ANNA UNIVERSITY, CHENNAI
AFFILIATED INSTITUTIONS
R – 2013
B.E. ROBOTICS AND AUTOMATION
I - VIII SEMESTERS CURRICULUM AND SYLLABUS

SEMESTER I

<table>
<thead>
<tr>
<th>SL. No.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>THEORY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>HS6151</td>
<td>Technical English – I</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>MA6151</td>
<td>Mathematics – I</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>3.</td>
<td>PH6151</td>
<td>Engineering Physics – I</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>CY6151</td>
<td>Engineering Chemistry – I</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>GE6151</td>
<td>Computer Programming</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>GE6152</td>
<td>Engineering Graphics</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>PRACTICALS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>GE6161</td>
<td>Computer Practices Laboratory</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>8.</td>
<td>GE6162</td>
<td>Engineering Practices Laboratory</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>9.</td>
<td>GE6163</td>
<td>Physics and Chemistry Laboratory - I</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td>17</td>
<td>2</td>
<td>11</td>
<td>26</td>
</tr>
</tbody>
</table>

SEMESTER II

<table>
<thead>
<tr>
<th>SL. No.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>THEORY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>HS6251</td>
<td>Technical English – II</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>MA6251</td>
<td>Mathematics – II</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>3.</td>
<td>PH6251</td>
<td>Engineering Physics – II</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>CY6251</td>
<td>Engineering Chemistry – II</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>GE6252</td>
<td>Basic Electrical and Electronics Engineering</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>6.</td>
<td>GE6253</td>
<td>Engineering Mechanics</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>PRACTICALS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>GE6261</td>
<td>Computer Aided Drafting and Modeling Laboratory</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>8.</td>
<td>GE6262</td>
<td>Physics and Chemistry Laboratory - II</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td>19</td>
<td>4</td>
<td>4</td>
<td>25</td>
</tr>
</tbody>
</table>
### SEMESTER – III

<table>
<thead>
<tr>
<th>SL. No.</th>
<th>CODE NO.</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>THEORY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>MA6351</td>
<td>Transforms and Partial Differential Equations</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>EC6302</td>
<td>Digital Electronics</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>RO6301</td>
<td>Sensors and Instrumentation</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>4.</td>
<td>EC6202</td>
<td>Electronic Devices and Circuits</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>5.</td>
<td>EE6356</td>
<td>Electrical Machines and Power Systems</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>GE6351</td>
<td>Environmental Science and Engineering</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>PRACTICAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>EC6362</td>
<td>Electronic Circuits and Digital Laboratory</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>8.</td>
<td>EE6363</td>
<td>Electrical Machines Laboratory</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td>18</td>
<td>2</td>
<td>8</td>
<td>24</td>
</tr>
</tbody>
</table>

### SEMESTER – IV

<table>
<thead>
<tr>
<th>SL. No.</th>
<th>CODE NO.</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>THEORY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>MA6451</td>
<td>Probability and Random Processes</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>RO6401</td>
<td>Automatic Control Systems</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>MF6505</td>
<td>CNC Machining Technology</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>EC6301</td>
<td>Object Oriented Programming and Data Structures</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>EC6404</td>
<td>Linear Integrated Circuits</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>AN6402</td>
<td>Kinematics and Dynamics of Machinery</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>PRACTICAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>RO6411</td>
<td>CNC and Metrology Laboratory</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>8.</td>
<td>ME6511</td>
<td>Dynamics Laboratory</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>9.</td>
<td>EC6467</td>
<td>LIC and Control Systems Laboratory</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td>18</td>
<td>2</td>
<td>9</td>
<td>26</td>
</tr>
</tbody>
</table>

### SEMESTER – V

<table>
<thead>
<tr>
<th>SL. No.</th>
<th>CODE NO.</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>THEORY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>ME6015</td>
<td>Operations Research</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>RO6501</td>
<td>Programmable Logic Controllers</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>3.</td>
<td>RO6502</td>
<td>Basics of Robotics</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>EE6502</td>
<td>Microprocessors and Microcontrollers</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>RO6503</td>
<td>Mechanical Design</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>6.</td>
<td>CS6303</td>
<td>Computer Architecture</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>PRACTICAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>RO6511</td>
<td>Engineering Design Laboratory</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>8.</td>
<td>MT6712</td>
<td>Robotics Laboratory</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>9.</td>
<td>RO6512</td>
<td>Innovation Laboratory</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td>18</td>
<td>1</td>
<td>10</td>
<td>25</td>
</tr>
</tbody>
</table>
### SEMESTER – VI

<table>
<thead>
<tr>
<th>SL. No.</th>
<th>CODE NO.</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>THEORY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>EC6653</td>
<td>Power Electronics and Drives</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>EC6655</td>
<td>Embedded and Real time Systems</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>RO6601</td>
<td>Vision Systems and Image processing</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>RO6602</td>
<td>Automation System Design</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>EC6665</td>
<td>Economics for Engineers</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>Elective I</td>
<td></td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>PRACTICAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>EC6663</td>
<td>Power Electronics and Drives Laboratory</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>8.</td>
<td>RO6611</td>
<td>Automation System Design Laboratory</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>9.</td>
<td>RO6612</td>
<td>Industrial Visit cum Lecture</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
<td>17</td>
<td>4</td>
<td>9</td>
<td>25</td>
</tr>
</tbody>
</table>

### SEMESTER – VII

<table>
<thead>
<tr>
<th>SL. No.</th>
<th>CODE NO.</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>THEORY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>RO6701</td>
<td>Precision Equipment Design</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>RO6702</td>
<td>Field and Service Robotics</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>RO6703</td>
<td>Totally Integrated Automation</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>Elective II</td>
<td></td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>Elective III</td>
<td></td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>Elective IV</td>
<td></td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>PRACTICAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>RO6711</td>
<td>Totally Integrated Automation Laboratory</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>8.</td>
<td>RO6712</td>
<td>Product Design Laboratory</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>9.</td>
<td>RO6713</td>
<td>Design and Fabrication Project</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
<td>18</td>
<td>3</td>
<td>10</td>
<td>25</td>
</tr>
</tbody>
</table>

### SEMESTER – VIII

<table>
<thead>
<tr>
<th>SL. No.</th>
<th>CODE NO.</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>THEORY</td>
<td></td>
<td>Elective V</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>Elective VI</td>
<td></td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>PRACTICAL</td>
<td></td>
<td>Project Work</td>
<td>0</td>
<td>0</td>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
<td>6</td>
<td>0</td>
<td>12</td>
<td>12</td>
</tr>
</tbody>
</table>

TOTAL NUMBER OF CREDITS TO BE EARNED FOR AWARD OF THE DEGREE = 195
### ELECTIVE – I

<table>
<thead>
<tr>
<th>SL. No.</th>
<th>CODE NO.</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>EC6073</td>
<td>Advanced Microprocessors and Microcontrollers</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>CS6078</td>
<td>Computer Architecture and Parallel Processing</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>CS6081</td>
<td>System Software</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>RO6001</td>
<td>Lean Manufacturing</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>RO6002</td>
<td>Industrial Design and Applied Ergonomics</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>ME6005</td>
<td>Process Planning and Cost Estimation</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

### ELECTIVE – II

<table>
<thead>
<tr>
<th>SL. No.</th>
<th>CODE NO.</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>EE6071</td>
<td>Special Machines and Controllers</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>CS6076</td>
<td>Artificial Intelligence for Robotics</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>IC6601</td>
<td>Advanced Control Systems</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>RO6003</td>
<td>Indian Ethos and Values</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>MG6851</td>
<td>Principles of Management</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>GE6084</td>
<td>Human Rights</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

### ELECTIVE – III

<table>
<thead>
<tr>
<th>SL. No.</th>
<th>CODE NO.</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>EC6601</td>
<td>VLSI Design</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>CS6009</td>
<td>Nano Computing</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>RO6004</td>
<td>Renewable Energy Sources</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>MT6005</td>
<td>Virtual Instrumentation</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>MG6071</td>
<td>Entrepreneurship Development</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>GE6083</td>
<td>Disaster Management</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

### ELECTIVE – IV

<table>
<thead>
<tr>
<th>SL. No.</th>
<th>CODE NO.</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>EC6077</td>
<td>Digital Signal Processors and its Applications</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>RO6005</td>
<td>Maintenance and Safety Engineering</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>RO6006</td>
<td>Software Project Management and Quality Assurance</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>CS6086</td>
<td>Neural Networks and Fuzzy Systems</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>RO6007</td>
<td>Industrial Robotics and Material Handling Systems</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>MG6571</td>
<td>Human Resource Management</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>
## ELECTIVE – V

<table>
<thead>
<tr>
<th>SL. No.</th>
<th>CODE NO.</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>RO6008</td>
<td>Embedded Systems Design</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>EC6801</td>
<td>Wireless Communication</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>EE6007</td>
<td>Micro Electro Mechanical Systems</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>RO6009</td>
<td>Industrial Networking</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>RO6010</td>
<td>Internet Tools and Java Programming</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

## ELECTIVE – VI

<table>
<thead>
<tr>
<th>SL. No.</th>
<th>CODE NO.</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>CE6071</td>
<td>Advanced Strength of Materials</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>ME6602</td>
<td>Automobile Engineering</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>MG6089</td>
<td>Supply Chain Management</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>ME6703</td>
<td>Computer Integrated Manufacturing Systems</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>
OBJECTIVES:
- To enable learners of Engineering and Technology develop their basic communication skills in English.
- To emphasize specially the development of speaking skills amongst learners of Engineering and Technology.
- To ensure that learners use the electronic media such as internet and supplement the learning materials used in the classroom.
- To inculcate the habit of reading and writing leading to effective and efficient communication.

UNIT I
Listening - Introducing learners to GIE - Types of listening - Listening to audio (verbal & sounds); Speaking - Speaking about one’s place, important festivals etc. – Introducing oneself, one’s family / friend; Reading - Skimming a reading passage – Scanning for specific information - Note-making; Writing - Free writing on any given topic (My favourite place / Hobbies / School life, etc.) - Sentence completion - Autobiographical writing (writing about one’s leisure time activities, hometown, etc.); Grammar - Prepositions - Reference words - Wh-questions - Tenses (Simple); Vocabulary - Word formation - Word expansion (root words / etymology); E-materials - Interactive exercises for Grammar & Vocabulary - Reading comprehension exercises - Listening to audio files and answering questions.

UNIT II
Listening - Listening and responding to video lectures / talks; Speaking - Describing a simple process (filling a form, etc.) - Asking and answering questions - Telephone skills – Telephone etiquette; Reading – Critical reading - Finding key information in a given text - Sifting facts from opinions; Writing - Biographical writing (place, people) - Process descriptions (general/specific) - Definitions - Recommendations – Instructions; Grammar - Use of imperatives - Subject-verb agreement; Vocabulary - Compound words - Word Association (connotation); E-materials - Interactive exercises for Grammar and Vocabulary - Listening exercises with sample telephone conversations / lectures – Picture-based activities.

UNIT III
Listening - Listening to specific task - focused audio tracks; Speaking - Role-play – Simulation - Group interaction - Speaking in formal situations (teachers, officials, foreigners); Reading - Reading and interpreting visual material; Writing - Jumbled sentences - Coherence and cohesion in writing - Channel conversion (flowchart into process) - Types of paragraph (cause and effect / compare and contrast / narrative / analytical) - Informal writing (letter/e-mail/blogs) - Paraphrasing; Grammar - Tenses (Past) - Use of sequence words - Adjectives; Vocabulary - Different forms and uses of words, Cause and effect words; E-materials - Interactive exercises for Grammar and Vocabulary - Excerpts from films related to the theme and follow up exercises - Pictures of flow charts and tables for interpretations.

UNIT IV
Listening - Watching videos / documentaries and responding to questions based on them; Speaking - Responding to questions - Different forms of interviews - Speaking at different types of interviews; Reading - Making inference from the reading passage - Predicting the content of a reading passage; Writing - Interpreting visual materials (line graphs, pie charts etc.) - Essay writing – Different types of essays; Grammar - Adverbs – Tenses – future time reference; Vocabulary - Single word substitutes - Use of abbreviations and acronyms; E-materials - Interactive exercises for Grammar and Vocabulary - Sample interviews - film scenes - dialogue writing.
UNIT V
Listening - Listening to different accents, Listening to Speeches/Presentations, Listening to broadcast and telecast from Radio and TV; Speaking - Giving impromptu talks, Making presentations on given topics; Reading - Email communication - Reading the attachment files having a poem/joke/proverb - Sending their responses through email; Writing - Creative writing, Poster making; Grammar - Direct and indirect speech; Vocabulary - Lexical items (fixed / semi fixed expressions); E-materials - Interactive exercises for Grammar and Vocabulary - Sending emails with attachment – Audio / video excerpts of different accents - Interpreting posters.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:
Learners should be able to
• speak clearly, confidently, comprehensibly, and communicate with one or many listeners using appropriate communicative strategies.
• write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.
• read different genres of texts adopting various reading strategies.
• listen/view and comprehend different spoken discourses/excerpts in different accents

TEXTBOOKS:

REFERENCES:

EXTENSIVE Reading (Not for Examination)

WEBSITES:

TEACHING METHODS:
• Lectures
• Activities conducted individually, in pairs and in groups like self introduction, peer introduction, group poster making, grammar and vocabulary games, etc.
• Discussions
• Role play activities
• Short presentations
• Listening and viewing activities with follow up activities like discussion, filling up worksheets, writing exercises (using language lab wherever necessary/possible) etc.
EVALUATION PATTERN:

Internal assessment: 20%
3 tests of which two are pen and paper tests and the other is a combination of different modes of assessment like

- Project
- Assignment
- Reviews
- Creative writing
- Poster making, etc.

All the four skills are to be tested with equal weightage given to each.

- Speaking assessment: Individual speaking activities, Pair work activities like role play, Interview, Group discussions
- Reading assessment: Reading passages with comprehension questions graded from simple to complex, from direct to inferential
- Writing assessment: Writing paragraphs, essays etc. Writing should include grammar and vocabulary.
- Listening/Viewing assessment: Lectures, dialogues, film clippings with questions on verbal as well as audio/visual content.

End Semester Examination: 80%

MA6151 MATHEMATICS – I

OBJECTIVES:

- To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
- To make the student knowledgeable in the area of infinite series and their convergence so that he/she will be familiar with limitations of using infinite series approximations for solutions arising in mathematical modeling.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To introduce the concepts of improper integrals, Gamma, Beta and Error functions which are needed in engineering applications.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

UNIT I MATRICES


UNIT II SEQUENCES AND SERIES

UNIT III  APPLICATIONS OF DIFFERENTIAL CALCULUS 9+3
Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes - Evolute as envelope of normals.

UNIT IV  DIFFERENTIAL CALCULUS OF SEVERAL VARIABLES 9+3

UNIT V  MULTIPLE INTEGRALS 9+3

OUTCOMES:
• This course equips students to have basic knowledge and understanding in one fields of materials, integral and differential calculus.

TEXT BOOKS:

REFERENCES:

PH6151  ENGINEERING PHYSICS – I  L T P C
3 0 0 3

OBJECTIVES:
• To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

UNIT I  CRYSTAL PHYSICS 9
Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Diamond and graphite structures (qualitative treatment) - Crystal growth techniques –solution, melt (Bridgman and Czochralski) and vapour growth techniques (qualitative)
UNIT II     PROPERTIES OF MATTER AND THERMAL PHYSICS

Elasticity- Hooke’s law - Relationship between three modulii of elasticity (qualitative) – stress -strain diagram – Poisson’s ratio –Factors affecting elasticity –Bending moment – Depression of a cantilever –Young’s modulus by uniform bending- I-shaped girders


UNIT III     QUANTUM PHYSICS


UNIT IV     ACOUSTICS AND ULTRASONICS


Production of ultrasonics by magnetostriiction and piezoelectric methods - acoustic grating - Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C – scan displays, Medical applications - Sonogram

UNIT V     PHOTONICS AND FIBRE OPTICS


Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) – attenuation, dispersion, bending - Fibre Optical Communication system (Block diagram) - Active and passive fibre sensors- Endoscope.

TOTAL: 45 PERIODS

OUTCOMES:

- The students will have knowledge on the basics of physics related to properties of matter, optics, acoustics etc., and they will apply these fundamental principles to solve practical problems related to materials used for engineering applications.

TEXT BOOKS:
1. Arumugam M. Engineering Physics. Anuradha publishers, 2010

REFERENCES:
1. Searls and Zemansky. University Physics, 2009
5. Rajagopal K. Engineering Physics. PHI, New Delhi, 2011
OBJECTIVES:

- To make the students conversant with basics of polymer chemistry.
- To make the student acquire sound knowledge of second law of thermodynamics and second law based derivations of importance in engineering applications in all disciplines.
- To acquaint the student with concepts of important photophysical and photochemical processes and spectroscopy.
- To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
- To acquaint the students with the basics of nano materials, their properties and applications.

UNIT I  POLYMER CHEMISTRY  9
Introduction: Classification of polymers – Natural and synthetic; Thermoplastic and Thermosetting. Functionality – Degree of polymerization. Types and mechanism of polymerization: Addition (Free Radical, cationic and anionic); condensation and copolymerization. Properties of polymers: Tg, Tacticity, Molecular weight – weight average, number average and polydispersity index. Techniques of polymerization: Bulk, emulsion, solution and suspension. Preparation, properties and uses of Nylon 6,6, and Epoxy resin.

UNIT II  CHEMICAL THERMODYNAMICS  9
Terminology of thermodynamics - Second law: Entropy - entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Clausius inequality. Free energy and work function: Helmholtz and Gibbs free energy functions (problems); Criteria of spontaneity; Gibbs-Helmholtz equation (problems); Clausius-Clapeyron equation; Maxwell relations – Van’t Hoff isotherm and isochoire(problems).

