INTERFACING MICROCONTROLLER WITH ACTUATORS: Interfacing-interfacing requirements –serial interfacing and parallel interfacing-Interfacing with seven segment display with decoder-Interfacing with relays- with solenoids- with sensors-interfacing with stepper motors-interfacing with DAC’s.
UNIT-V
PLC: Programmable Logic Controller-advantages of PLC’s-basic structure of PLC’s-input-output-forms of PLC’s-Input output processing-Ladder programming –logic functions-instructions-internal relays-operation of timers and counters (briefly)-advantages of PLC over other controllers.

TEXT BOOKS

REFERENCES
S273 - INNOVATION AND ENTREPRENEURSHIP

Prerequisite Subject: Industrial Management

Course Educational Objectives:
1. To understand the nature of entrepreneurship.
2. To motivate the Entrepreneurial instincts.
3. To give a clear picture about the process and involved in setting up an small scale industrial settings and bigger settings.
4. To make the potential entrepreneurs know about the possible risks and failures of the product make them learn how to overcome these problems
5. To make students understand the importance of innovation, which would be helpful to have an edge over all other competitors

Course Outcomes:
After completion of the course student will be able to:
1. Can develop various business related skills like marketing, quality management, production, distribution and human resource management etc.
2. Will be able to startup and handle the own enterprise.
3. Will be able to develop team building, planning skills and above all broad vision about the business.
4. Would be in a position to convert and innovative thought into a commercial opportunity, which can boost up the economy.

UNIT-I
CREATIVITY AND INNOVATION: Concepts, shifting, composition of the economy, purposeful innovation and seven sources of innovative opportunity, the innovation process. Innovative strategies: strategies that aim at introducing an innovation. Innovation and entrepreneurship: can they work together? Planning – incompatible with innovation and entrepreneurship

UNIT-II
INTRODUCTION TO ENTREPRENEURSHIP: Definition of Entrepreneur, Entrepreneurial Traits, Traditional entrepreneurship vs Modern Entrepreneurship, Entrepreneur vs. Manager, Entrepreneur vsIntrapreneur. The Entrepreneurial decision process.Role of Entrepreneurship in Economic Development, Ethical, Environmental challenges and Social responsibility of Entrepreneurs.Opportunities for Entrepreneurs in India and abroad.Woman as Entrepreneur.

UNIT- III
CREATING AND STARTING THE VENTURE: Sources of new Ideas, Generation of new entry Opportunity, Opportunity Analysis, creating, problem solving, product planning and development process. SWOT Analysis; first-Mover advantages and disadvantagesTypes of business organizations, Features and evaluation of joint ventures, acquisitions, merges, franchising.

UNIT - IV
UNIT - V
PRODUCTION AND MARKETING MANAGEMENT: Thrust of production management, Selection of production Techniques, plant utilization and maintenance, requirements at work place, materials management. Marketing functions, market segmentation, market research and channels of distribution, Sales promotion and product pricing.

TEXT BOOKS
1. Hisrich : Entrepreneurship, TMH, New Delhi, 2009
2. by Martin M.J ,“Managing innovation and entrepreneurship in technology based firm”. John Wiley publishers,1994,

REFERENCES
1. Vasantha Desai ,Entrepreneurship, TMH,New Delhi, 2009
2. Rajeev Roy: Entrepreneurship, Oxford University Press, New Delhi,2010
Prerequisite Subject: Production Planning and Control

Course Objectives:
The objective of this course is to:
1. Underline the significance of Quality Management in industries.
2. Describe the principles of Quality control and business models.
3. Illustrate various statistical process control tools required for the industry.
4. Discuss various quality control models and their applications.
5. Create awareness about quality systems methodology for its implementation.

Course Outcomes:
After completion of the course students are able to:
1. Apply the principles of quality control.
2. Use quality management methods for analyzing and solving problems of organization.
3. Design efficient systems.
4. Apply the principles of Taguchi techniques to the industrial needs.
5. Implement quality system standards in the organizations.

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

UNIT - II

UNIT - III
STATISTICAL PROCESS CONTROL : The seven tools of quality, Statistical Fundamentals, Population and Sample, Normal curve, Control charts for variables and attributes, Process capability, Concepts of six sigma, New seven Management tools.

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

UNIT - V

TEXT BOOK

REFERENCES