UNIT III  PHOTOCHEMISTRY AND SPECTROSCOPY  9

UNIT IV  PHASE RULE AND ALLOYS  9

UNIT V  NANOCHEMISTRY  9
Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Nanoparticles: nano cluster, nano rod, nanotube(CNT) and nanowire. Synthesis: precipitation, thermolysis, hydrothermal, solvothermal, electrode position, chemical vapour deposition, laser ablation; Properties and applications

TOTAL :45 PERIODS

OUTCOMES:

- The knowledge gained on polymer chemistry, thermodynamics, spectroscopy, phase rule and nano materials will provide a strong platform to understand the concepts on these subjects for further learning.
TEXT BOOKS:

REFERENCES:

GE6151 COMPUTER PROGRAMMING

OBJECTIVES:
The students should be made to:
- Learn the organization of a digital computer.
- Be exposed to the number systems.
- Learn to think logically and write pseudo code or draw flow charts for problems.
- Be exposed to the syntax of C.
- Be familiar with programming in C.
- Learn to use arrays, strings, functions, pointers, structures and unions in C.

UNIT I INTRODUCTION

UNIT II C PROGRAMMING BASICS

UNIT III ARRAYS AND STRINGS

UNIT IV FUNCTIONS AND PointERS
UNIT V  STRUCTURES AND UNIONS

Introduction – need for structure data type – structure definition – Structure declaration – Structure within a structure - Union - Programs using structures and Unions – Storage classes, Pre-processor directives.

OUTCOMES:
At the end of the course, the student should be able to:
• Design C Programs for problems.
• Write and execute C programs for simple applications.

TEXTBOOKS:

REFERENCES:

GE6152  ENGINEERING GRAPHICS

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

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

UNIT I  PLANE CURVES AND FREE HAND SKETCHING
Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects

UNIT II  PROJECTION OF POINTS, LINES AND PLANE SURFACES
Orthographic projection- principles-Principal planes-First angle projection-projection of points.
Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.
UNIT III PROJECTION OF SOLIDS
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method and auxiliary plane method.

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

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

COMPUTER AIDED DRAFTING (Demonstration Only)
Introduction to drafting packages and demonstration of their use.

TOTAL : 75 PERIODS

OUTCOMES:
On Completion of the course the student will be able to
• perform free hand sketching of basic geometrical constructions and multiple views of objects.
• do orthographic projection of lines and plane surfaces.
• draw projections and solids and development of surfaces.
• prepare isometric and perspective sections of simple solids.
• demonstrate computer aided drafting.

TEXT BOOK:

REFERENCES:

Publication of Bureau of Indian Standards:
Special points applicable to University Examinations on Engineering Graphics:
1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day.

GE6161 COMPUTER PRACTICES LABORATORY

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

LIST OF EXPERIMENTS:
1. Search, generate, manipulate data using MS office/ Open Office
2. Presentation and Visualization – graphs, charts, 2D, 3D
3. Problem formulation, Problem Solving and Flowcharts
4. C Programming using Simple statements and expressions
5. Scientific problem solving using decision making and looping.
6. Simple programming for one dimensional and two dimensional arrays.
7. Solving problems using String functions
8. Programs with user defined functions – Includes Parameter Passing
9. Program using Recursive Function and conversion from given program to flow chart.
10. Program using structures and unions.

TOTAL : 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
- Apply good programming design methods for program development.
- Design and implement C programs for simple applications.
- Develop recursive programs.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:
Standalone desktops with C compiler 30 Nos.
(or)
Server with C compiler supporting 30 terminals or more.
OBJECTIVES:

- To provide exposure to the students with hands-on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

**GROUP A (CIVIL & MECHANICAL)**

I **CIVIL ENGINEERING PRACTICE**

**Buildings:**

(a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

**Plumbing Works:**

(a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
(b) Study of pipe connections requirements for pumps and turbines.
(c) Preparation of plumbing line sketches for water supply and sewage works.
(d) Hands-on-exercise:

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

(e) Demonstration of plumbing requirements of high-rise buildings.

**Carpentry using Power Tools only:**

(a) Study of the joints in roofs, doors, windows and furniture.
(b) Hands-on-exercise:

Wood work, joints by sawing, planing and cutting.

II **MECHANICAL ENGINEERING PRACTICE**

**Welding:**

(a) Preparation of arc welding of butt joints, lap joints and tee joints.
(b) Gas welding practice

**Basic Machining:**

(a) Simple Turning and Taper turning
(b) Drilling Practice

**Sheet Metal Work:**

(a) Forming & Bending:
(b) Model making – Trays, funnels, etc.
(c) Different type of joints.

**Machine assembly practice:**

(a) Study of centrifugal pump
(b) Study of air conditioner

**Demonstration on:**

(a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.
(b) Foundry operations like mould preparation for gear and step cone pulley.
(c) Fitting – Exercises – Preparation of square fitting and vee – fitting models.

GROUP B (ELECTRICAL & ELECTRONICS)

III ELECTRICAL ENGINEERING PRACTICE 10
1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
5. Measurement of energy using single phase energy meter.

IV ELECTRONICS ENGINEERING PRACTICE 13
1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
2. Study of logic gates AND, OR, EOR and NOT.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

TOTAL: 45 PERIODS

OUTCOMES:
- ability to fabricate carpentry components and pipe connections including plumbing works.
- ability to use welding equipments to join the structures.
- ability to fabricate electrical and electronics circuits.

REFERENCES:

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

CIVIL

1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. 15 Sets.
2. Carpentry vice (fitted to work bench) 15 Nos.
4. Models of industrial trusses, door joints, furniture joints 5 each
5. Power Tools: (a) Rotary Hammer 2 Nos
   (b) Demolition Hammer 2 Nos
   (c) Circular Saw 2 Nos
   (d) Planer 2 Nos
(e) Hand Drilling Machine  
(f) Jigsaw  

MECHANICAL

1. Arc welding transformer with cables and holders 5 Nos.
2. Welding booth with exhaust facility 5 Nos.
3. Welding accessories like welding shield, chipping hammer, wire brush, etc. 5 Sets.
4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit. 2 Nos.
5. Centre lathe 2 Nos.
6. Hearth furnace, anvil and smithy tools 2 Sets.
7. Moulding table, foundry tools 2 Sets.
8. Power Tool: Angle Grinder 2 Nos
9. Study-purpose items: centrifugal pump, air-conditioner One each.

ELECTRICAL

1. Assorted electrical components for house wiring 15 Sets
2. Electrical measuring instruments 10 Sets
3. Study purpose items: Iron box, fan and regulator, emergency lamp 1 each
4. Megger (250V/500V) 1 No.
5. Power Tools: (a) Range Finder 2 Nos
   (b) Digital Live-wire detector 2 Nos

ELECTRONICS

1. Soldering guns 10 Nos.
2. Assorted electronic components for making circuits 50 Nos.
3. Small PCBs 10 Nos.
5. Study purpose items: Telephone, FM radio, low-voltage power supply

GE6163  

PHYSICS AND CHEMISTRY LABORATORY – I

OBJECTIVES:
• To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics and properties of matter.

LIST OF EXPERIMENTS
(Any FIVE Experiments)
1. (a) Determination of Wavelength, and particle size using Laser  
(b) Determination of acceptance angle in an optical fiber.
2. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
3. Determination of wavelength of mercury spectrum – spectrometer grating
5. Determination of Young’s modulus by Non uniform bending method
6. Determination of specific resistance of a given coil of wire – Carey Foster’s Bridge
OUTCOMES:
- The hands on exercises undergone by the students will help them to apply physics principles of optics and thermal physics to evaluate engineering properties of materials.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:
1. Diode laser, lycopodium powder, glass plate, optical fiber.
2. Ultrasonic interferometer
3. Spectrometer, mercury lamp, grating
4. Lee’s Disc experimental set up
5. Traveling microscope, meter scale, knife edge, weights
6. Carey foster’s bridge set up
   (vernier Caliper, Screw gauge, reading lens are required for most of the experiments)

CHEMISTRY LABORATORY- I

OBJECTIVES:
- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
- To acquaint the students with the determination of molecular weight of a polymer by vacometry.

LIST OF EXPERIMENTS
(Any FIVE Experiments)
1. Determination of DO content of water sample by Winkler’s method.
2. Determination of chloride content of water sample by argentometric method.
3. Determination of strength of given hydrochloric acid using pH meter.
4. Determination of strength of acids in a mixture using conductivity meter.
5. Estimation of iron content of the water sample using spectrophotometer.
   (1,10- phenanthroline / thiocyanate method).
7. Conductometric titration of strong acid vs strong base.

TOTAL: 30 PERIODS

OUTCOMES:
- The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

REFERENCES:

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:
1. Iodine flask - 30 Nos
2. pH meter - 5 Nos
3. Conductivity meter - 5 Nos
4. Spectrophotometer - 5 Nos
5. Ostwald Viscometer - 10 Nos

Common Apparatus : Pipette, Burette, conical flask, porcelain tile, dropper (each 30 Nos.)
OBJECTIVES:

- To make learners acquire listening and speaking skills in both formal and informal contexts.
- To help them develop their reading skills by familiarizing them with different types of reading strategies.
- To equip them with writing skills needed for academic as well as workplace contexts.
- To make them acquire language skills at their own pace by using e-materials and language lab components.

UNIT I

Listening - Listening to informal conversations and participating; Speaking - Opening a conversation (greetings, comments on topics like weather) - Turn taking - Closing a conversation (excuses, general wish, positive comment, thanks); Reading - Developing analytical skills, Deductive and inductive reasoning - Extensive reading; Writing - Effective use of SMS for sending short notes and messages - Using ‘emoticons’ as symbols in email messages; Grammar - Regular and irregular verbs - Active and passive voice; Vocabulary - Homonyms (e.g. ‘can’) - Homophones (e.g. ‘some’, ‘sum’); E-materials - Interactive exercise on Grammar and vocabulary – blogging; Language Lab - Listening to different types of conversation and answering questions.

UNIT II

Listening - Listening to situation based dialogues; Speaking - Conversation practice in real life situations, asking for directions (using polite expressions), giving directions (using imperative sentences), Purchasing goods from a shop, Discussing various aspects of a film (they have already seen) or a book (they have already read); Reading - Reading a short story or an article from newspaper, Critical reading, Comprehension skills; Writing - Writing a review / summary of a story / article, Personal letter (Inviting your friend to a function, congratulating someone for his / her success, thanking one’s friends / relatives); Grammar - modal verbs, Purpose expressions; Vocabulary - Phrasal verbs and their meanings, Using phrasal verbs in sentences; E-materials - Interactive exercises on Grammar and vocabulary, Extensive reading activity (reading stories / novels), Posting reviews in blogs - Language Lab - Dialogues (Fill up exercises), Recording students’ dialogues.

UNIT III

Listening - Listening to the conversation - Understanding the structure of conversations; Speaking - Conversation skills with a sense of stress, intonation, pronunciation and meaning - Seeking information – expressing feelings (affection, anger, regret, etc.); Reading - Speed reading – reading passages with time limit - Skimming; Writing - Minutes of meeting – format and practice in the preparation of minutes - Writing summary after reading articles from journals - Format for journal articles – elements of technical articles (abstract, introduction, methodology, results, discussion, conclusion, appendices, references) - Writing strategies; Grammar - Conditional clauses - Cause and effect expressions; Vocabulary - Words used as nouns and verbs without any change in the spelling (e.g. ‘rock’, ‘train’, ‘ring’); E-materials - Interactive exercise on Grammar and vocabulary - Speed Reading practice exercises; Language Lab - Intonation practice using EFLU and RIE materials – Attending a meeting and writing minutes.

UNIT IV

Listening - Listening to a telephone conversation, Viewing model interviews (face-to-face, telephonic and video conferencing); Speaking - Role play practice in telephone skills - listening and responding, -asking questions, -note taking – passing on messages, Role play and mock interview for grasping interview skills; Reading - Reading the job advertisements and the profile of the company concerned – scanning; Writing - Applying for a job – cover letter - résumé preparation – vision, mission and goals of the candidate; Grammar - Numerical expressions - Connectives (discourse markers); Vocabulary - Idioms and their meanings – using idioms in sentences; E-materials - Interactive exercises on
Grammar and Vocabulary - Different forms of résumés- Filling up a résumé / cover letter; Language Lab - Telephonic interview – recording the responses - e-résumé writing.

UNIT V

Listening - Viewing a model group discussion and reviewing the performance of each participant - Identifying the characteristics of a good listener; Speaking - Group discussion skills – initiating the discussion – exchanging suggestions and proposals – expressing dissent/agreement – assertiveness in expressing opinions – mind mapping technique; Reading - Note making skills – making notes from books, or any form of written materials - Intensive reading; Writing – Checklist - Types of reports – Feasibility / Project report – report format – recommendations / suggestions – interpretation of data (using charts for effective presentation); Grammar - Use of clauses; Vocabulary – Collocation; E-materials - Interactive grammar and vocabulary exercises - Sample GD - Pictures for discussion, Interactive grammar and vocabulary exercises; Language Lab - Different models of group discussion.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:
Learners should be able to
• speak convincingly, express their opinions clearly, initiate a discussion, negotiate, argue using appropriate communicative strategies.
• write effectively and persuasively and produce different types of writing such as narration, description, exposition and argument as well as creative, critical, analytical and evaluative writing.
• read different genres of texts, infer implied meanings and critically analyse and evaluate them for ideas as well as for method of presentation.
• listen/view and comprehend different spoken excerpts critically and infer unspoken and implied meanings.

TEXTBOOKS:

REFERENCES:

EXTENSIVE Reading (Not for Examination)

Websites
2. http://owl.english.purdue.edu
TEACHING METHODS:
- Lectures
- Activities conducted individually, in pairs and in groups like individual writing and presentations, group discussions, interviews, reporting, etc
- Long presentations using visual aids
- Listening and viewing activities with follow up activities like discussions, filling up worksheets, writing exercises (using language lab wherever necessary/possible) etc
- Projects like group reports, mock interviews etc using a combination of two or more of the language skills

EVALUATION PATTERN:

Internal assessment: 20%
- 3 tests of which two are pen and paper tests and the other is a combination of different modes of assessment like
  - Project
  - Assignment
  - Report
  - Creative writing, etc.

All the four skills are to be tested with equal weightage given to each.
- Speaking assessment: Individual presentations, Group discussions
- Reading assessment: Reading passages with comprehension questions graded following Bloom’s taxonomy
- Writing assessment: Writing essays, CVs, reports etc. Writing should include grammar and vocabulary.
- Listening/Viewing assessment: Lectures, dialogues, film clippings with questions on verbal as well as audio/visual content graded following Bloom’s taxonomy.

End Semester Examination: 80%

MA6251 MATHEMATICS – II

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

UNIT I VECTOR CALCULUS
- Gradient, divergence and curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green’s theorem in a plane, Gauss divergence theorem and Stokes’ theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelepipeds.
UNIT II  ORDINARY DIFFERENTIAL EQUATIONS  9+3
Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy’s and Legendre’s linear equations – Simultaneous first order linear equations with constant coefficients.

UNIT III  LAPLACE TRANSFORM  9+3

UNIT IV  ANALYTIC FUNCTIONS  9+3
Functions of a complex variable – Analytic functions: Necessary conditions – Cauchy-Riemann equations and sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping: \( w = z+k, kz, 1/z, z^2, e^z \) and bilinear transformation.

UNIT V  COMPLEX INTEGRATION  9+3
Complex integration – Statement and applications of Cauchy’s integral theorem and Cauchy’s integral formula – Taylor’s and Laurent’s series expansions – Singular points – Residues – Cauchy’s residue theorem – Evaluation of real definite integrals as contour integrals around unit circle and semi-circle (excluding poles on the real axis).

OUTCOMES:
- The subject helps the students to develop the fundamentals and basic concepts in vector calculus, ODE, Laplace transform and complex functions. Students will be able to solve problems related to engineering applications by using these techniques.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:

- To enrich the understanding of various types of materials and their applications in engineering and technology.

UNIT I CONDUCTING MATERIALS

UNIT II SEMICONDUCTING MATERIALS

UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS

Superconductivity: properties – Type I and Type II superconductors – BCS theory of superconductivity(Qualitative) - High \( T_c \) superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT IV DIELECTRIC MATERIALS

UNIT V ADVANCED ENGINEERING MATERIALS

TOTAL: 45 PERIODS

OUTCOMES:

- The students will have the knowledge on physics of materials and that knowledge will be used by them in different engineering and technology applications.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- Principles of electrochemical reactions, redox reactions in corrosion of materials and methods for corrosion prevention and protection of materials.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.
- Preparation, properties and applications of engineering materials.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.

UNIT I WATER TECHNOLOGY

Introduction to boiler feed water-requirements-formation of deposits in steam boilers and heat exchangers- disadvantages (wastage of fuels, decrease in efficiency, boiler explosion) prevention of scale formation - softening of hard water - external treatment zeolite and demineralization - internal treatment- boiler compounds (phosphate, calgon, carbonate, colloidal) - caustic embrittlement - boiler corrosion-priming and foaming- desalination of brackish water – reverse osmosis.

UNIT II ELECTROCHEMISTRY AND CORROSION


UNIT III ENERGY SOURCES

Introduction- nuclear energy- nuclear fission- controlled nuclear fission- nuclear fusion- differences between nuclear fission and fusion- nuclear chain reactions- nuclear reactor power generator-classification of nuclear reactor- light water reactor- breeder reactor- solar energy conversion- solar cells- wind energy. Batteries and fuel cells: Types of batteries- alkaline battery- lead storage battery- nickel-cadmium battery- lithium battery- fuel cell H₂ - O₂ fuel cell- applications.

UNIT IV ENGINEERING MATERIALS

Abrasives: definition, classification or types, grinding wheel, abrasive paper and cloth. Refractories: definition, characteristics, classification, properties – refactoriness and RUL, dimensional stability, thermal spalling, thermal expansion, porosity; Manufacture of alumina, magnesite and silicon carbide, Portland cement- manufacture and properties - setting and hardening of cement, special cement- waterproof and white cement–properties and uses. Glass - manufacture, types, properties and uses.

UNIT V FUELS AND COMBUSTION


TOTAL: 45 PERIODS
OUTCOMES:
- The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.

TEXT BOOKS:

REFERENCES:

GE6252 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

OBJECTIVES:
- To explain the basic theorems used in Electrical circuits and the different components and function of electrical machines.
- To explain the fundamentals of semiconductor and applications.
- To explain the principles of digital electronics
- To impart knowledge of communication.

UNIT I ELECTRICAL CIRCUITS & MEASUREMENTS
- Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters.

UNIT II ELECTRICAL MECHANICS

UNIT III SEMICONDUCTOR DEVICES AND APPLICATIONS

UNIT IV DIGITAL ELECTRONICS
UNIT V  FUNDAMENTALS OF COMMUNICATION ENGINEERING  12

Communication Systems: Radio, TV, Fax, Microwave, Satellite and Optical Fibre (Block Diagram Approach only).

TOTAL: 60 PERIODS

OUTCOMES:

• ability to identify the electrical components explain the characteristics of electrical machines.
• ability to identify electronics components and use of them to design circuits.

TEXT BOOKS:

REFERENCES:
Principal axes of inertia - Mass moment of inertia for prismatic, cylindrical and spherical solids from first principle – Relation to area moments of inertia.

UNIT IV: DYNAMICS OF PARTICLES 12

UNIT V: FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS 12
Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction – wedge friction - Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere.

OUTCOMES:
- ability to explain the differential principles applies to solve engineering problems dealing with force, displacement, velocity and acceleration.
- ability to analyse the forces in any structures.
- ability to solve rigid body subjected to dynamic forces.

TEXT BOOKS:

REFERENCES:

GE6261 COMPUTER AIDED DRAFTING AND MODELING LABORATORY L T P C 0 1 2 2

OBJECTIVES:
- To develop skill to use software to create 2D and 3D models.

List of Exercises using software capable of Drafting and Modeling
1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.
2. Drawing of a Title Block with necessary text and projection symbol.
3. Drawing of curves like parabola, spiral, involute using B spline or cubic spline.
4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and
5. Drawing front view, top view and side view of objects from the given pictorial views (eg. V-block, Base of a mixie, Simple stool, Objects with hole and curves).
6. Drawing of a plan of residential building (Two bed rooms, kitchen, hall, etc.)
7. Drawing of a simple steel truss.
8. Drawing sectional views of prism, pyramid, cylinder, cone, etc,
10. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.

Note: Plotting of drawings must be made for each exercise and attached to the records written by students.

TOTAL: 45 PERIODS

OUTCOMES:
• ability to use the software packers for drafting and modeling
• ability to create 2D and 3D models of Engineering Components

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Description of Equipment</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Pentium IV computer or better hardware, with suitable graphics facility</td>
<td>30 No.</td>
</tr>
<tr>
<td>2.</td>
<td>Licensed software for Drafting and Modeling.</td>
<td>30 Licenses</td>
</tr>
<tr>
<td>3.</td>
<td>Laser Printer or Plotter to print / plot drawings</td>
<td>2 No.</td>
</tr>
</tbody>
</table>

GE6262 PHYSICS AND CHEMISTRY LABORATORY – II

OBJECTIVES:
• To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics and properties of matter.

LIST OF EXPERIMENTS
(Any FIVE Experiments)
1. Determination of Young’s modulus by uniform bending method
2. Determination of band gap of a semiconductor
3. Determination of Coefficient of viscosity of a liquid – Poiseuille’s method
4. Determination of Dispersive power of a prism - Spectrometer
5. Determination of thickness of a thin wire – Air wedge method
6. Determination of Rigidity modulus – Torsion pendulum

OUTCOMES:
• The students will have the ability to test materials by using their knowledge of applied physics principles in optics and properties of matter.
LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:
1. Traveling microscope, meter scale, Knife edge, weights
2. Band gap experimental set up
3. Burette, Capillary tube, rubber tube, stop clock, beaker and weighing balance
4. spectrometer, prism, sodium vapour lamp.
5. Air-wedge experimental set up.
6. Torsion pendulum set up.
   a. (vernier Caliper, Screw gauge, reading lens are required for most of the experiments)

CHEMISTRY LABORATORY - II

OBJECTIVES:
• To make the student acquire practical skills in the wet chemical and instrumental methods for quantitative estimation of hardness, alkalinity, metal ion content, corrosion in metals and cement analysis.

LIST OF EXPERIMENTS
(Any FIVE Experiments)
1. Determination of alkalinity in water sample
2. Determination of total, temporary & permanent hardness of water by EDTA method
3. Estimation of copper content of the given solution by EDTA method
4. Estimation of iron content of the given solution using potentiometer
5. Estimation of sodium present in water using flame photometer
6. Corrosion experiment – weight loss method
7. Conductometric precipitation titration using BaCl₂ and Na₂SO₄

TOTAL: 30 PERIODS

OUTCOMES:
• The students will be conversant with hands-on knowledge in the quantitative chemical analysis of water quality related parameters, corrosion measurement and cement analysis.

REFERENCES:
• Laboratory classes on alternate weeks for Physics and Chemistry.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:
1. Potentiometer - 5 Nos
2. Flame photo meter - 5 Nos
3. Weighing Balance - 5 Nos
4. Conductivity meter - 5 Nos

Common Apparatus : Pipette, Burette, conical flask, percelain tile, dropper (30 Nos each)
OBJECTIVES:
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

UNIT I  PARTIAL DIFFERENTIAL EQUATIONS  
Formation of partial differential equations – Singular integrals -- Solutions of standard types of first order partial differential equations - Lagrange’s linear equation -- Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT II  FOURIER SERIES  

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

UNIT IV  FOURIER TRANSFORMS  

UNIT V  Z - TRANSFORMS AND DIFFERENCE EQUATIONS  

OUTCOMES:
- The understanding of the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.

TEXT BOOKS

REFERENCES:
EC6302  DIGITAL ELECTRONICS  

OBJECTIVES:

- To introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions
- To introduce the methods for simplifying Boolean expressions
- To outline the formal procedures for the analysis and design of combinational circuits
- To introduce the concept of memories and programmable logic devices.
- To illustrate the concept of synchronous and asynchronous sequential circuits

UNIT I  MINIMIZATION TECHNIQUES AND LOGIC GATES


Logic Gates: AND, OR, NOT, NAND, NOR, Exclusive–OR and Exclusive–NOR Implementations of Logic Functions using gates, NAND–NOR implementations – Multi level gate implementations- Multi output gate implementations. TTL and CMOS Logic and their characteristics – Tristate gates

UNIT II  COMBINATIONAL CIRCUITS


UNIT III  SEQUENTIAL CIRCUITS

UNIT IV  MEMORY DEVICES

UNIT V  SYNCHRONOUS AND ASYNCHRONOUS SEQUENTIAL CIRCUITS
Synchronous Sequential Circuits: General Model – Classification – Design – Use of Algorithmic State Machine – Analysis of Synchronous Sequential Circuits

TOTAL: 45 PERIODS

OUTCOMES:
Students will be able to:
- Analyze different methods used for simplification of Boolean expressions.
- Design and implement Combinational circuits.
- Design and implement synchronous and asynchronous sequential circuits.
- Write simple HDL codes for the circuits.

TEXT BOOK:

REFERENCES:

RO6301  SENSORS AND INSTRUMENTATION  L T P C
3 0 2 4

OBJECTIVES:
- To introduce the terminologies associated with the measuring system.
- To impart knowledge on sensors and transducer for temperature measurements.
- To understand and calibrate the method of measuring pressure, displacement and velocity.
- To introduce flow measuring devices and operations
- To practically expose the students to different measurement devices and use of them to measuring different variable.

UNIT I  MEASURING SYSTEM:
UNIT II  SENSORS AND TRANSDUCERS FOR TEMPERATURE MEASUREMENT  8+6

UNIT III  PRESSURE & FLOW MEASUREMENT:  8+6
Principle of operation, Characteristics and signal conditioning- Liquid manometers, Capacitance diaphragms, piezoelectric diaphragm, Venturi flow meters, Magnetic flow meter, float switch.

UNIT IV  DISPLACEMENT & VELOCITY MEASUREMENT:  10+9
Linear and angular measurement systems, Potentiometer type- resistive- strain gauge, capacitive and inductive, LVDT, Limit switches, inductive and capacitive proximity switches, ultrasonic and photoelectric sensors- linear scales, Laser Interferometers, tachogenerator, Encoders-absolute and incremental ,Synchros and resolvers.

UNIT V  OTHER SENSORS:  15+3

LIST OF EXPERIMENTS:
1. Measuring quantities using instruments
2. Measurement of temperature using Platinum RTD and plotting its characteristics
4. Study of strain measurement using strain gauges and cantilever assembly.
5. Flow measurement
6. Study of Input Output characteristics of LVDT.
7. To determine linear Range of operation and Sensitivity of LVDT.
8. Measurement of speed using a proximity switch
9. Velocity and displacement measurement using Encoder.
10. Tactile sensors for force and torque measurement

TOTAL (L:45+T:30): 75 PERIODS

OUTCOMES:
• ability to explain the different terms related to measurement system
• ability to calibrate and use the sensors and transducer for temperature, force, pressure, velocity and displacements.
• ability to demonstrate different measurement techniques for measuring different variables.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:

- To know the structure, operation and applications of the basic electronic devices.

UNIT I  PN JUNCTION DEVICES
PN junction diode – structure, operation and V-I characteristics, diffusion and transient capacitance -
Rectifiers – Half Wave and Full Wave Rectifier,– Display devices- LED, Laser diodes, Zener diode-
characteristics-Zener Reverse characteristics – Zener as regulator

UNIT II  TRANSISTORS
BJT, JFET, MOSFET - structure, operation, characteristics and Biasing UJT, Thyristor and IGBT -
Structure and characteristics.

UNIT III  AMPLIFIERS
BJT small signal model – Analysis of CE, CB, CC amplifiers- Gain and frequency response –
MOSFET small signal model– Analysis of CS and Source follower – Gain and frequency response-
High frequency analysis.

UNIT IV  MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER
BIMOS cascade amplifier, Differential amplifier – Common mode and Difference mode analysis – FET
input stages – Single tuned amplifiers – Gain and frequency response – Neutralization methods,
power amplifiers –Types (Qualitative analysis).

UNIT V  FEEDBACK AMPLIFIERS AND OSCILLATORS
Advantages of negative feedback – voltage / current, series , Shunt feedback –positive feedback –
Condition for oscillations, phase shift – Wien bridge, Hartley, Colpitts and Crystal oscillators.

TOTAL : 45 PERIODS

OUTCOMES:
Upon Completion of the course, the students will be able to:

- Explain the structure of basic electronic devices.
- Design applications using basic* electronic devices.

TEXT BOOKS:

REFERENCES:
   2003.
5. Robert B. Northrop, “Analysis and Application of Analog Electronic Circuits to Biomedical
OBJECTIVES:
• To know about basic electrical prime movers, electrical transmission and distribution systems.

UNIT I  D.C. MACHINES  10

UNIT II  TRANSFORMERS  10

UNIT III  INDUCTION MOTORS  10

UNIT IV  SYNCHRONOUS AND SPECIAL MACHINES  8

UNIT V  INTRODUCTION TO POWER SYSTEM  7
Structure of electric power systems – generation, transmission, sub-transmission and distribution systems - EHVAC and EHVDC transmission systems – substation layout. (Concepts only).

TOTAL: 45 PERIODS

OUTCOMES:
• understanding the principles of operations and characteristics of DC machines
• knowledge of electrical transformers and induction motors
• able to visualise the operation of synchronous motors stepper and sevo motors.
• comprehending the power transmission and distributing systems.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:

- To study the nature and the facts about environment.
- To find and implement scientific, technological, economic, and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions, and its value.
- To study the dynamic processes and understand the features of the earth’s interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control, and waste management.

UNIT I  ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY  12
Definition, scope, and importance of risk and hazards; Chemical hazards, physical hazards, biological hazards in the environment – concept of an ecosystem – structure and function of an ecosystem – producers, consumers, and decomposers – Oxygen cycle and Nitrogen cycle – energy flow in the ecosystem – ecological succession processes – Introduction, types, characteristic features, structure, and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity: genetic, species, and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic, and option values – Biodiversity at global, national, and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds. Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II  ENVIRONMENTAL POLLUTION  10
Definition – causes, effects, and control measures of: (a) Air pollution (Atmospheric chemistry - Chemical composition of the atmosphere; Chemical and photochemical reactions in the atmosphere - formation of smog, PAN, acid rain, oxygen and ozone chemistry; - Mitigation procedures – Control of particulate and gaseous emission, Control of SO\textsubscript{2}, NO\textsubscript{x}, CO and HC) (b) Water pollution: Physical and chemical properties of terrestrial and marine water and their environmental significance; Water quality parameters – physical, chemical and biological; absorption of heavy metals - Water treatment processes. (c) Soil pollution – soil waste management: causes, effects, and control measures of municipal solid wastes – (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – role of an individual in prevention of pollution – pollution case studies – Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III  NATURAL RESOURCES  10
Forest resources: Use and over-exploitation, deforestation, case studies – timber extraction, mining, dams and their effects on forests, and tribal people – Water resources: Use and overutilization of surface and ground water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Energy Conversion processes – Biogas – production and uses, anaerobic digestion; case studies – Land resources: Land as a resource, land degradation, man-induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Introduction to Environmental Biochemistry: Proteins – Biochemical
degradation of pollutants, Bioconversion of pollutants.

Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV  SOCIAL ISSUES AND THE ENVIRONMENT  7

UNIT V  HUMAN POPULATION AND THE ENVIRONMENT  6

TOTAL : 45 PERIODS

OUTCOMES:
Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.
• Public awareness of environmental is at infant stage.
• Ignorance and incomplete knowledge has lead to misconceptions
• Development and improvement in std. of living has lead to serious environmental disasters

TEXT BOOKS :

REFERENCES:

EC6362  ELECTRONIC CIRCUITS AND DIGITAL LABORATORY  L T P C
0 0 3 2

OBJECTIVES:
• To practically train the student to study the characteristics of electronic components and circuits.
LIST OF EXPERIMENTS:
1. Characteristics of diode and clipper circuits.
2. Characteristics of Zener diode and Zener voltage regulator
3. Characteristics of BJT.
4. Characteristics of JFET
5. Application of BJT as an amplifier and switch.
6. Study of Basic Digital ICs.
7. Implementation of Adder and Subtractor circuits
9. Study of Multiplexer and Demultiplexer.
10. Design and Implementation of Counters and registers

TOTAL: 45 PERIODS

OUTCOMES:
• ability to use the electronics components and use of them to built electronic circuits for process the signals.

REFERENCES:

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>SL.No.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0 – 30V RPS</td>
<td>12</td>
</tr>
<tr>
<td>2</td>
<td>0 – 50V RPS</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>0 – 5V RPS</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>0 – 30V Voltmeter</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>0 – 10V Voltmeter</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>0 – 50V Voltmeter</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>0 – 1V Voltmeter</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>0 – 30mA Ammeter</td>
<td>5</td>
</tr>
<tr>
<td>9</td>
<td>0 – 100mA AC Amplifier</td>
<td>2</td>
</tr>
<tr>
<td>10</td>
<td>Audio Oscillator</td>
<td>5</td>
</tr>
<tr>
<td>11</td>
<td>CRO (30 MHZ)</td>
<td>15</td>
</tr>
<tr>
<td>12</td>
<td>Diodes, Zener Diodes</td>
<td>20</td>
</tr>
<tr>
<td>13</td>
<td>Transistors (PNP &amp; NPN)</td>
<td>10</td>
</tr>
<tr>
<td>14</td>
<td>UJT</td>
<td>10</td>
</tr>
<tr>
<td>15</td>
<td>SCR</td>
<td>10</td>
</tr>
<tr>
<td>16</td>
<td>JFET</td>
<td>10</td>
</tr>
<tr>
<td>17</td>
<td>MOSFET</td>
<td>10</td>
</tr>
<tr>
<td>18</td>
<td>DIAC &amp; TRIAC</td>
<td>10</td>
</tr>
<tr>
<td>19</td>
<td>Photodiode</td>
<td>5</td>
</tr>
<tr>
<td>20</td>
<td>Photo Transistor</td>
<td>5</td>
</tr>
<tr>
<td>21</td>
<td>Required Passive Components</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Variable Resistor</td>
<td></td>
</tr>
</tbody>
</table>
OBJECTIVES:
- To impart hands on experience in verification of circuit laws and theorems, measurement of circuit parameters, study of circuit characteristics and simulation of time response.
- To expose the students to the basic operation of electrical machines and help them to develop experimental skills.

LIST OF EXPERIMENTS:
1. Open circuit characteristics of D.C. shunt generator.
2. Load characteristics of D.C. shunt generator.
3. Load test on D.C. shunt motor.
4. Load test on D.C. series motor.
5. Swinburne's test
7. Load test on single phase transformer
8. Open circuit and short circuit tests on single phase transformer (Determination of equivalent circuit parameters).
9. Load test on single phase induction motor.
10. No load and blocked rotor tests on three phase induction motor (Determination of equivalent circuit parameters)
11. Load test on three phase induction motor.
12. Study of Starters

TOTAL: 45 PERIODS

OUTCOMES:
- Ability to verify the circuit laws and theorems and measure the circuit parameter.
- Ability to operate electrical machines.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DC Shunt Motor with Loading Arrangement</td>
<td>3 nos</td>
</tr>
<tr>
<td>2</td>
<td>Single Phase Transformer</td>
<td>4 nos</td>
</tr>
<tr>
<td>3</td>
<td>DC Series Motor with Loading Arrangement</td>
<td>1 No.</td>
</tr>
<tr>
<td>4</td>
<td>Three Phase Induction Motor with Loading Arrangement</td>
<td>2 nos</td>
</tr>
<tr>
<td>5</td>
<td>Single Phase Induction Motor with Loading Arrangement</td>
<td>1 No.</td>
</tr>
<tr>
<td>6</td>
<td>DC Shunt Motor Coupled With DC Compound Generator</td>
<td>2 nos</td>
</tr>
<tr>
<td>7</td>
<td>DC Shunt Motor Coupled With DC Shunt Generator</td>
<td>1 No</td>
</tr>
<tr>
<td>8</td>
<td>Tachometer - Digital/Analog</td>
<td>8 nos</td>
</tr>
<tr>
<td>9</td>
<td>Single Phase Auto Transformer</td>
<td>2 nos</td>
</tr>
<tr>
<td>10</td>
<td>Three Phase Auto Transformer</td>
<td>1 No</td>
</tr>
<tr>
<td>11</td>
<td>Single Phase Resistive Loading Bank</td>
<td>2 nos</td>
</tr>
<tr>
<td>12</td>
<td>Three Phase Resistive Loading Bank</td>
<td>2 nos</td>
</tr>
<tr>
<td>13</td>
<td>SPST switch</td>
<td>2 nos</td>
</tr>
</tbody>
</table>
OBJECTIVES:
• To provide necessary basic concepts in probability and random processes for applications such as random signals, linear systems etc in communication engineering.

UNIT I RANDOM VARIABLES 9+3
Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions.

UNIT II TWO-DIMENSIONAL RANDOM VARIABLES 9+3
Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables.

UNIT III RANDOM PROCESSES 9+3

UNIT IV CORRELATION AND SPECTRAL DENSITIES 9+3

UNIT V LINEAR SYSTEMS WITH RANDOM INPUTS 9+3
Linear time invariant system – System transfer function – Linear systems with random inputs – Auto correlation and Cross correlation functions of input and output.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES
• The students will have an exposure of various distribution functions and help in acquiring skills in handling situations involving more than one variable. Able to analyze the response of random inputs to linear time invariant systems.

TEXT BOOKS

REFERENCES
OBJECTIVES:
• To study the basics of control system and its response .stability of mechanical and electrical systems . Use of MATLAB to design a stable control system.

UNIT I INTRODUCTION 9
Open loop and closed loop systems - Examples - Elements of closed loop systems - Transfer function - Modeling of physical systems – Mechanical, Thermal, Hydraulic systems and Electric Networks - Transfer function of DC generator, DC servomotor, AC servomotor, Potentiometer, Synchrons, Tachogenerator, Stepper motor - Block diagram - reduction techniques, Signal flow graph – Mason’ gain formula. (Related Tutorials Using MATLAB/ Simulink – Toolboxes & Functions)

UNIT II TIME DOMAIN ANALYSIS 9

UNIT III FREQUENCY DOMAIN ANALYSIS 9
Frequency domain specifications - Time and frequency response correlation – Polar plot – Bode plot – All pass minimum phase and non-minimum phase systems. (Related Tutorials Using MATLAB/ Simulink – Toolboxes & Functions)

UNIT IV SYSTEM STABILITY 9

UNIT V ROOT LOCUS METHOD 9

STATE SPACE ANALYSIS: Limitations of conventional control theory - Concepts of state, state variables and state model – state model for linear time invariant systems - Introduction to state space representation using physical - Phase and canonical variables. (Related Tutorials Using MATLAB/ Simulink – Toolboxes & Functions)

TOTAL : 45 PERIODS

OUTCOMES:
• To expose students to the state space representation and its analysis.
• To introduce non-linear systems and their control. To impart knowledge on advanced control techniques

TEXT BOOKS:
2. Richard C Dorf and Robert H Bishop, "Modern Control Systems.", Addison-Wesley -2007

REFERENCES:
OBJECTIVES:
Upon completion of this subject, student will be able to:
- Understand evolution and principle of CNC machine tools
- Describe constructional features of CNC machine tools
- Explain drives and positional transducers used in CNC machine tools
- Write simple programs for CNC turning and machining centres
- Generate CNC programs for popular CNC controllers
- Describe tooling and work holding devices for CNC machine tools

UNIT I  INTRODUCTION TO CNC MACHINE TOOLS  6
Evolution of CNC Technology, principles, features, advantages, applications, CNC and DNC concept, classification of CNC Machines – turning centre, machining centre, grinding machine, EDM, types of control systems, CNC controllers, characteristics, interpolators – Computer Aided Inspection

UNIT II  STRUCTURE OF CNC MACHINE TOOL  10
CNC Machine building, structural details, configuration and design, guide ways – Friction, Anti friction and other types of guide ways, elements used to convert the rotary motion to a linear motion – Screw and nut, recirculating ball screw, planetary roller screw, recirculating roller screw, rack and pinion, spindle assembly, torque transmission elements – gears, timing belts, flexible couplings, Bearings.

UNIT III  DRIVES AND CONTROLS  9

UNIT IV  CNC PROGRAMMING  11
Coordinate system, structure of a part program, G & M Codes, tool length compensation, cutter radius and tool nose radius compensation, do loops, subroutines, canned cycles, mirror image, parametric programming, machining cycles, programming for machining centre and turning centre for well known controllers such as Fanuc, Heidenhain, Sinumerik etc., generation of CNC codes from CAM packages.

UNIT V  TOOLING AND WORK HOLDING DEVICES  9
Introduction to cutting tool materials – Carbides, Ceramics, CBN, PCD – inserts classification- PMK, NSH, qualified, semi qualified and preset tooling, tooling system for Machining centre and Turning centre, work holding devices for rotating and fixed work parts, economics of CNC, maintenance of CNC machines.

OUTCOMES:
- Upon completion of this course the students can able to understand evolution and principle of CNC machine tools and describe constructional features of CNC machine tools

TEXT BOOKS:
REFERENCES:

EC6301 OBJECT ORIENTED PROGRAMMING AND DATA STRUCTURES

OBJECTIVES:
- To comprehend the fundamentals of object oriented programming, particularly in C++.
- To use object oriented programming to implement data structures.
- To introduce linear, non-linear data structures and their applications.

UNIT I DATA ABSTRACTION & OVERLOADING

UNIT II INHERITANCE & POLYMORPHISM
Base Classes and Derived Classes – Protected Members – Casting Class pointers and Member Functions – Overriding – Public, Protected and Private Inheritance – Constructors and Destructors in derived Classes – Implicit Derived – Class Object To Base – Class Object Conversion – Composition Vs. Inheritance – Virtual functions – This Pointer – Abstract Base Classes and Concrete Classes – Virtual Destructors – Dynamic Binding.

UNIT III LINEAR DATA STRUCTURES
Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation – singly linked lists – Polynomial Manipulation - Stack ADT – Queue ADT - Evaluating arithmetic expressions.

UNIT IV NON-LINEAR DATA STRUCTURES

UNIT V SORTING and SEARCHING
Sorting algorithms: Insertion sort - Quick sort - Merge sort - Searching: Linear search – Binary Search

OUTCOMES:
Upon completion of the course, students will be able to:
- Explain the concepts of Object oriented programming.
- Write simple applications using C++.
- Discuss the different methods of organizing large amount of data.

TOTAL: 45 PERIODS
TEXT BOOKS:

REFERENCES:

EC6404 LINEAR INTEGRATED CIRCUITS

OBJECTIVES:
- To introduce the basic building blocks of linear integrated circuits.
- To teach the linear and non-linear applications of operational amplifiers.
- To introduce the theory and applications of analog multipliers and PLL.
- To teach the theory of ADC and DAC.
- To introduce the concepts of waveform generation and introduce some special function ICs.

UNIT I BASICS OF OPERATIONAL AMPLIFIERS
Current mirror and current sources, Current sources as active loads, Voltage sources, Voltage References, BJT Differential amplifier with active loads, Basic information about op-amps – Ideal Operational Amplifier - General operational amplifier stages -and internal circuit diagrams of IC 741, DC and AC performance characteristics, slew rate, Open and closed loop configurations.

UNIT II APPLICATIONS OF OPERATIONAL AMPLIFIERS
Sign Changer, Scale Changer, Phase Shift Circuits, Voltage Follower, V-to-I and I-to-V converters, adder, subtractor, Instrumentation amplifier, Integrator, Differentiator, Logarithmic amplifier, Antilogarithmic amplifier, Comparators, Schmitt trigger, Precision rectifier, peak detector, clipper and clamper, Low-pass, high-pass and band-pass Butterworth filters.

UNIT III ANALOG MULTIPLIER AND PLL
Analog Multiplier using Emitter Coupled Transistor Pair - Gilbert Multiplier cell – Variable transconductance technique, analog multiplier ICs and their applications, Operation of the basic PLL, Closed loop analysis, Voltage controlled oscillator, Monolithic PLL IC 565, application of PLL for AM detection, FM detection, FSK modulation and demodulation and Frequency synthesizing.

UNIT IV ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS
UNIT V  WAVEFORM GENERATORS AND SPECIAL FUNCTION ICS

Sine-wave generators, Multivibrators and Triangular wave generator, Saw-tooth wave generator, ICL8038 function generator, Timer IC 555, IC Voltage regulators – Three terminal fixed and adjustable voltage regulators - IC 723 general purpose regulator - Monolithic switching regulator, Switched capacitor filter IC MF10, Frequency to Voltage and Voltage to Frequency converters, Audio Power amplifier, Video Amplifier, Isolation Amplifier, Opto-couplers and fibre optic IC.

TOTAL: 45 PERIODS

OUTCOMES:
Upon Completion of the course, the students will be able to:

- Design linear and non linear applications of op – amps.
- Design applications using analog multiplier and PLL.
- Design ADC and DAC using op – amps.
- Generate waveforms using op – amp circuits.
- Analyze special function ICs.

TEXT BOOKS:

REFERENCES:

AN6402  KINEMATICS AND DYNAMICS OF MACHINERY

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

UNIT II  GEARs and GEAR TRAINS

UNIT III  FRICTION

UNIT IV  FORCE ANALYSIS

UNIT V  BALANCING AND VIBRATION

TOTAL (L: 45+ T:15): 60 PERIODS

OUTCOMES:
• Upon completion of this course, the students can able to apply Students can able to apply fundamentals of mechanism for the design of new mechanisms and analyse them for optimum design.

TEXT BOOKS:

REFERENCES:

47
OBJECTIVES:
- To impart knowledge in CNC programming for turning and milling operations and to use measuring systems for the geometrical measurements of gears and threads.

LIST OF EXPERIMENTS:
1. Study of the CNC machine
2. Programming and simulation of a lathe in Keller software
3. Programming and simulation of a machining centre in Keller software
4. Programming a CNC Lathe-Fanuc
5. Programming a CNC machining centre-Fanuc
6. Programming and simulation in Heidenhain controller
7. Optical profile projector - study of profile of gear tooth, screw threads.
8. Tool maker’s microscope - to study cutting tool geometry, screw threads.
9. Tool wear and surface finish measurement.
10. Dimensional measurement of machined components using, bore gauge, air gauge and Height master

OUTCOMES:
- Ability to understand the features and operation of CNC machines.
- Ability to prepare CNC program from the component drawings
- Understanding the usage of profile projectors and tool makers microscopes.

TOTAL : 45 PERIODS

REFERENCE:
- Laboratory Manual Prepared by R&AE Department

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CNC lathe</td>
<td>1 no</td>
</tr>
<tr>
<td>2</td>
<td>CNC milling machine</td>
<td>1 no</td>
</tr>
<tr>
<td>3</td>
<td>Production type CNC machining centre</td>
<td>1 no</td>
</tr>
<tr>
<td>4</td>
<td>CNC lathe and milling programming software (FANUC controller)</td>
<td>10 Licenses</td>
</tr>
<tr>
<td>5</td>
<td>CNC lathe and milling programming software (Heidenhain controller)</td>
<td>5 Licenses</td>
</tr>
<tr>
<td>6</td>
<td>Optical profile projector</td>
<td>1 no</td>
</tr>
<tr>
<td>7</td>
<td>tool makers microscope</td>
<td>1 no</td>
</tr>
<tr>
<td>8</td>
<td>measuring gauges for hole depth and height.</td>
<td></td>
</tr>
</tbody>
</table>

ME6511        DYNAMICS LABORATORY        L T P C
0 0 3 2

OBJECTIVES:
- To supplement the principles learnt in kinematics and Dynamics of Machinery.
- To understand how certain measuring devices are used for dynamic testing.

LIST OF EXPERIMENTS
1. a) Study of gear parameters.
   b) Experimental study of velocity ratios of simple, compound, Epicyclic and differential gear trains.
2. a) Kinematics of Four Bar, Slider Crank, Crank Rocker, Double crank, Double rocker, Oscillating cylinder Mechanisms.  
   b) Kinematics of single and double universal joints.  
3. a) Determination of Mass moment of inertia of Fly wheel and Axle system.  
   b) Determination of Mass Moment of Inertia of axisymmetric bodies using Turn Table apparatus.  
   c) Determination of Mass Moment of Inertia using bifilar suspension and compound pendulum.  
4. Motorized gyroscope – Study of gyroscopic effect and couple.  
5. Governor - Determination of range sensitivity, effort etc., for Watts, Porter, Proell, and Hartnell Governors.  
6. Cams – Cam profile drawing, Motion curves and study of jump phenomenon  
7. a) Single degree of freedom Spring Mass System – Determination of natural  
    Frequency and verification of Laws of springs – Damping coefficient determination.  
   b) Multi degree freedom suspension system – Determination of influence coefficient.  
8. a) Determination of torsional natural frequency of single and Double Rotor systems.-  
    Undamped and Damped Natural frequencies.  
   b) Vibration Absorber – Tuned vibration absorber.  
9. Vibration of Equivalent Spring mass system – undamped and damped vibration.  
11. a) Balancing of rotating masses. (b) Balancing of reciprocating masses.  
12. a) Transverse vibration of Free-Free beam – with and without concentrated masses.  
   b) Forced Vibration of Cantilever beam – Mode shapes and natural frequencies.  
   c) Determination of transmissibility ratio using vibrating table.  

**TOTAL : 45 PERIODS**

**OUTCOME**  
- Ability to demonstrate the principles of kinematics and dynamics of machinery  
- Ability to use the measuring devices for dynamic testing.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cam follower setup.</td>
<td>1 No.</td>
</tr>
<tr>
<td>2</td>
<td>Motorised gyroscope.</td>
<td>1 No.</td>
</tr>
<tr>
<td>3</td>
<td>Governor apparatus - Watt, Porter, Proell and Hartnell governors.</td>
<td>1 No.</td>
</tr>
<tr>
<td>4</td>
<td>Whirling of shaft apparatus.</td>
<td>1 No.</td>
</tr>
<tr>
<td>5</td>
<td>Dynamic balancing machine.</td>
<td>1 No.</td>
</tr>
<tr>
<td>6</td>
<td>Two rotor vibration setup.</td>
<td>1 No.</td>
</tr>
<tr>
<td>7</td>
<td>Spring mass vibration system.</td>
<td>1 No.</td>
</tr>
<tr>
<td>8</td>
<td>Torsional Vibration of single rotor system setup.</td>
<td>1 No.</td>
</tr>
<tr>
<td>9</td>
<td>Gear Models</td>
<td>1 No.</td>
</tr>
<tr>
<td>10</td>
<td>Kinematic Models to study various mechanisms.</td>
<td>1 No.</td>
</tr>
<tr>
<td>11</td>
<td>Turn table apparatus.</td>
<td>1 No.</td>
</tr>
</tbody>
</table>
| 12   | Transverse vibration setup of  
    a) cantilever  
    b) Free-Free beam  
    c) Simply supported beam. | 1 No.|
EC6467 LIC AND CONTROL SYSTEMS LABORATORY  L T P C  0 0 3 2

OBJECTIVES:
• To impart launch on experience in characterising different LIC
• To train the students in MATLAB simulation of study the characteristics of LIC

LIST OF EXPERIMENTS:
3. Performance characteristics of Voltage Regulator ICs.
4. Study of 555 Timer and 566 VCO.
5. Design and Implementation of Active Filters.
6. Determination of transfer function of DC servomotor.
7. Determination of transfer function of AC servomotor and study of synchros.
8. Time domain Response of first order and second order systems using MATLAB.
9. Frequency response of first and second order system using MATLAB.
10. Characteristics of PID controllers using MATLAB.

OUTCOMES:
• ability to design LIC and describe the characteristics.

TOTAL : 45 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dual, (0-30V) variable Power Supply</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>CRO 30MHz</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>Digital Multimeter</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>Function Generator 1 MHz</td>
<td>8</td>
</tr>
<tr>
<td>5</td>
<td>IC Tester (Analog)</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>Bread board</td>
<td>10</td>
</tr>
<tr>
<td>7</td>
<td>Computer (PSPICE installed)</td>
<td>1</td>
</tr>
</tbody>
</table>

ME6015 OPERATIONS RESEARCH  L T P C  3 0 0 3

OBJECTIVES:
• To provide knowledge and training in using optimization techniques under limited resources for the engineering and business problems.

UNIT I  LINEAR MODELS  15

UNIT II TRANSPORTATION MODELS AND NETWORK MODELS  8

UNIT III INVENTORY MODELS  6
Inventory models – Economic order quantity models – Quantity discount models – Stochastic inventory models – Multi product models – Inventory control models in practice.
UNIT IV  QUEUEING MODELS
Queueing models - Queueing systems and structures – Notation parameter – Single server and multi
server models – Poisson input – Exponential service – Constant rate service – Infinite population –
Simulation.

UNIT V  DECISION MODELS
Decision models – Game theory – Two person zero sum games – Graphical solution- Algebraic
solution– Linear Programming solution – Replacement models – Models based on service life –

TOTAL: 45 PERIODS

OUTCOMES:
• Upon completion of this course, the students can able to use the optimization techniques for
use engineering and Business problems

TEXT BOOK:

REFERENCES:
1994.
1990.

RO6501  PROGRAMMABLE LOGIC CONTROLLERS  L T P C
3 0 2 4

OBJECTIVES:
The student should be made to
• Be familiar with factory automation
• Be exposed to programmable logic controllers
• Learn to programme PLC
• Be exposed to HMI systems
• Learn to install and maintain procedures for PLC
• Be exposed to applications of PLC

UNIT I  INTRODUCTION TO FACTORY AUTOMATION
History and developments in industrial automation. Vertical integration of industrial automation,
Control elements in industrial automation, PLC introduction.

UNIT II  PROGRAMMABLE LOGIC CONTROLLERS
Basics of PLC, Advantages, Capabilities of PLC, Architecture of PLC, Scan cycle, Types of PLC,
Types of I/O modules, Configuring a PLC, PLC wiring.

UNIT III  PROGRAMMING OF PLC
Types of Programming - Simple process control programs using Relay Ladder Logic - PLC arithmetic
functions - Timers and counters –data transfer-comparison and manipulation instructions, PID
instructions, PTO / PWM generation.
UNIT IV  HMI SYSTEMS
Necessity and Role in Industrial Automation, Text display - operator panels - Touch panels - Panel PCs - Integrated displays, interfacing PLC to HMI.

UNIT V  INSTALLATION
APPLICATIONS OF PLC
Case studies of Machine automation, Process automation, Selection parameters for PLC. Introduction to Programmable Automation Controller.

OUTCOMES:
Upon completion of this course students can able to
• Explain programmable logic controllers
• Program PLC
• Explain HMI systems
• Install and maintain procedures for PLC
• Build application on PLC

TEXT BOOKS:

REFERENCES:

LIST OF EXPERIMENTS:
1. Wire up a PLC for the given lamp circuit
2. Design a Ladder logic for the given lamp circuit
3. Design and implement ladder logic for the forward and reverse control of a hydraulic cylinder.
4. Design a ladder diagram for performing the given arithmetic operations.
5. Design a ladder diagram for performing the given application using counters
6. Design a ladder diagram for performing the given application using Timers.
7. Interfacing PLC to HMI- text display.
8. Programming a graphical HMI
9. Networking PLCs- drives and a host computer.
10. Troubleshooting PLCs

RO6502  BASICS OF ROBOTICS  L T P C  3 0 0 3
OBJECTIVES:
• To introduce the basic concepts, parts of robots and types of robots.
• To make the student familiar with the various drive systems for robot, sensors and their applications in robots and programming of robots.
• To discuss about the various applications of robots, justification and implementation of robot.
UNIT I  INTRODUCTION  9
Specifications of Robots - Classifications of robots – Work envelope - Flexible automation versus 
Robotic technology – Applications of Robots

ROBOT KINEMATICS AND DYNAMICS
Positions, Orientations and frames, Mappings: Changing descriptions from frame to frame, Operators: 
Translations, Rotations and Transformations - Transformation Arithmetic - D-H Representation - 
Forward and inverse Kinematics Of Six Degree of Freedom Robot Arm – Robot Arm dynamics

UNIT II  ROBOT DRIVES AND POWER TRANSMISSION SYSTEMS  9
Robot drive mechanisms, hydraulic – electric – servomotor- stepper motor - pneumatic drives, 
Mechanical transmission method - Gear transmission, Belt drives, cables, Roller chains, Link - Rod 
systems - Rotary-to-Rotary motion conversion, Rotary-to-Linear motion conversion, Rack and Pinion 
drives, Lead screws, Ball Bearing screws,

UNIT III  MANIPULATORS  9
Construction of Manipulators, Manipulator Dynamic and Force Control, Electronic and Pneumatic 
manipulators

UNIT IV  ROBOT END EFFECTORS  9
Classification of End effectors – Tools as end effectors. Drive system for grippers-Mechanical-
Active and passive grippers.

UNIT V  PATHPLANNING & PROGRAMMING:  9
Trajectory planning and avoidance of obstacles, path planning, skew motion, joint integrated motion – 
straight line motion-Robot languages -.computer control and Robot software.

TOTAL : 45 PERIODS

OUTCOMES:
• The Student must be able to design automatic manufacturing cells with robotic control using 
  the principle behind robotic drive system, end effectors, sensor, machine vision robot 
  kinematics and programming.

TEXT BOOKS:

REFERENCES:
1. Richard D Klafter, Thomas A Chmielewski, Michael Negin, "Robotics Engineering – An 
   McGraw Hill, 1987
OBJECTIVES

- To study the Architecture of uP8085 & uC 8051
- To study the addressing modes & instruction set of 8085 & 8051.
- To introduce the need & use of Interrupt structure 8085 & 8051.
- To develop skill in simple applications development with programming 8085 & 8051
- To introduce commonly used peripheral / interfacing

UNIT I 8085 PROCESSOR

UNIT II PROGRAMMING OF 8085 PROCESSOR
Instruction -format and addressing modes – Assembly language format – Data transfer, data manipulation& control instructions – Programming: Loop structure with counting & Indexing – Look up table - Subroutine instructions - stack.

UNIT III 8051 MICRO CONTROLLER

UNIT IV PERIPHERAL INTERFACING
Study on need, Architecture, configuration and interfacing, with ICs: 8255 , 8259 , 8254,8237,8251, 8279,- A/D and D/A converters &Interfacing with 8085& 8051

UNIT V MICRO CONTROLLER PROGRAMMING & APPLICATIONS

OUTCOMES

- Ability to understand and analyse, linear and digital electronic circuits.
- To understand and apply computing platform and software for engineering problems.

TEXT BOOKS

REFERENCES:
OBJECTIVES:
• To gain knowledge in the design of common types of machine elements.

UNIT I DESIGN OF GEARS
Review of gear fundamentals, interference, gear forces, determining dimensions of a spur gear pair. Design of helical gears-parallel axis helical gear, normal and transverse planes, helix angles, equivalent number of teeth, determining dimension of helical gear pair, nomenclature of straight and bevel gears.

UNIT II DESIGN OF SHAFTS AND COUPLINGS
Forces on shafts due to gears, belts and chains, estimation of shaft size based on strength and critical speed. Couplings-types and applications, Design of square keys-use of standards, rigid couplings, flexible flange couplings - selection.

UNIT III SELECTION OF V BELTS AND CHAINS
V belts for given power and velocity ratio, selection of micro V-belts, timing belts. Selection of roller chain and power speed ratio, silent chain.

UNIT IV ROLLING CONTACT BEARINGS
Static and dynamic load capacity, cubic mean load, variable load, probability of survival, selection of deep groove and angular contact ball bearings.

UNIT V FRICTION DRIVES
Clutches - role of clutches, positive and gradually engaged clutches, toothed claw clutches, design of single plate and multiple plate clutches, variable speed drives, types and selection

OUTCOMES:
• ability to make the design of transmission systems using gear
• understanding shaft and coupling design procedure
• ability to select belts and bearings for given design requirements.
• knowledge of friction drives.

TEXT BOOKS:

REFERENCES:
4. Faculty of Mechanical Engineering, PSG College of Technology, "Design Data Book", M/s. DPV Printers, Coimbatore, 2000

TOTAL: 60 PERIODS
OBJECTIVES:
- To make students understand the basic structure and operation of digital computer.
- To understand the hardware-software interface.
- To familiarize the students with arithmetic and logic unit and implementation of fixed point and floating-point arithmetic operations.
- To expose the students to the concept of pipelining.
- To familiarize the students with hierarchical memory system including cache memories and virtual memory.
- To expose the students with different ways of communicating with I/O devices and standard I/O interfaces.

UNIT I OVERVIEW & INSTRUCTIONS

UNIT II ARITHMETIC OPERATIONS
ALU - Addition and subtraction – Multiplication – Division – Floating Point operations – Subword parallelism.

UNIT III PROCESSOR AND CONTROL UNIT
Basic MIPS implementation – Building datapath – Control Implementation scheme – Pipelining – Pipelined datapath and control – Handling Data hazards & Control hazards – Exceptions.

UNIT IV PARALLELISM
Instruction-level-parallelism – Parallel processing challenges – Flynn’s classification – Hardware multithreading – Multicore processors

UNIT V MEMORY AND I/O SYSTEMS
Memory hierarchy - Memory technologies – Cache basics – Measuring and improving cache performance - Virtual memory, TLBs - Input/output system, programmed I/O, DMA and interrupts, I/O processors.

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
- Design arithmetic and logic unit.
- Design and anlayse pipelined control units
- Evaluate performance of memory systems.
- Understand parallel processing architectures.

TEXT BOOK:

REFERENCES:
PEARSON EDUCATION, 2005.

RO6511 ENGINEERING DESIGN LABORATORY

OBJECTIVES:
• To expose the students is the usage of CAD/CAE softwares for modeling and analysis purposes.

LIST OF EXPERIMENTS:
1. Solid modeling of engineering components and assembly.
2. Determination of stresses and factor of safety in critical machine components by FEM and experimental validation of the results by strain measurement.
3. Dynamic analysis of chassis frame of an automobile.
5. Kinematic and dynamic analysis of mechanisms using mechanism analysis software.

TOTAL : 45 PERIODS

OUTCOMES:
• Exposed to use CAD softwares for modeling of machine components.
• Exposed to use softwares for mechanism analysis
• Knowledge in conducting crash/impact analysis using FEA.

REFERENCE:
1. Laboratory Manual Prepared by RAE Department

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3-D solid modeling CAD software</td>
<td>10 licences</td>
</tr>
<tr>
<td>2</td>
<td>Multibody kinematic and dynamic analysis software</td>
<td>5 licences</td>
</tr>
<tr>
<td>3</td>
<td>non linear / crash / impact analysis software</td>
<td>2 licences</td>
</tr>
<tr>
<td>4</td>
<td>metal forming / metal cutting simulation software</td>
<td>2 licenses</td>
</tr>
<tr>
<td>5</td>
<td>loading and strain measuring set up</td>
<td>1 no</td>
</tr>
<tr>
<td>6</td>
<td>workstation configuration computers</td>
<td>15 nos</td>
</tr>
</tbody>
</table>
OBJECTIVES:

- To understand the different robotic configurations and their subsystems.

LIST OF EXPERIMENTS

1. Study of different types of robots based on configuration and application.
2. Study of different type of links and joints used in robots
3. Study of components of robots with drive system and end effectors.
4. Determination of maximum and minimum position of links.
5. Verification of transformation (Position and orientation) with respect to gripper and world coordinate system
7. Robot programming exercises

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to visualize the configurations of various types of robots.
- Understanding the components of robots like arms, linkages, drive systems and end effectors.
- Ability to measure the performance of robots

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>FUNUC programmable robot arm</td>
<td>1 no</td>
</tr>
<tr>
<td>2</td>
<td>rectangular, cylindrical and articulated type robot</td>
<td>1 each</td>
</tr>
<tr>
<td>3</td>
<td>software for robot motion control</td>
<td>5 licences</td>
</tr>
<tr>
<td>4</td>
<td>mobile&amp; flying robot</td>
<td>1 each</td>
</tr>
<tr>
<td>5</td>
<td>robot links, end effectors, drives, control card</td>
<td>1 set</td>
</tr>
</tbody>
</table>

RO6512 INNOVATION LABORATORY

Students have to do a Mechatronics project based on their idea. It can be a modeling, simulation, design or hardware project.

TOTAL: 30 PERIODS

EC6653 POWER ELECTRONICS AND DRIVES

OBJECTIVES:

- To get overview of different types of power semiconductor devices and their switching characteristics.
- To understand the operation, characteristics and performance parameters of controlled rectifiers.
To study the operation, switching techniques and basics topologies of DC-DC switching regulators.

To learn the different modulation techniques of pulse width modulated invertors and to understand harmonic reduction methods.

To study the operation of AC voltage controller and various configurations.

UNIT I REVIEW OF POWER SEMICONDUCTOR DEVICES

UNIT II CONVERTERS

UNIT III INVERTERS AND CHOPPERS
Voltage Source inverters –bridge inverters, Current source inverters – voltage and waveform control of inverters. DC choppers – step up and step down – uninterrupted power supplies.

UNIT IV DC DRIVES
Basic characteristics of DC motor – Operating modes – quadrant operation of chopper – Closed loop control of DC drives.

UNIT V AC DRIVES
Induction motor – Performance characteristics – Stator and rotor voltage control, frequency and voltage control – Current Control – Introduction to synchronous motor, stepper motor, switched reluctance motor drives – Basics of vector control.

OUTCOMES:
- ability to understand and analyze, linear and digital electronic circuits.

TEXT BOOKS:

REFERENCES:

TOTAL : 60 PERIODS
OBJECTIVES:
The student should be made to:
- Learn the architecture and programming of ARM processor.
- Be familiar with the embedded computing platform design and analysis.
- Be exposed to the basic concepts of real time Operating system.
- Learn the system design techniques and networks for embedded systems.

UNIT I  INTRODUCTION TO EMBEDDED COMPUTING AND ARM PROCESSORS
Complex systems and micro processors—Embedded system design process—Design example: Model train controller- Instruction sets preliminaries - ARM Processor – CPU: programming input and output-supervisor mode, exceptions and traps – Co-processors- Memory system mechanisms – CPU performance- CPU power consumption.

UNIT II  EMBEDDED COMPUTING PLATFORM DESIGN
The CPU Bus-Memory devices and systems—Designing with computing platforms—consumer electronics architecture—platform-level performance analysis - Components for embedded programs- Models of programs- Assembly, linking and loading – compilation techniques- Program level performance analysis – Software performance optimization – Program level energy and power analysis and optimization – Analysis and optimization of program size- Program validation and testing.

UNIT III  PROCESSES AND OPERATING SYSTEMS
Introduction – Multiple tasks and multiple processes – Multirate systems- Preemptive real-time operating systems- Priority based scheduling- Interprocess communication mechanisms – Evaluating operating system performance- power optimization strategies for processes – Example Real time operating systems-POSIX-Windows CE.

UNIT V  SYSTEM DESIGN TECHNIQUES AND NETWORKS
Design methodologies- Design flows - Requirement Analysis – Specifications-System analysis and architecture design – Quality Assurance techniques- Distributed embedded systems – MPSoCs and shared memory multiprocessors.

UNIT V  CASE STUDY
Data compressor - Alarm Clock - Audio player - Software modem-Digital still camera - Telephone answering machine-Engine control unit – Video accelerator.

OUTCOMES:
Upon completion of the course, students will be able to:
- Describe the architecture and programming of ARM processor.
- Outline the concepts of embedded systems
- Explain the basic concepts of real time Operating system design.
- Use the system design techniques to develop software for embedded systems
- Differentiate between the general purpose operating system and the real time operating system
- Model real-time applications using embedded-system concepts

TEXT BOOK:
REFERENCES:

RO6601 VISION SYSTEMS AND IMAGE PROCESSING L T P C
3 0 0 3

OBJECTIVES:

- To know about the principles and applications of vision system in modern manufacturing environment

UNIT I VISION SYSTEM
Basic Components – Elements of visual perception, Lenses: Pinhole cameras, Gaussian Optics – Cameras – Camera-Computer interfaces

UNIT II VISION ALGORITHMS

UNIT III OBJECT RECOGNITION
Object recognition, Approaches to Object Recognition, Recognition by combination of views – objects with sharp edges, using two views only, using a single view, use of dept values.

UNIT IV APPLICATIONS

UNIT V ROBOT VISION
Basic introduction to Robotic operating System (ROS) - Real and Simulated Robots - Introduction to OpenCV, Open NI and PCL, installing and testing ROS camera Drivers, ROS to OpenCV - The cv_bridge Package.

TOTAL: 45 PERIODS

OUTCOMES:

- knowledge or gadgets of vision systems
- ability to understand the image capturing and processing techniques
- knowledge in application of vision and image processing in Robot operations.
TEXT BOOKS:

REFERENCES:

RO6602 AUTOMATION SYSTEM DESIGN L T P C 3 0 0 3

OBJECTIVES:
• To know about the pneumatic, electric, hydraulic and electronic systems in automation of mechanical operations.

UNIT I FUNDAMENTAL CONCEPTS OF INDUSTRIAL AUTOMATION 9
Fundamental concepts in manufacturing and automation, definition of automation, reasons for automating. Types of production and types of automation, automation strategies, levels of automation.

UNIT II TRANSFER LINES AND AUTOMATED ASSEMBLY 9

UNIT III PNEUMATIC CONTROL 9
Components, constructional details, filter, lubricator, regulator, constructional features, types of cylinders, control valves for direction, pressure and flow, air motors, air hydraulic equipments. PNEUMATIC CONTROL SYSTEM DESIGN: General approach to control system design, symbols and drawings, schematic layout, travel step diagram, circuit, control modes, program control, sequence control, cascade method, Karnaugh-Veitch mapping.

UNIT IV PROGRAMMABLE AUTOMATION 9
UNIT V  ELEMENTS OF HYDRAULIC SYSTEMS

Pumps and motors- types, characteristics. Cylinders, types, typical construction details. Valves for control of direction, flow and pressure, types, typical construction details.

HYDRAULIC SYSTEM DESIGN:
Power pack—elements, design. Pipes- material, pipe fittings. seals and packing. maintenance of hydraulic systems. Selection criteria for cylinders, valves, pipes. Heat generation in hydraulic system

ADVANCED TOPICS IN HYDRAULICS AND PNEUMATICS: Electro pneumatics, ladder diagram. Servo and Proportional valves - types, operation, application. Hydro-Mechanical servo systems. PLC-construction, types, operation, programming

TOTAL: 45 PERIODS

OUTCOMES:
- knowledge of industrial automation by transfer lines and automated assembly lines.
- understanding of automated controls using pneumatic and hydraulic systems
- ability to understand the electronic control systems in metal machining and other manufacturing processes.

TEXT BOOKS:

REFERENCES:

EC6665  ECONOMICS FOR ENGINEERS  L T P C
2 1 0 3

OBJECTIVES:
- To understand the fundamental economic concepts applicable to engineering.
- To learn the techniques of incorporating inflation factor in economic decision making.

UNIT I  INTRODUCTION:
Definition – Nature – Scope and Significance of Economics for Engineers.
UNIT II  COST AND REVENUE:  
12

UNIT III  MARKET FAILURE:  
12
MONEY AND BANKING: Money – Functions – Quantity theory of money – Banking – Commercial Banks – Functions – Central Bank (RBI) – Functions – Case Study in Recent Development in Banking.

UNIT IV  FOREIGN EXCHANGE:  
6

UNIT V  BUSINESS CYCLE AND NATIONAL INCOME:  
5

Total(L: 30 + T:15): 45 PERIODS

OUTCOMES:
• Upon successful completion of this course, students will get the ability to apply the basics of economics and cost analysis to engineering and take economically sound decisions.

TEXT BOOKS:

REFERENCES:
5. Dutt and Sundaram “Indian Economy”, S.Chand and Co, New Delhi, 2011

EC6663  POWER ELECTRONICS AND DRIVES LABORATORY  
L T P C  
0 0 3 2

OBJECTIVES:
• To provide hands on experience with power electronic converter design and testing

LIST OF EXPERIMENTS:
1. Gate Pulse Generation using R,RC and UJT.
2. Characteristics of SCR and Triac
3. Characteristics of MOSFET and IGBT
4. AC to DC half controlled converter
5. AC to DC fully controlled Converter
6. Step down and step up MOSFET based choppers
7. IGBT based single phase PWM inverter
8. IGBT based three phase PWM inverter
9. AC Voltage controller
10. Switched mode power converter.
11. Simulation of PE circuits (1Φ & 3Φ semiconductor, 1Φ & 3Φ full converter, dc-dc converters, ac voltage controllers).

OUTCOMES:
- Ability to understand and analyse, linear and digital electronic circuits.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Device characteristics (for SCR, MOSFET, TRIAC and IGBT kit with built in / discrete power supply and meters)</td>
<td>2 each</td>
</tr>
<tr>
<td>2</td>
<td>Single phase SCR based half controlled converter and fully controlled converter along with built-in/separate/firing circuit/module and meter</td>
<td>2 each</td>
</tr>
<tr>
<td>3</td>
<td>MOSFET based step up and step down choppers (Built in/ Discrete)</td>
<td>1 each</td>
</tr>
<tr>
<td>4</td>
<td>IGBT based single phase PWM inverter module/Discrete Component</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>IGBT based three phase PWM inverter module/Discrete Component</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>Switched mode power converter module/Discrete Component</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>SCR &amp; TRIAC based 1 phase AC controller along with lamp or rheostat load</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>Cyclo converter kit with firing module</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Dual regulated Dc power supply with common ground</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Cathode ray Oscilloscope</td>
<td>10</td>
</tr>
<tr>
<td>11</td>
<td>Isolation Transformer</td>
<td>5</td>
</tr>
<tr>
<td>12</td>
<td>Single phase Auto transformer</td>
<td>3</td>
</tr>
<tr>
<td>13</td>
<td>Components (Inductance, Capacitance)</td>
<td>3 set for each</td>
</tr>
<tr>
<td>14</td>
<td>Multimeter</td>
<td>5</td>
</tr>
<tr>
<td>15</td>
<td>LCR meter</td>
<td>3</td>
</tr>
<tr>
<td>16</td>
<td>Rheostats of various ranges</td>
<td>2 sets of 10 value</td>
</tr>
<tr>
<td>17</td>
<td>Work tables</td>
<td>10</td>
</tr>
<tr>
<td>18</td>
<td>DC and AC meters of required ranges</td>
<td>20</td>
</tr>
<tr>
<td>19</td>
<td>Component data sheets to be provided</td>
<td></td>
</tr>
</tbody>
</table>
OBJECTIVES:
- To illustrate the design and simulation of multiple actuator systems using pneumatic, electro-pneumatic and PLCs and enable the students to integrate various fringe conditions in multiple actuator systems. To expose the students in sensors/actuators interfaced with computers.

LIST OF EXPERIMENTS:
1. Co-ordinated motion of multiple pneumatic actuators in a desired sequence using Cascade method
2. Integration of fringe condition modules in multiple actuator pneumatic systems
3. Co-ordinated motion of multiple actuator, electro–pneumatic systems in a desired sequence using hard–wire programmed control systems
4. Co-ordinated motion of multiple actuator, electro–pneumatic systems in a desired sequence using PLC.
5. Interfacing of an LVDT with a PC for monitoring the displacement of machine slide and raising an alarm if the displacement exceeds specified limit.
6. Inspection using Machine vision System
7. Control of speed, direction and number of revolutions of a stepper motor using PC.

TOTAL :45 PERIODS

OUTCOMES
- Able to design and layout multiple actuator systems with start shop and emergency modules
- Able to develop Ladder logic for electro-pneumatic actuator systems.
- Acquiring skill of interfacing different sensors like LVDT, ultrasonic and touch sensors.
- Ability to develop control system for stepper motors.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>NAME OF THE EQUIPMENT</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Basic Pneumatic Trainer Kit with manual and electrical controls</td>
<td>1 each</td>
</tr>
<tr>
<td>2</td>
<td>PNEUMOSIM software / Automation studio</td>
<td>10 sets</td>
</tr>
<tr>
<td>3</td>
<td>8051 – Microcontroller kit with stepper motor and drive circuit LABVIEW software</td>
<td>2 sets</td>
</tr>
<tr>
<td>4</td>
<td>machine vision system with software</td>
<td>1 no</td>
</tr>
<tr>
<td>5</td>
<td>stepper motors with PC interface cards</td>
<td>2 nos</td>
</tr>
<tr>
<td>6</td>
<td>servo motor with PC interface card</td>
<td>1 no</td>
</tr>
<tr>
<td>7</td>
<td>ultrasonic, touch and non contact sensors</td>
<td>2 each</td>
</tr>
</tbody>
</table>
OBJECTIVES:

- To impart knowledge in the increasing quality concepts of parts, accuracy requirement of machine tools and also to introduce latest topics in Manufacturing like micro machining and smart materials so as to equip them to join core electronic manufacturing industries.

UNIT I INTRODUCTION TO PRECISION ENGINEERING:

Precision manufacturing, Intelligent manufacturing – objectives, Reconfigurable systems.

UNIT II MOTION ERRORS:

Errors and error measurements, Model of measurement, Statistical measurements, Propagation of errors, Motion errors principle – translational body, rotational body, geometric and kinematic errors, Other types of errors in machines – thermal, cutting force induced, environmental, common geometric errors – cosine, abbe, dead path errors, Methodologies of error elimination.

UNIT III DESIGN STRATEGIES FOR MACHINE TOOLS

Standard sizes, Precision engineering principles – design, modeling and simulation, Design roadmap – conceptual analysis, materials selection, kinematic design of bearing and guide ways, Structural analysis – static and dynamic analysis, Micro machines – design approach, design challenges – kinematics, interactive forces, actuators,

UNIT IV PARALLEL KINEMATIC MACHINES (PKM)

Serial and parallel systems, Precision design of PKM – need of PKM, low cost, degrees of freedom, workspace volume, high stiffness and agility, repeatability in movement, low inertia, Configurations and characteristic issues – degrees of calculation, Design principles – Kinematic modeling.

UNIT V PRECISION CONTROL


TOTAL= L: 45 + T: 15 = 60 PERIODS

OUTCOMES:

- Upon completion of this course the student can able to use of quality concepts parts, accuracy requirements of machine tools and use of latest machining process such as micro machining and micro fabrication.

REFERENCES:

OBJECTIVES:
- To study the various parts of robots and fields of robotics.
- To study the various kinematics and inverse kinematics of robots.
- To study the control of robots for some specific applications.

UNIT I  INTRODUCTION
9

UNIT II  LOCALIZATION
9

UNIT III  PLANNING AND NAVIGATION
9
Introduction-Path planning overview- Road map path planning- Cell decomposition path planning- Potential field path planning-Obstacle avoidance - Case studies: tiered robot architectures.

UNIT IV  FIELD ROBOTS
9
Ariel robots- Collision avoidance-Robots for agriculture, mining, exploration, underwater, civilian and military applications, nuclear applications, Space applications.

UNIT V  HUMANOIDS:
9

OUTCOMES:
Upon completion of the course, the student should be able to:
- Explain the basic concepts of working of robot
- Analyze the function of sensors in the robot
- Write program to use a robot for a typical application
- Use Robots in different applications

TOTAL : 45 PERIODS

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To gain knowledge in various electrical and electronic programmable automations and their applications.

UNIT I TOTALLY INTEGRATED AUTOMATION:
Need, components of TIA systems, advantages, Programmable Automation Controllers (PAC), Vertical Integration structure.

UNIT II HMI SYSTEMS:
Necessity and Role in Industrial Automation, Need for HMI systems. Types of HMI - Text display - operator panels - Touch panels - Panel PCs - Integrated displays (PLC & HMI). Check with PLC 502 and remove

UNIT III SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA)

UNIT IV COMMUNICATION PROTOCOLS of SCADA

UNIT V DISTRIBUTED CONTROL SYSTEMS (DCS):
APPLICATIONS OF PLC & DCS: Case studies of Machine automation, Process automation, Introduction to SCADA Comparison between SCADA and DCS.

TOTAL: 45 PERIODS

OUTCOMES:
- knowledge of PLC & PAC automation
- ability to apply SCADA and usage of C programming for report generation
- acquiring informations on communication protocols in automation systems
- ability to design and develop automatic control system using distributed control systems.

TEXT BOOKS:

REFERENCES:
3. CIMPLICITY SCADA Packages Manual, Fanuc India Ltd, 2004
OBJECTIVES:
- To develop skill in developing integrated automatic control of drives and other actuating systems

LIST OF EXPERIMENTS:
1. Study of PAC
2. Programming a PAC for a given task
3. Configuring a text display with PLC
4. Programming and configuring a graphical display with PLC.
5. Study of SCADA
6. Development of screens for SCADA
7. Interfacing a SCADA with PLC
8. Study of DCS
9. Programming a DCS
10. Controlling a variable speed drive through PLC/SCADA

OUTCOMES:
- Skill in programming PAC and PLCs.
- Acquiring knowledge in SCADA and interfacing SCADA with PLC and PCs
- Ability to control variable speed drive.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS
1. PAC
2. PLC
3. SCADA
4. DCS
5. PC’S - 4No’s

TOTAL: 45 PERIODS

RO6712  PRODUCT DESIGN LABORATORY  L T P C  0 0 3 2

Students have to do design a product based on the given topic. It includes modeling, simulation, and design of a particular product.

TOTAL: 45 PERIODS

RO6713  DESIGN AND FABRICATION PROJECT  L T P C  0 0 4 2

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

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

TOTAL : 60 PERIODS

OUTCOMES:

• Use of design principles and develop conceptual and engineering design of any components.
• Ability to fabricate any components using different manufacturing tools.

RO6811

PROJECT WORK

OBJECTIVES:

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

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

TOTAL: 180 PERIODS

OUTCOMES:

• On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

EC6073

ADVANCED MICROPROCESSORS AND MICROCONTROLLERS

OBJECTIVES:

The student should be made to:

• Study the Architecture of 8085 microprocessor.
• Study the Architecture of 8086 microprocessor.
• Learn the design aspects of I/O and Memory Interfacing circuits.
• Study about communication and bus interfacing.
• Study the Architecture of 8051 microcontroller.
UNIT I  8086 MICROPROCESSOR  8

UNIT II  80286 MICROPROCESSOR  8
Functional block diagram - Modes of operation – Real and protected mode – Memory management and protection features.

UNIT III  80386, 80486 PROCESSORS  8

UNIT IV  PENTIUM MICROPROCESSOR  6
Introduction – Architecture – Special Pentium registers – Memory management.

UNIT V  PIC MICROCONTROLLER  15
Architecture – Memory structure – Register File – Addressing modes – Interrupts – Timers: Modes of operation
PIC PERIPHERAL FUNCTIONS AND SPECIAL FEATURES:
PWM output – Analog to Digital converter – UART – Watchdog timer – RESET Alternatives – Power Down mode – I²C Bus operation

OUTCOMES:
At the end of the course, the student should be able to:
• Design and implement programs on 8085 microprocessor.
• Design and implement programs on 8086 microprocessor.
• Design I/O circuits.
• Design Memory Interfacing circuits.
• Design and implement 8051 microcontroller based systems.

TEXT BOOKS:
1. Barry B Brey, "The Intel Microprocessor 8086/8088, 80186/80188, 80286, 80386, 80486

REFERENCES:
OBJECTIVES:
The student should be made to:
- Learn the various number systems.
- Understand the various logic gates.
- Be familiar with various combinational circuits.
- Understand the various components used in the design of digital computers.
- Understand arithmetic algorithms.

UNIT I  INTRODUCTION


UNIT II  PIPELINING AND VECTOR PROCESSING

UNIT III  ARRAY PROCESSING:

UNIT IV  MULTIPROCESSOR ARCHITECTURE:

UNIT V  INTRODUCTION TO RISC ARCHITECTURE
Instruction execution characteristics – Instruction execution charts – Register files – Register optimization – Reduced Instruction Set Architecture – RISC pipelining – RISC versus CISC.

TOTAL 45 PERIODS

OUTCOMES:
At the end of this course, the student will be able to:
- Perform arithmetic operations in any number system.
- Simplify the Boolean expression using K-Map and Tabulation techniques.
- Use boolean simplification techniques to design a combinational hardware circuit.
- Analyze a given digital circuit – combinational and sequential.
- Identify different functional units in a digital computer system.
- Trace execution of instruction sequence in a processor.
• Explain the implementation of each functional unit.

TEXT BOOKS:

REFERENCES:

CS6081 SYSTEM SOFTWARE

OBJECTIVES:
The student should be made to:
• Understand the phases in a software project.
• Understand fundamental concepts of requirements engineering and Analysis Modelling.
• Understand the major considerations for enterprise integration and deployment.
• Learn various testing and maintenance measures.

UNIT I ASSEMBLERS
MACRO LANGUAGE AND MACRO PROCESSORS: Macro instructions, features of a macro facility – implementation.

UNIT II LOADERS
Loader schemes – compile and go loaders, general load scheme – absolute loaders – direct linking loaders and their design. Other loading schemes: linking loaders, overlays, dynamic binders.

UNIT III COMPILERS
Introduction – Structure of a compiler – phases of a compiler - compiler writing tools.
LEXICAL ANALYSIS:
Role of a lexical analyzer – finite automata – regular expressions to finite automata – minimizing the number of states of a deterministic finite automata – implementation of a lexical analyzer.

UNIT IV PARSING TECHNIQUES

UNIT V INTERMEDIATE CODE GENERATION
Postfix notation, Quadruples, triples, indirect triples – Representing information in a symbol table – introduction to code optimization – basic blocks – DAG representation – error detection and recovery - code generation.

TOTAL :45 PERIODS
OUTCOMES:
At the end of the course, the student should be able to
• Identify the key activities in managing a software project.
• Compare different process models.
• Concepts of requirements engineering and Analysis Modeling.
• Apply systematic procedure for software design and deployment.
• Compare and contrast the various testing and maintenance.

REFERENCES:

UNIT I INTRODUCTION:
LEAN MANUFACTURING CONCEPTS:
Value creation and waste elimination – seven types of waste – pull production-different models of pull production - the Kanban system-continuous flow-the continuous improvement process / Kaizen-Worker involvement. Design of Kanban quantities – Leveled production - tools for continuous improvement.

UNIT II GROUP TECHNOLOGY AND CELLULAR LAYOUT
JIT with cell manufacturing – part families- production flow analysis – Composite part concept – machine cell design – quantitative analysis – case studies – single piece flow

UNIT III VALUE STREAM MAPPING
The value stream benefits mapping process - the current state map-mapping icons - mapping steps. VSM exercises - Takt time calculations.

UNIT IV LEAN MANUFACTURING TOOLS AND METHODOLOGIES
Standardized work- standard work sequence timing and working progress . Quality at source – Autonomation / Jidoka, Visual management system, Mistake proofing / Poka-Yoke. 5S technique – Elements and waste elimination through 5S, advantages and benefits - 5S-audit - visual control aids for improvement, flexible work force
UNIT V TOTAL PRODUCTIVE MAINTENANCE

Goals and benefits – Hidden factory, the six big losses, types of maintenance. Overall equipment effectiveness - pillars of TPM and implementation. Change over and set up timer education techniques. Temple of quality, OEE calculations.


OUTCOMES:
- ability to implement lean manufacturing concepts in industries
- ability to group the parts
- ability to use the lean manufacturing tools and method
- ability to apply Total Productive Maintenance concepts in industries.

TEXT BOOKS:

REFERENCES:

RO6002 INDUSTRIAL DESIGN AND APPLIED ERGONOMICS

OBJECTIVES:
- To explain the general principles that governs the interaction of humans and their working environment for improving worker performance and safety.

UNIT I INTRODUCTION
Definition, human technological system, multidisciplinary engineering approach, human–machine system, manual, mechanical, automated system, human system reliability, conceptual design, advanced development, detailed design and development.

INFORMATION INPUT:
Input and processing, text, graphics, symbols, codes, visual display of dynamic information, auditory, tactual, olfactory displays, speech communications.

UNIT II HUMAN OUTPUT AND CONTROL
Physical work, manual material handling, motor skill, human control of systems, controls and data entry devices, hand tools and devices.

WORKPLACE DESIGN:
Applied anthro
pometry, workspace design and seating, arrangement of components within a physical
space, interpersonal aspects of work place design, design of repetitive task, design of manual
handling task, work capacity, stress, and fatigue.

UNIT III ENVIRONMENTAL CONDITIONS
Illumination, climate, noise, motion, sound, vibration, colour and aesthetic concepts.

BIOMECHANICS:
Biostatic mechanics, statics of rigid bodies, biodynamic mechanics, human body kinematics, kinetics,
impact and collision.

UNIT IV BIO THERMODYNAMICS AND BIOENERGETICS
Biothermal fundamentals, human operator heat transfer, human system bioenergetics,
thermoregulatory physiology, human operator thermo regularity, passive operator, active operator,
heat stress.

UNIT V HUMAN FACTORS APPLICATIONS
Human error, accidents, human factors and the automobile, organizational and social aspects, steps
according to ISO/DIS6385, OSHA’s approach, virtual environments.

TOTAL : 45 PERIODS

OUTCOMES:
• The Student should apply ergonomic principles to design workplaces for the improvement of
human performance and implement latest occupational health and safety to the work place.

TEXT BOOK:

REFERENCES:

ME6005 PROCESS PLANNING AND COST ESTIMATION

OBJECTIVES:
• To introduce the process planning concepts to make cost estimation for various products after
process planning

UNIT I INTRODUCTION TO PROCESS PLANNING
Introduction- methods of process planning-Drawing interpretation-Material evaluation – steps in
process selection-.Production equipment and tooling selection

UNIT II PROCESS PLANNING ACTIVITIES
Process parameters calculation for various production processes-Selection jigs and fixtures election
of quality assurance methods - Set of documents for process planning-Economics of process
planning- case studies

UNIT III INTRODUCTION TO COST ESTIMATION
Importance of costing and estimation —methods of costing-elements of cost estimation –Types of
estimates – Estimating procedure- Estimation labor cost, material cost- allocation of over head
charges- Calculation of depreciation cost

77
UNIT IV PRODUCTION COST ESTIMATION
Estimation of Different Types of Jobs - Estimation of Forging Shop, Estimation of Welding Shop, Estimation of Foundry Shop

UNIT V MACHINING TIME CALCULATION
Estimation of Machining Time - Importance of Machine Time Calculation - Calculation of Machining Time for Different Lathe Operations, Drilling and Boring - Machining Time Calculation for Milling, Shaping and Planning - Machining Time Calculation for Grinding

TOTAL: 45 PERIODS

OUTCOMES:
• Upon completion of this course, the students can able to use the concepts of process planning and cost estimation for various products.

TEXT BOOK:

REFERENCES:

EE6071 SPECIAL MACHINES AND CONTROLLERS

OBJECTIVES:
• To know about special types of electrical motors, their characteristics and applications.

UNIT I STEPPER MOTORS
Types - Constructional features - principle of operation - variable reluctance motor - single and Multi stack configurations - Permanent Magnet Stepper motor - Hybrid stepper motor. Different modes of Excitation - theory of torque predictions - Drive systems and circuit for open loop and closed loop control of stepper motor.

UNIT II SWITCHED RELUCTANCE MOTORS

UNIT III PERMANENT MAGNET BRUSHLESS D.C. MOTORS

UNIT IV PERMANENT MAGNET SYNCHRONOUS MOTORS
Principle of operation, EMF, power input and torque expressions, Phasor diagram, Power Controllers, Torque speed characteristics, Self control, Vector control, Current control Schemes - Applications.
UNIT V  LINEAR MOTORS:
Linear Induction motor (LIM) classification – construction – Principle of operation – Concept of current sheet – goodness factor – DC Linear motor (DCLM) types – circuit equation - DCLM control applications – Linear Synchronous motor (LSM) – Types – Applications
SERVOMOTORS: Servomotor – Types – Constructional features, principle of operation - control applications

TOTAL : 45 PERIODS

OUTCOMES:
• understanding principles of operation, types and applications of stepper motors
• knowledge in evaluating the performance of DC motors
• ability to understand the working and applications linear motors and servo motors.

TEXT BOOKS:

REFERENCES:

CS6076  ARTIFICIAL INTELLIGENCE FOR ROBOTICS  L T P C
3 0 0 3

OBJECTIVES:
The student should be made to:
• Study the concepts of Artificial Intelligence.
• Learn the methods of solving problems using Artificial Intelligence.
• Introduce the concepts of Expert Systems and machine learning.

UNIT I  INTRODUCTION
History, state of the art, Need for AI in Robotics. Thinking and acting humanly, intelligent agents, structure of agents.

PROBLEM SOLVING:
Solving problems by searching –Informed search and exploration–Constraint satisfaction problems– Adversarial search, knowledge and reasoning–knowledge representation – first order logic.

UNIT II  PLANNING
Planning with forward and backward State space search – Partial order planning – Planning graphs– Planning with propositional logic – Planning and acting in real world.
UNIT III REASONING: 8

UNIT IV LEARNING: 8
Forms of learning – Knowledge in learning – Statistical learning methods – reinforcement learning, communication, perceiving and acting, Probabilistic language processing, perception.

UNIT V AI IN ROBOTICS: 8
Robotic perception, localization, mapping – configuring space, planning uncertain movements, dynamics and control of movement, Ethics and risks of artificial intelligence in robotics.

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
• Identify problems that are amenable to solution by AI methods.
• Identify appropriate AI methods to solve a given problem.
• Formalise a given problem in the language/framework of different AI methods.
• Implement basic AI algorithms.
• Design and carry out an empirical evaluation of different algorithms on a problem formalisation, and state the conclusions that the evaluation supports.

TEXT BOOKS:

REFERENCE:

IC6601 ADVANCED CONTROL SYSTEM L T P C
3 0 0 3

OBJECTIVES
• To provide knowledge on design in state variable form
• To provide knowledge in phase plane analysis.
• To give basic knowledge in describing function analysis.
• To study the design of optimal controller.
• To study the design of optimal estimator including Kalman Filter

UNIT I STATE VARIABLE DESIGN 9
Introduction to state Model effect of state Feedback Necessary and Sufficient Condition for Arbitrary Pole-placement pole placement Design design of state Observers separation principle servo design State Feedback with integral control

UNIT II PHASE PLANE ANALYSIS 9
Features of linear and non-linear systems Common physical non-linearities Methods of linearization Concept of phase portraits Singular points Limit cycles Construction of phase portraits Phase plane analysis of linear and non-linear systems Isocline method.
UNIT III DESCRIBING FUNCTION ANALYSIS

UNIT IV OPTIMAL CONTROL
Introduction - Time varying optimal control – LQR steady state optimal control – Solution of Ricatti’s equation – Application examples.

UNIT V OPTIMAL ESTIMATION
Optimal estimation – Kalman Bucy Filter-Solution by duality principle-Discrete systems- Kalman Filter- Application examples..

TOTAL : 45 PERIODS

OUTCOMES:
• Ability to apply advanced control theory to practical engineering problems.

TEXT BOOKS

REFERENCES

RO6003 INDIAN ETHOS AND VALUES

OBJECTIVES:
• To understand the Indian human values work ethics and social responsibilities and impact on the society.

UNIT I HUMAN VALUES AND ETHOS
Meaning and Significance of Values – Sources of Individual Values - Value crisis in the Contemporary Indian Society –Moral and Ethical Values.
SOCIAL RESPONSIBILITY AND ETHICS: Concept of Social Responsibility – Need and Importance of Social Responsibility – Business Ethics.

UNIT II APPLICATION OF VALUES
Relevance of Values in Management – Personal Values and Values at Work place – Values for Managers.
WORK ETHICS: Professional Values and Ethics – Need – Issues – Challenges – Ethical Leadership – Ethical dilemma - Case Study

UNIT III ORGANIZATIONAL CULTURE AND ITS CHALLENGES
Elements of strong organization culture – Brooks Perterson’s classification of culture.
UNIT IV  SHARED VALUES IN THE ORGANIZATION AND ITS IMPACT  6
Need to identify and share values – the Value Construct and How to Promote Shared Values.

UNIT V  UNIVERSAL VALUES  11
Cross Cultural Values - Impact of Culture on Organizations and Managing Workforce Diversity.
INTERPERSONAL RELATIONSHIP: 
Managing emotions – Emotional Intelligence – Building Better interpersonal Relations –Dealing with Subordinates – Case Study.

OUTCOMES:
• understanding the impart of human values in the society
• evaluation of values in different work environments
• understanding the effect of organizational culture and cross culture values.

TEXT BOOKS:

REFERENCES:

UNIT IV        DIRECTING

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

OUTCOMES:
• Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management

TEXTBOOKS:

REFERENCES:

GE6084        HUMAN RIGHTS
OBJECTIVES:
• To sensitize the Engineering students to various aspects of Human Rights.

UNIT I

UNIT II

UNIT III
Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.
UNIT IV
Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V

OUTCOME:
- Engineering students will acquire the basic knowledge of human rights.

REFERENCES:

EC6601 VLSI DESIGN

OBJECTIVES:
- In this course, the MOS circuit realization of the various building blocks that is common to any microprocessor or digital VLSI circuit is studied.
- Architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology are discussed.
- The main focus in this course is on the transistor circuit level design and realization for digital operation and the issues involved as well as the topics covered are quite distinct from those encountered in courses on CMOS Analog IC design.

UNIT I MOS TRANSISTOR PRINCIPLE
NMOS and PMOS transistors, Process parameters for MOS and CMOS, Electrical properties of CMOS circuits and device modeling, Scaling principles and fundamental limits, CMOS inverter scaling, propagation delays, Stick diagram, Layout diagrams

UNIT II COMBINATIONAL LOGIC CIRCUITS
Examples of Combinational Logic Design, Elmore’s constant, Pass transistor Logic, Transmission gates, static and dynamic CMOS design, Power dissipation – Low power design principles

UNIT III SEQUENTIAL LOGIC CIRCUITS
Static and Dynamic Latches and Registers, Timing issues, pipelines, clock strategies, Memory architecture and memory control circuits, Low power memory circuits, Synchronous and Asynchronous design

UNIT IV DESIGNING ARITHMETIC BUILDING BLOCKS
Data path circuits, Architectures for ripple carry adders, carry look ahead adders, High speed adders, accumulators, Multipliers, dividers, Barrel shifters, speed and area tradeoff

UNIT V IMPLEMENTATION STRATEGIES
Full custom and Semi custom design, Standard cell design and cell libraries, FPGA building block architectures, FPGA interconnect routing procedures.

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course, students should
- Explain the basic CMOS circuits and the CMOS process technology.
- Discuss the techniques of chip design using programmable devices.
- Model the digital system using Hardware Description Language.

TEXTBOOKS:

REFERENCES:

CS6009  NANO COMPUTING  L T P C
                                  3 0 0 3

OBJECTIVES:
The student should be made to:
- Learn nano computing challenges
- Be familiar with the imperfections
- Be exposed to reliability evaluation strategies
- Learn nano scale quantum computing
- Understand Molecular Computing and Optimal Computing

UNIT I  NANOCOMPUTING-PROSPECTS AND CHALLENGES

UNIT II NANO computing WITH IMPERFECTIONS

UNIT III RELIABILITY OF NANOCOMPUTING

UNIT IV NANOSCALE QUANTUM COMPUTING
OUTCOMES:  
Upon completion of the course, the student should be able to:  
- Discuss nano computing challenges.  
- Handle the imperfections.  
- Apply reliability evaluation strategies.  
- Use nano scale quantum computing.  
- Utilize Molecular Computing and Optimal Computing.

TEXT BOOK:  

REFERENCES:  

OBJECTIVES:  
- To get exposure on various types of Renewable Energy sources and their usage.

UNIT I  PRINCIPLES OF SOLAR RADIATION  
Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.

UNIT II SOLAR ENERGY COLLECTION  
Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

UNIT III SOLAR ENERGY STORAGE AND APPLICATIONS  
Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications- solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion.

UNIT IV WIND ENERGY  
Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria  
UNIT V GEOTHERMAL ENERGY: Resources, types of wells, methods of harnessing the energy, potential in India.

OCEAN ENERGY: OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

DIRECT ENERGY CONVERSION: Need for DEC, Carnot cycle, limitations, principles of DEC.

TOTAL : 45 PERIODS

OUTCOMES:
- understanding the physics of solar radiation.
- ability to classify the solar energy collectors and methodologies of storing solar energy.
- knowledge in capturing and applying other forms of energy sources like wind, biogas and Geothermal energies.

TEXT BOOKS:

REFERENCES:

MT6005 VIRTUAL INSTRUMENTATION

OBJECTIVES:
- The principle and applications of virtual instruments are introduced in mechatronics systems.

UNIT I REVIEW OF VIRTUAL INSTRUMENTATION
Historical perspectives, advantages, block diagram and architecture of a virtual instrument, data-flow techniques, graphical programming in data flow, comparison with conventional programming.

UNIT II VI PROGRAMMING TECHNIQUES
VIS and sub-VIS loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, string and file I/O.

UNIT III DATA ACQUISITION BASICS
AOC.OAC. 010. Counters & timers. PC Hardware structure, timing. Interrupts OMA, software and hardware installation.

UNIT IV COMMON INSTRUMENT INTERFACES
Current loop, RS.232C/RS.485, GPIB, System buses, interface buses: USB, PCMCIA, VXI, SCXI, PXI, etc., networking basics for office & Industrial applications, Visa and IVI, image acquisition and processing. Motion control.

UNIT V USE OF ANALYSIS TOOLS
Fourier transforms, power spectrum correlation methods, windowing & filtering, VI application in various fields.

TOTAL: 45 PERIODS

OUTCOMES:
• The students will be able to use virtual instruments to design various mechatronics systems.

TEXT BOOK

REFERENCES:

MG6071 ENTERPRENEURSHIP DEVELOPMENT L T P C
3 0 0 3

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

UNIT I ENTREPRENEURSHIP 9
Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur
Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.

UNIT II MOTIVATION 9
Major Motives Influencing an Entrepreneur – Achievement Motivation Training, Self Rating, Business Games, Thematic Apperception Test – Stress Management, Entrepreneurship Development Programs – Need, Objectives.

UNIT III BUSINESS 9

UNIT IV FINANCING AND ACCOUNTING 9

UNIT V SUPPORT TO ENTREPRENEURS 9

TOTAL : 45 PERIODS

OUTCOMES :
• Upon completion of the course, students will be able to gain knowledge and skills needed to run a business successfully.
TEXTBOOKS:

REFERENCES:

GE6083 DISASTER MANAGEMENT

OBJECTIVES:
• To provide students an exposure to disasters, their significance and types.
• To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
• To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
• To enhance awareness of institutional processes in the country and
• To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

UNIT I INTRODUCTION TO DISASTERS
Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don’ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR)
Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processes and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT
Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV DISASTER RISK MANAGEMENT IN INDIA
Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and
Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS 9
Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL: 45 PERIODS

OUTCOMES:
The students will be able to
• Differentiate the types of disasters, causes and their impact on environment and society
• Assess vulnerability and various methods of risk reduction measures as well as mitigation.
• Draw the hazard and vulnerability profile of India, Scenarious in the Indian context, Disaster damage assessment and management.

TEXTBOOK:

REFERENCES
1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005

EC6077 DIGITAL SIGNAL PROCESSORS AND ITS APPLICATIONS L T P C
3 0 0 3

OBJECTIVES:
• To understand the concept of information, types of channels
• To understand the capabilities of various source coding theorems and the fundamental limit of transmission over the channel.
• To understand the capabilities of various channel coding theorems.
• To develop the knowledge on pass band communication and spread spectrum.

UNIT I ARCHITECTURE OFTMS320C5X 9
Introduction -Bus structure-Central Arithmetic Logic unit(CALU)-Auxiliary Register ALU(ARAU)-Index register(INDX)-Auxiliary register compare register-Block move address register-,Block repeat registers-parallel logic unit-memory mapped registers-program controllers-on chip features.

UNIT II TMS320C5X PROGRAMMING 9
Assembly language syntax-Addressing modes, Load/store instructions-Addition/subtraction instructions-Move instructions-Multiplication instruction-NORM instruction-Program control
instructions-Peripheral instructions-Instruction Pipelining in C5x-Pipeline structure, Pipeline operation-
Normal pipeline operation.

UNIT III APPLICATIONS
C50 based starter kit-Programs for familiarization of the addressing modes-Program for familiarization
of Arithmetic Instructions-Programs in C5x for Processing Real time signals.

UNIT IV ARCHITECTURE OF TMS320C54X
Introduction-Architecture-Buses-Memory Organization-CPU-ALU-Barrel shifter-Multiplier/ Adder unit-
Compare, Select and store unit-Exponent Encoder-C54X pipeline-On chip Peripherals-Data Address
Generation logic-Program address generation logic.

UNIT V TMS320C54X PROGRAMMING
Data Addressing-Arithmetic instructions-Move instructions-Load/Store instructions-Logical
instructions-Control instructions-Conditional store instructions-Repeat instructions-I/o instructions-Bit
manipulation instructions-parallel instructions-special instructions-Application programs.

OUTCOMES:
Upon completion of the course, students will be able to
- Discuss the representation of signals and the process of sampling, quantization and coding
  that are fundamental to the digital transmission of analog signals.
- Design the baseband and band pass signal transmission and reception techniques.
- Explain error control coding which encompasses techniques for the encoding and decoding of
digital data streams for their reliable transmission over noisy channels.

TEXT BOOK:
1. Venkataramani B., Bhaskar M. "Digital Signal Processors: Architecture, Programming and

REFERENCES:

RO6005 MAINTENANCE AND SAFETY ENGINEERING

OBJECTIVES:
- To impart knowledge on maintenance and fundamentals and safety engineering practices.

UNIT I MAINTENANCE:
Types – breakdown, preventive, predictive, TPM; elements of preventive maintenance – checklist,
schedule, procedure.

UNIT II TOTAL PRODUCTIVE MAINTENANCE:
Principles; preparatory stages of implementation – TPM organisation structure, creation; basic TPM
policies and aids, master plan.
TPM IMPLEMENTATION:
Small group activities, autonomous maintenance, establishing planned maintenance, training,
developing equipment management program.
UNIT III SAFETY SYSTEMS ANALYSIS: 6
Definitions, safety systems; safety information system: basic concept, safety cost / benefit analysis; industrial safety engineering, OSHA regulations.

UNIT IV HAZARD ANALYSIS: 10
FIRE PROTECTION SYSTEM: Chemistry of fire, water sprinkler, fire hydrant, alarm and detection system. Suppression system: CO₂ system, foam system, Dry Chemical Powder (DCP) system, halon system, portable extinguisher.

UNIT V SAFETY IN MACHINE OPERATION: 10
Design for safety, lock out system, work permit system, safety in use of power press, cranes. Safety in foundry, forging, welding, hot working and cold working, electroplating and boiler operation.

TOTAL: 45 PERIODS

OUTCOMES:
• Students must be able to identify and prevent chemical, environmental mechanical, fire hazard through analysis and apply proper safety techniques on safety engineering and management.

TEXT BOOKS:

REFERENCES:
Software Projects various other types of projects - Problems with software projects - an overview of project planning - Project evaluation - Project Analysis and technical planning - Project estimates - Preparation of Estimates - COCOMO model - Function Point Analysis - Putnam Model - Non-development overheads.

UNIT II ACTIVITY PLANNING
Project schedules - Sequencing and scheduling projects - Network planning models - Shortening project duration - Identifying critical activities.

UNIT III RISK MANAGEMENT
Resource allocation - Monitoring and Control - Managing people and organizing teams - Planning for small projects - Handling large projects - Divide and Conquer - Software Project survival.

UNIT IV SOFTWARE CONFIGURATION MANAGEMENT
Basic functions, responsibilities, standards, configuration Management, Prototyping - Models of prototyping.

UNIT V SOFTWARE QUALITY ASSURANCE
CASE STUDY: Introduction to Project Management Tools – Typical Applications.(CCPM Critical Chain Project Management

OUTCOMES:
At the end of the course, the student should be able to
• Identify the key activities in managing a software project.
• Compare different process models.
• Concepts of requirements engineering and Analysis Modeling.
• Apply systematic procedure for software design and deployment.
• Compare and contrast the various testing and maintenance

REFERENCES:
OBJECTIVES:
The student should be made to:
- Learn the various soft computing frame works
- Be familiar with design of various neural networks
- Be exposed to fuzzy logic
- Learn genetic programming
- Be exposed to hybrid systems

UNIT I  INTRODUCTION TO NEURAL NETWORKS  7
Differences between Biological and Artificial Neural Networks - Typical Architecture, Common Activation Functions, McCulloch - Pitts Neuron, Simple Neural Nets for Pattern Classification, Linear Separability - Hebb Net, Perceptron, Adaline, Madaline - Architecture, algorithm, and Simple Applications.

UNIT II  PATTERN ASSOCIATION  7

UNIT III  COMPETITION, ADAPTIVE RESONANCE AND BACKPROPAGATION NEURAL NETWORKS  13

UNIT IV  CLASSICAL AND FUZZY SETS AND RELATIONS  6

UNIT V  MEMBERSHIP FUNCTIONS  15
Features of membership function, Standard forms and Boundaries, fuzzification, membership value assignments, Fuzzy to Crisp Conversions, Lambda Cuts for fuzzy sets and relations, Defuzzification methods.

APPLICATIONS:
Neural Networks: Robotics, Image compression, Control systems - Fuzzy Logic: Mobile robot navigation, Autotuning a PID Controller.

TOTAL:45 PERIODS

OUTCOMES:
Upon completion of the course, the student should be able to:
- Apply various soft computing frame works
- Design of various neural networks
- Use fuzzy logic
- Apply genetic programming
- Discuss hybrid soft computing

TEXT BOOKS:
REFERENCES:

RO6007 INDUSTRIAL ROBOTICS AND MATERIAL HANDLING SYSTEMS

OBJECTIVES:
• To introduce the basic concepts, parts of robots and types of robots.
• To make the student familiar with the various drive systems for robot, sensors and their applications in robots and programming of robots.
• To discuss about the various applications of robots, justification and implementation of robot.

UNIT I INTRODUCTION 6
Types of industrial robots, Load handling capacity, general considerations in Robotic material handling, material transfer, machine loading and unloading, CNC machine tool loading, Robot centered cell.

UNIT II ROBOTS FOR INSPECTION 8
Robotic vision systems, image representation, object recognition and categorization, depth measurement, image data compression, visual inspection, software considerations.

UNIT III OTHER APPLICATIONS 8
Application of Robots in continuous arc welding, Spot welding, Spray painting, assembly operation, cleaning, robot for underwater applications.

UNIT IV END EFFECTORS 11
Gripper force analysis and gripper design, design of multiple degrees of freedom, active and passive grippers.

SELECTION OF ROBOT:
Factors influencing the choice of a robot, robot performance testing, economics of robotisation, Impact of robot on industry and society.

UNIT V MATERIAL HANDLING 12
Concepts of material handling, principles and considerations in material handling systems design, conventional material handling systems - industrial trucks, monorails, rail guided vehicles, conveyor systems, cranes and hoists, advanced material handling systems, automated guided vehicle systems, automated storage and retrieval systems(ASRS), bar code technology, radio frequency identification technology.

TOTAL: 45 PERIODS

OUTCOMES:
• The Student must be able to design automatic manufacturing cells with robotic control using the principle behind robotic drive system, end effectors, sensor, machine vision robot kinematics and programming.

TEXT BOOKS:
REFERENCES:

MG6571 HUMAN RESOURCE MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:
• To acquaint students with the issues related to staffing, training, performance and compensation of Human Resources.

UNIT I INTRODUCTION TO HUMAN RESOURCE MANAGEMENT 5

UNIT II HUMAN RESOURCE PLANNING 8

UNIT III TRAINING AND EXECUTIVE DEVELOPMENT 10
Types of training and Executive development methods – purpose – benefits.

UNIT IV EMPLOYEE COMPENSATION 12

UNIT V PERFORMANCE EVALUATION AND CONTROL 10

TOTAL: 45 PERIODS

OUTCOMES:
• To understand the process of effective Human Resource Management.

TEXTBOOKS:

REFERENCES:
OBJECTIVES:
The student should be made to:

- Learn the architecture and programming of ARM processor.
- Be familiar with the embedded computing platform design and analysis.
- Be exposed to the basic concepts of real time Operating system.
- Learn the system design techniques and networks for embedded systems

UNIT I  INTRODUCTION TO EMBEDDED SYSTEM  7
Embedded system, Functional building block of embedded system, Characteristics of embedded system applications, Challenges in embedded system design, Embedded system design processes.

UNIT II  ARCHITECTURE OF EMBEDDED SYSTEM  10
Computer architecture taxonomy, CPUs – Programming input and output, Supervisor mode, Exceptions & Traps, Co-processors, Memory system mechanisms - CPU bus - Memory devices - I/O devices - Component interfacing - Assembly and linking - Basic compilation techniques – Program optimization.

UNIT III  OS FOR EMBEDDED SYSTEMS  10
Introduction to RTOS, Multiple tasks and multiple processes, Context switching, Operating system, Scheduling policies, Interprocess communication mechanisms. Introduction to µC/OS II.

UNIT IV  PERFORMANCE ISSUES OF EMBEDDED SYSTEMS  8
CPU Performance, CPU power consumption, Program level performance analysis, Analysis and optimization of program size, energy and power, Evaluating operating system performance, Power management and optimization strategies for processes, Multiprocessors – CPUs and accelerators, Multiprocessor performance analysis.

UNIT V  DESIGN & IMPLEMENTATION  10

TOTAL : 45 PERIODS

OUTCOMES:
Upon completion of the course, students will be able to:

- Describe the architecture and programming of ARM processor.
- Outline the concepts of embedded systems
- Explain the basic concepts of real time Operating system design.
- Use the system design techniques to develop software for embedded systems
- Differentiate between the general purpose operating system and the real time operating system
- Model real-time applications using embedded-system concepts

TEXT BOOKS:
REFERENCES:

EC6801 WIRELESS COMMUNICATION L T P C
3 0 0 3

OBJECTIVES:
The student should be made to:
• Be familiar with the characteristic of wireless channel
• Understand the design of a cellular system
• Learn the various digital signaling techniques and multipath mitigation techniques
• Be exposed to the concepts of multiple antenna techniques

UNIT I WIRELESS CHANNELS

UNIT II CELLULAR ARCHITECTURE
Multiple Access techniques - FDMA, TDMA, CDMA – Capacity calculations–Cellular concept-
Frequency reuse - channel assignment- hand off- interference & system capacity- trunking & grade of service – Coverage and capacity improvement.

UNIT III DIGITAL SIGNALING FOR FADING CHANNELS
Structure of a wireless communication link, Principles of Offset-QPSK, p/4-DQPSK, Minimum Shift Keying, Gaussian Minimum Shift Keying, Error performance in fading channels, OFDM principle – Cyclic prefix, Windowing, PAPR.

UNIT IV MULTIPATH MITIGATION TECHNIQUES
Equalisation – Adaptive equalization, Linear and Non-Linear equalization, Zero forcing and LMS Algorithms. Diversity – Micro and Macrodiversity, Diversity combining techniques, Error probability in fading channels with diversity reception, Rake receiver,

UNIT V MULTIPLE ANTENNA TECHNIQUES
MIMO systems – spatial multiplexing -System model -Pre-coding - Beam forming - transmitter diversity, receiver diversity- Channel state information-capacity in fading and non-fading channels.

TOTAL : 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
• Explain the characteristic of wireless channel
• Design a cellular system
• Compare the various digital signaling techniques and multipath mitigation techniques
• Explain the concepts of multiple antenna techniques
TEXTBOOKS:

REFERENCES:

EE6007 MICRO ELECTRO MECHANICAL SYSTEMS  L T P C
3 0 0 3

OBJECTIVES:
- To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices.
- To educate on the rudiments of Micro fabrication techniques.
- To introduce various sensors and actuators
- To introduce different materials used for MEMS
- To educate on the applications of MEMS to disciplines beyond Electrical and Mechanical engineering.

UNIT I INTRODUCTION

UNIT II SENSORS AND ACTUATORS-I

UNIT III SENSORS AND ACTUATORS-II

UNIT IV MICROMACHINING
UNIT V POLYMER AND OPTICAL MEMS

Polymers in MEMS – Polimide - SU-8 - Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene – Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS – Lenses and Mirrors – Actuators for Active Optical MEMS.

OUTCOMES:
• Ability to understand the operation of micro devices, micro systems and their applications.
• Ability to design the micro devices, micro systems using the MEMS fabrication process.

TEXT BOOKS:

REFERENCES:

RO6009 INDUSTRIAL NETWORKING

OBJECTIVES:
The student should be made to:
• Understand the evolution of computer networks using the layered network architecture.
• Understand the concepts of data communications.
• Be familiar with the Transmission media and Tools.
• Design computer networks using sub-netting and routing concepts.

UNIT I INTRODUCTION
FIBRE OPTICS:
Introduction – Fibre optic cable components and parameters – Basic cable types – Connection fibres – troubleshooting.

UNIT II MODBUS

UNIT III ETHERNET SYSTEMS
CAN BUS:

UNIT IV  WIRELESS COMMUNICATIONS  9

UNIT V  APPLICATIONS  6

OUTCOMES:
At the end of the course, the student should be able to:
• Apply the concepts of data communications.
• Design computer networks using sub-netting and routing concepts.
• Compare the various medium access control techniques.
• Compare and contrast the characteristics of physical layer.
• Analyze the different protocols.
• Compare and contrast the different network components.

TEXT BOOKS:
1. Steve Mackay, Edwin Wright, Deon Reynders and John Park, “Practical Industrial Data Networks: Design, Installation and Troubleshooting”, Newnes (Elsevier), 2004

REFERENCES:

RO6010  INTERNET TOOLS AND JAVA PROGRAMMING  L T P C
3 0 0 3

OBJECTIVES:
The student should be made to:
• Learn Java Programming.
• Understand different Internet Technologies.
• Be familiar with client – side programming and server – side programming.
• Learn to develop web applications.

UNIT I  INTERNET TOOLS
OBJECT ORIENTATION IN JAVA:
UNIT II  ABSTRACT FUNCTIONS AND PACKAGES  6
Abstract classes - Abstract Functions – Method Overloading and Method Overriding- Wrapper Classes.
Packages - Access protection - Importing packages - Interface - Defining and Implementing Interface -
Applying Interface - Variables in Interfaces.

UNIT III  EXCEPTION HANDLING  9
Fundamentals - Exception types - Uncaught Exception - Using Try and Catch - Multiple catch clauses
- Nested Try statements - Throw - Throws - Java Built-in Exception - Creating your own subclasses.
MULTI THREADED PROGRAMMING:
Java thread model - Priorities - Synchronization - Messaging - Thread class and runnable Interface -
Main thread - Creating the Thread - Synchronization - Interthread Communication - Deadlock.

UNIT IV  I/O, APPELTS  12
I/O basics - Stream - Stream Classes - Predefined stream - Reading/Writing console input - Applet
fundamentals - Native methods.- GUI Components - Applets - Java Scripts – AWT / Swings.

UNIT V  INTRODUCTION TO NETWORK PROGRAMMING  9
Fundamentals - Internet Addresses - Internet Protocols - DNS - Internet Services - Socket
programming, UDP, TCP.
JAVA DATABASE PROGRAMMING: JDBC –Database Connection and Table Creation – Execution of
Embedded SQL Statements - ResultSet and ResultSetMetaData – Examples.
TOTAL :45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
• Implement Java programs.
• Create a basic website using HTML and Cascading Style Sheets.
• Design and implement dynamic web page with validation using JavaScript objects and by
  applying different event handling mechanisms.
• Design rich client presentation using AJAX.
• Design and implement simple web page in PHP, and to present data in XML format.
• Design and implement server side programs using Servlets and JSP.

REFERENCES:
  Publications, New Delhi, 2000
OBJECTIVES:
- To analyse the stresses and deformations through advanced mathematical models.
- To estimate the design strength of various industrial equipments.

UNIT I  ANALYSIS OF PLATES  8

UNIT II  THICK CYLINDERS AND SPHERES  10
Equilibrium and compatibility conditions - Lame’s Theorem – Boundary conditions – distribution of radial and tangential stresses – compound cylinders – Interference fits - Stresses due to temperature distributions.

UNIT III  ROTATING DISCS  10
Lame-Clayperon Theorem – radial and tangential stresses in discs due to centrifugal effects – boundary conditions – solid and hollow discs – Interference fit on shafts – Strengthening of the hub – residual stresses – Autofrettage – Discs of variable thickness – Disc profile for uniform strength.

UNIT IV  BEAMS ON ELASTIC FOUNDATION  8
Infinite beam subjected to concentrated load – Boundary Conditions – Infinite beam subjected to a distributed load segment – Triangular load – Semi infinite beam subjected to loads at the ends and concentrated load near the ends – Short beams.

UNIT V  CURVED BEAMS AND CONTACT STRESSES  9
Analysis of stresses in beams with large curvature – Stress distribution in curved beams – Stresses in crane hooks and C clamps – Contact Stresses – Hertz equation for contact stresses – applications to rolling contact elements.

OUTCOMES:
- Upon completion of this course, the students can able to apply mathematical knowledge to calculate the deformation behavior of simple structures. Critically analyse problem and solve the problems related to mechanical elements and analyse the deformation behavior for different types of loads.

TEXT BOOKS:

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

UNIT I  VEHICLE STRUCTURE AND ENGINES
Types of automobiles, vehicle construction and different layouts, chassis, frame and body, Vehicle aerodynamics (various resistances and moments involved), IC engines –components-functions and materials, variable valve timing (VVT).

UNIT II  ENGINE AUXILIARY SYSTEMS
Electronically controlled gasoline injection system for SI engines, Electronically controlled diesel injection system (Unit injector system, Rotary distributor type and common rail direct injection system), Electronic ignition system (Transistorized coil ignition system, capacitive discharge ignition system), Turbo chargers (WGT, VGT), Engine emission control by three way catalytic converter system, Emission norms (Euro and BS).

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

UNIT IV  STEERING, BRAKES AND SUSPENSION SYSTEMS
Steering geometry and types of steering gear box-Power Steering, Types of Front Axle, Types of Suspension Systems, Pneumatic and Hydraulic Braking Systems, Antilock Braking System (ABS), electronic brake force distribution (EBD) and Traction Control.

UNIT V  ALTERNATIVE ENERGY SOURCES

Note: Practical Training in dismantling and assembling of Engine parts and Transmission Systems should be given to the students.

TOTAL: 45 PERIODS

OUTCOMES:
- Upon completion of this course, the students will be able to identify the different components in automobile engineering.
- Have clear understanding on different auxiliary and transmission systems usual.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
• To provide an insight on the fundamentals of supply chain networks, tools and techniques.

UNIT I INTRODUCTION
Role of Logistics and Supply chain Management: Scope and Importance- Evolution of Supply Chain - Decision Phases in Supply Chain - Competitive and Supply chain Strategies – Drivers of Supply Chain Performance and Obstacles.

UNIT II SUPPLY CHAIN NETWORK DESIGN

UNIT III LOGISTICS IN SUPPLY CHAIN

UNIT IV SOURCING AND COORDINATION IN SUPPLY CHAIN
Role of sourcing supply chain supplier selection assessment and contracts- Design collaboration - sourcing planning and analysis - supply chain co-ordination - Bull whip effect – Effect of lack of co-ordination in supply chain and obstacles – Building strategic partnerships and trust within a supply chain.

UNIT V SUPPLY CHAIN AND INFORMATION TECHNOLOGY
The role IT in supply chain- The supply chain IT frame work Customer Relationship Management – Internal supply chain management – supplier relationship management – future of IT in supply chain – E-Business in supply chain.

OUTCOMES:
• The student would understand the framework and scope of supply chain networks and functions.

TEXTBOOK :

REFERENCES:
OBJECTIVES:

• To understand the application of computers in various aspects of Manufacturing viz., Design, Proper planning, Manufacturing cost, Layout & Material Handling system.

UNIT I  INTRODUCTION

UNIT II  PRODUCTION PLANNING AND CONTROL AND COMPUTERISED PROCESS PLANNING

UNIT III  CELLULAR MANUFACTURING

UNIT IV  FLEXIBLE MANUFACTURING SYSTEM (FMS) AND AUTOMATED GUIDED VEHICLE SYSTEM (AGVS)

UNIT V  INDUSTRIAL ROBOTICS

TOTAL : 45 PERIODS

OUTCOMES:

• Upon completion of this course, the Student can able to understand the use of computers in process planning and use of FMS and Robotics in CIM

TEXT BOOKS:

REFERENCES: