ANNA UNIVERSITY, CHENNAI
UNIVERSITY DEPARTMENTS
B.E. INDUSTRIAL ENGINEERING
REGULATIONS – 2015
CHOICE BASED CREDIT SYSTEM

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

Our B.E. (Industrial Engineering) graduates will be able to:

I. Find gainful employment in manufacturing and service sector.
II. Get elevated to managerial position and lead the organization competitively.
III. Enter into higher studies leading to post-graduate and research degrees.
IV. Become consultant and provide solutions to the practical problems of any organization.
V. Become an entrepreneur and be part of a supply chain or make and sell products in the open market.

PROGRAMME OUTCOMES (POs):
After going through the four years of study, our Industrial Engineering Graduates will exhibit ability to:

<table>
<thead>
<tr>
<th>PO #</th>
<th>Graduate Attribute</th>
<th>Programme Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Engineering knowledge</td>
<td>Apply knowledge of mathematics, basic science and engineering science.</td>
</tr>
<tr>
<td>2</td>
<td>Problem analysis</td>
<td>Identify, formulate and solve engineering problems.</td>
</tr>
<tr>
<td>3</td>
<td>Design/development of solutions</td>
<td>Design a system or process to improve its performance, satisfying its constraints.</td>
</tr>
<tr>
<td>4</td>
<td>Conduct investigations of complex problems</td>
<td>Conduct experiments &amp; collect, analyze and interpret the data.</td>
</tr>
<tr>
<td>5</td>
<td>Modern tool usage</td>
<td>Apply various tools and techniques to improve the efficiency of the system.</td>
</tr>
<tr>
<td>6</td>
<td>The Engineer and society</td>
<td>Conduct themselves to uphold the professional and social obligations.</td>
</tr>
<tr>
<td>7</td>
<td>Environment and sustainability</td>
<td>Design the system with environment consciousness and sustainable development.</td>
</tr>
<tr>
<td>8</td>
<td>Ethics</td>
<td>Interact in industry, business and society in a professional and ethical manner.</td>
</tr>
<tr>
<td>9</td>
<td>Individual and team work</td>
<td>Function in a multidisciplinary team.</td>
</tr>
<tr>
<td>10</td>
<td>Communication</td>
<td>Proficiency in oral and written Communication.</td>
</tr>
<tr>
<td>11</td>
<td>Project management and finance</td>
<td>Implement cost effective and improved system.</td>
</tr>
<tr>
<td>12</td>
<td>Life-long learning</td>
<td>Continue professional development and learning as a life-long activity.</td>
</tr>
<tr>
<td>PROGRAMME EDUCATIONAL OBJECTIVES</td>
<td>PO1</td>
<td>PO2</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td>I</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>II</td>
<td></td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>IV</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>V</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>
## B.E. INDUSTRIAL ENGINEERING

### Mapping of Course Outcome and Programme Outcome

<table>
<thead>
<tr>
<th>Year</th>
<th>Semester</th>
<th>Course Name</th>
<th>PO01</th>
<th>PO02</th>
<th>PO03</th>
<th>PO04</th>
<th>PO05</th>
<th>PO06</th>
<th>PO07</th>
<th>PO08</th>
<th>PO09</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Foundational English</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mathematics – I</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Engineering Physics</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Engineering Chemistry</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Engineering Graphics</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Basic Sciences Laboratory</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Engineering Practices Laboratory</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Technical English</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mathematics-II</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Computing Techniques</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fundamentals of Electrical Engineering</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Manufacturing Technology – I</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Manufacturing Technology Laboratory</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Manufacturing Technology Laboratory – I</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Computer Practices</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>Probability and Statistics</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Strength of Materials</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Manufacturing Technology – II</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Engineering Economy and Cost Estimation</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Engineering Mechanics</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Strength of Materials Laboratory</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Manufacturing Technology Laboratory – II</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Environmental Science and Engineering</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fluid Mechanics and Machinery</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Electronics Engineering</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mechanics of Machines</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Work System Design</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Production and Operations Management</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fluid Mechanics and Machinery Laboratory</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Work System Design Laboratory</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

*Attended*

**DIRECTOR**

Centre for Academic Courses
Anna University, Chennai-600 025
<table>
<thead>
<tr>
<th>YEAR 3</th>
<th>Course Name</th>
<th>PO01</th>
<th>PO02</th>
<th>PO03</th>
<th>PO04</th>
<th>PO05</th>
<th>PO06</th>
<th>PO07</th>
<th>PO08</th>
<th>PO09</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semester 5</td>
<td>Operations Research-I</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Quality Control and Assurance</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Machine Design</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Thermodynamics</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Professional Elective I</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Open Elective I</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Optimization Lab</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Computer Aided Machine Drawing</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Semester 6</td>
<td>Operations Research - II</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Applied Ergonomics</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Facility Layout and Materials Handling</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reliability Engineering</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Professional Elective-II</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Open Elective – II</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ergonomics Lab</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Data Analytics Lab</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>YEAR 4</th>
<th>Course Name</th>
<th>PO01</th>
<th>PO02</th>
<th>PO03</th>
<th>PO04</th>
<th>PO05</th>
<th>PO06</th>
<th>PO07</th>
<th>PO08</th>
<th>PO09</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semester 7</td>
<td>Simulation Modeling and Analysis</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Design of Experiments</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Supply Chain and Logistics Management</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Professional Elective-III</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Professional Elective – IV</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Industrial Training/Mini Project/Internship</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Discrete Simulation Lab</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Communication Skills and Soft Skills</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Semester 8</td>
<td>Manufacturing Automation</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Professional Elective – V</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Professional Elective - VI</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Project work</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Comprehension</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Automation Lab</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>
ANNA UNIVERSITY, CHENNAI  
UNIVERSITY DEPARTMENTS  
B.E. INDUSTRIAL ENGINEERING  
REGULATIONS – 2015  
CHOICE BASED CREDIT SYSTEM  
CURRICULA AND SYLLABI I - VIII SEMESTERS

SEMMESTER I

<table>
<thead>
<tr>
<th>SL. NO</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>CONTACT PERIODS</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>THEORY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>HS7151</td>
<td>Foundational English</td>
<td>HS</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>MA7151</td>
<td>Mathematics – I</td>
<td>BS</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>3.</td>
<td>PH7151</td>
<td>Engineering Physics</td>
<td>BS</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>CY7151</td>
<td>Engineering Chemistry</td>
<td>BS</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>GE7152</td>
<td>Engineering Graphics</td>
<td>ES</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PRACTICAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>BS7161</td>
<td>Basic Sciences Laboratory</td>
<td>BS</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>7.</td>
<td>GE7162</td>
<td>Engineering Practices</td>
<td>ES</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>TOTAL</td>
<td>27</td>
<td>17</td>
<td>2</td>
<td>8</td>
</tr>
</tbody>
</table>

SEMMESTER II

<table>
<thead>
<tr>
<th>SL. NO</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>CONTACT PERIODS</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>THEORY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>HS7251</td>
<td>Technical English</td>
<td>HS</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>MA7251</td>
<td>Mathematics II</td>
<td>BS</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>3.</td>
<td>GE7151</td>
<td>Computing Techniques</td>
<td>ES</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>EE7253</td>
<td>Fundamentals of Electrical Engineering</td>
<td>ES</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>ME7252</td>
<td>Manufacturing Technology- I</td>
<td>ES</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>PH7251</td>
<td>Materials Science</td>
<td>BS</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PRACTICAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>ME7261</td>
<td>Manufacturing Technology Laboratory - I</td>
<td>ES</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>8.</td>
<td>GE7161</td>
<td>Computer Practices</td>
<td>ES</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>TOTAL</td>
<td>28</td>
<td>20</td>
<td>0</td>
<td>8</td>
</tr>
</tbody>
</table>

Director

Centre For Academic Courses
Anna University, Chennai 600 025
### SEMESTER III

<table>
<thead>
<tr>
<th>SL. NO.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>CONTACT PERIODS</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>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>CE7251</td>
<td>Strength of Materials</td>
<td>ES</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>GE7153</td>
<td>Engineering Mechanics</td>
<td>ES</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>3.</td>
<td>IE7301</td>
<td>Engineering Economy and Cost Estimation</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>MA7357</td>
<td>Probability and Statistics</td>
<td>BS</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>5.</td>
<td>ME7352</td>
<td>Manufacturing Technology-II</td>
<td>PC</td>
<td>3</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>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>CE7261</td>
<td>Strength of Materials Laboratory</td>
<td>ES</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>7.</td>
<td>ME7361</td>
<td>Manufacturing Technology Laboratory – II</td>
<td>PC</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td>25</td>
<td>17</td>
<td>8</td>
<td>21</td>
</tr>
</tbody>
</table>

### SEMESTER IV

<table>
<thead>
<tr>
<th>SL. NO.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>CONTACT PERIODS</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>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>CE7352</td>
<td>Fluid Mechanics and Machinery</td>
<td>ES</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>EC7354</td>
<td>Electronics Engineering</td>
<td>ES</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>GE7251</td>
<td>Environmental Science and Engineering</td>
<td>HS</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>IE7401</td>
<td>Work System Design</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>IE7451</td>
<td>Production and Operations Management</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>ME7353</td>
<td>Mechanics of Machines</td>
<td>PC</td>
<td>3</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>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>CE7361</td>
<td>Fluid Mechanics and Machinery Laboratory</td>
<td>ES</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>8.</td>
<td>IE7411</td>
<td>Work System Design Laboratory</td>
<td>PC</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td>26</td>
<td>18</td>
<td>8</td>
<td>22</td>
</tr>
</tbody>
</table>
### SEMESTER V

<table>
<thead>
<tr>
<th>SL. NO</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>CONTACT PERIODS</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>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>IE7501</td>
<td>Operations Research - I</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>IE7502</td>
<td>Quality Control and Assurance</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>ME7451</td>
<td>Machine Design</td>
<td>PC</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>4.</td>
<td>ME7452</td>
<td>Thermodynamics</td>
<td>PC</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>5.</td>
<td></td>
<td>Professional Elective I</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td></td>
<td>Open Elective I*</td>
<td>OE</td>
<td>3</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>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>IE7511</td>
<td>Optimization Laboratory</td>
<td>PC</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>8.</td>
<td>ME7561</td>
<td>Computer Aided Machine Drawing</td>
<td>PC</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td>30</td>
<td>18</td>
<td>4</td>
<td>8</td>
</tr>
</tbody>
</table>

### SEMESTER VI

<table>
<thead>
<tr>
<th>SL. NO</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>CONTACT PERIODS</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>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>IE7601</td>
<td>Applied Ergonomics</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>IE7602</td>
<td>Facility Layout and Materials Handling</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>IE7603</td>
<td>Operations Research - II</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>IE7604</td>
<td>Reliability Engineering</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td></td>
<td>Professional Elective II</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td></td>
<td>Open Elective II*</td>
<td>OE</td>
<td>3</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>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>IE7611</td>
<td>Data Analytics Laboratory</td>
<td>PC</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>8.</td>
<td>IE7612</td>
<td>Ergonomics Laboratory</td>
<td>PC</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td>26</td>
<td>18</td>
<td>0</td>
<td>8</td>
</tr>
</tbody>
</table>

### SEMESTER VII

<table>
<thead>
<tr>
<th>SL. NO</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>CONTACT PERIODS</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>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>IE7701</td>
<td>Simulation Modeling and Analysis</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>IE7702</td>
<td>Supply Chain and Logistics Management</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>IE7751</td>
<td>Design of Experiments</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td>Professional Elective III</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td></td>
<td>Professional Elective IV</td>
<td>PE</td>
<td>3</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>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>HS7561</td>
<td>Communication Skills and Soft Skills</td>
<td>HS</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>7.</td>
<td>IE7711</td>
<td>Discrete Simulation Laboratory</td>
<td>PC</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>8.</td>
<td>IE7712</td>
<td>Industrial Training/Mini Project /Internship*</td>
<td>EEC</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td>26</td>
<td>16</td>
<td>0</td>
<td>10</td>
</tr>
</tbody>
</table>

* the students will undergo inplant training / Internship during previous vacation
## SEMESTER VIII

<table>
<thead>
<tr>
<th>SL. NO</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>CONTACT PERIODS</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>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>IE7801</td>
<td>Manufacturing Automation</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td>Professional Elective V</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td>Professional Elective VI</td>
<td>PE</td>
<td>3</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>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>IE7811</td>
<td>Automation Laboratory</td>
<td>PC</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>5.</td>
<td>IE7812</td>
<td>Comprehension</td>
<td>EEC</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>6.</td>
<td>IE7813</td>
<td>Project work&lt;sup&gt;a&lt;/sup&gt;</td>
<td>EEC</td>
<td>20</td>
<td>0</td>
<td>0</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td></td>
<td>37</td>
<td>9</td>
<td>0</td>
<td>28</td>
<td>23</td>
</tr>
</tbody>
</table>

*Course from the curriculum of other UG Programmes
# The contact periods will not appear in the slot time table

**TOTAL NO. OF CREDITS:179**

### HUMANITIES AND SOCIAL SCIENCES (HS)

<table>
<thead>
<tr>
<th>SL. No</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>CONTACT PERIODS</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>HS7151</td>
<td>Foundational English</td>
<td>HS</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>HS7251</td>
<td>Technical English</td>
<td>HS</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>3.</td>
<td>GE7251</td>
<td>Environmental Science and Engineering</td>
<td>HS</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>HS7561</td>
<td>Communication Skills and Soft Skills</td>
<td>HS</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

### BASIC SCIENCES (BS)

<table>
<thead>
<tr>
<th>SL. No</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>CONTACT PERIODS</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>MA7151</td>
<td>Mathematics – I</td>
<td>BS</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>PH7151</td>
<td>Engineering Physics</td>
<td>BS</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>CY7151</td>
<td>Engineering Chemistry</td>
<td>BS</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>BS7161</td>
<td>Basic Sciences Laboratory</td>
<td>BS</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>5.</td>
<td>MA7251</td>
<td>Mathematics-II</td>
<td>BS</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>6.</td>
<td>PH7251</td>
<td>Materials Science</td>
<td>BS</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>7.</td>
<td>MA7357</td>
<td>Probability and Statistics</td>
<td>BS</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
</tbody>
</table>

### ENGINEERING SCIENCES (ES)

<table>
<thead>
<tr>
<th>SL. No</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>CONTACT PERIODS</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>GE7152</td>
<td>Engineering Graphics</td>
<td>ES</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>GE7162</td>
<td>Engineering Practices Laboratory</td>
<td>ES</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>3.</td>
<td>GE7151</td>
<td>Computing Techniques</td>
<td>ES</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>EE7253</td>
<td>Fundamentals of Electrical Engineering</td>
<td>ES</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>SL. NO.</td>
<td>COURSE CODE</td>
<td>COURSE TITLE</td>
<td>CATEGORY</td>
<td>CONTACT PERIODS</td>
<td>L</td>
<td>T</td>
<td>P</td>
<td>C</td>
</tr>
<tr>
<td>--------</td>
<td>-------------</td>
<td>------------------------------</td>
<td>----------</td>
<td>----------------</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>1.</td>
<td>ME7352</td>
<td>Manufacturing Technology -II</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>IE7301</td>
<td>Engineering Economy and Cost Estimation</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>ME7361</td>
<td>Manufacturing Technology Laboratory II</td>
<td>PC</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>4.</td>
<td>ME7353</td>
<td>Mechanics of Machines</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>IE7401</td>
<td>Work System Design</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>IE7451</td>
<td>Production and Operations Management</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>7.</td>
<td>IE7411</td>
<td>Work System Design Laboratory</td>
<td>PC</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>8.</td>
<td>IE7501</td>
<td>Operations Research-I</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>9.</td>
<td>IE7502</td>
<td>Quality Control and Assurance</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>10.</td>
<td>ME7451</td>
<td>Machine Design</td>
<td>PC</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>11.</td>
<td>ME7452</td>
<td>Thermodynamics</td>
<td>PC</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>12.</td>
<td>IE7511</td>
<td>Optimization Laboratory</td>
<td>PC</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>13.</td>
<td>ME7561</td>
<td>Computer Aided Machine Drawing</td>
<td>PC</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>14.</td>
<td>IE7603</td>
<td>Operations Research - II</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>15.</td>
<td>IE7601</td>
<td>Applied Ergonomics</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>16.</td>
<td>IE7602</td>
<td>Facility Layout and Materials Handling</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>17.</td>
<td>IE7604</td>
<td>Reliability Engineering</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>18.</td>
<td>IE7612</td>
<td>Ergonomics Laboratory</td>
<td>PC</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>19.</td>
<td>IE7611</td>
<td>Data Analytics Laboratory</td>
<td>PC</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>20.</td>
<td>IE7701</td>
<td>Simulation Modeling and Analysis</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>21.</td>
<td>IE7751</td>
<td>Design of Experiments</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>22.</td>
<td>IE7702</td>
<td>Supply Chain and Logistics Management</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>23.</td>
<td>IE7711</td>
<td>Discrete Simulation Laboratory</td>
<td>PC</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>24.</td>
<td>IE7801</td>
<td>Manufacturing Automation</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>25.</td>
<td>IE7811</td>
<td>Automation Laboratory</td>
<td>PC</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>SL. No</td>
<td>COURSE CODE</td>
<td>COURSE TITLE</td>
<td>CATEGORY</td>
<td>CONTACT PERIODS</td>
<td>L</td>
<td>T</td>
<td>P</td>
<td>C</td>
</tr>
<tr>
<td>-------</td>
<td>-------------</td>
<td>--------------------------------------------------</td>
<td>----------</td>
<td>----------------</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>1.</td>
<td>GE7071</td>
<td>Disaster Management</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>GE7074</td>
<td>Human Rights</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>GE7652</td>
<td>Total Quality Management</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>IE7001</td>
<td>Accounting and Finance for Management</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>IE7002</td>
<td>Advanced Optimization Techniques</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>IE7003</td>
<td>Applied Multi-Variate Statistical Analysis</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>7.</td>
<td>IE7004</td>
<td>Computational Methods and Algorithms</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>8.</td>
<td>IE7005</td>
<td>Decision Support and Intelligent Systems</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>9.</td>
<td>IE7006</td>
<td>Evolutionary Optimization</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>10.</td>
<td>IE7007</td>
<td>Information Systems Analysis and Design</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>11.</td>
<td>IE7008</td>
<td>Maintenance Engineering and Management</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>12.</td>
<td>IE7009</td>
<td>Modeling of Manufacturing Systems</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>13.</td>
<td>IE7010</td>
<td>Operations Scheduling</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>14.</td>
<td>IE7011</td>
<td>Principles of Computer Integrated Manufacturing Systems</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>15.</td>
<td>IE7012</td>
<td>Product Design and Value Engineering</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>16.</td>
<td>IE7013</td>
<td>Productivity Management and Re-engineering</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>17.</td>
<td>IE7014</td>
<td>Robotics Engineering</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>18.</td>
<td>IE7015</td>
<td>Systems Engineering</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>19.</td>
<td>IE7071</td>
<td>Human Resource Management</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>20.</td>
<td>IE7072</td>
<td>Metrology and Inspection</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>21.</td>
<td>IE7073</td>
<td>Project Management</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>22.</td>
<td>IE7074</td>
<td>Safety Engineering and Management</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>23.</td>
<td>ME7077</td>
<td>Entrepreneurship Development</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>24.</td>
<td>MF7073</td>
<td>Electronics Manufacturing Technology</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>25.</td>
<td>MF7074</td>
<td>Flexible Manufacturing Systems</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>26.</td>
<td>MG7451</td>
<td>Principles of Management</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>27.</td>
<td>GE7072</td>
<td>Foundation Skills in Integrated Product Development</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>
### EMPLOYABILITY ENHANCEMENT COURSES (EEC)

<table>
<thead>
<tr>
<th>SL. NO.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>CONTACT PERIODS</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>IE7712</td>
<td>Industrial Training/Mini Project/Internship</td>
<td>EEC</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>2.</td>
<td>IE7812</td>
<td>Comprehension</td>
<td>EEC</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>3.</td>
<td>IE7813</td>
<td>Project work</td>
<td>EEC</td>
<td>20</td>
<td>0</td>
<td>0</td>
<td>20</td>
<td>10</td>
</tr>
</tbody>
</table>
## SUMMARY

<table>
<thead>
<tr>
<th>SL. NO.</th>
<th>SUBJECT AREA</th>
<th>CREDITS AS PER SEMESTER</th>
<th>CREDITS TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>I</td>
<td>II</td>
</tr>
<tr>
<td>1.</td>
<td>HS</td>
<td>04</td>
<td>04</td>
</tr>
<tr>
<td>2.</td>
<td>BS</td>
<td>12</td>
<td>07</td>
</tr>
<tr>
<td>3.</td>
<td>ES</td>
<td>06</td>
<td>13</td>
</tr>
<tr>
<td>4.</td>
<td>PC</td>
<td>00</td>
<td>00</td>
</tr>
<tr>
<td>5.</td>
<td>PE</td>
<td>00</td>
<td>00</td>
</tr>
<tr>
<td>6.</td>
<td>OE</td>
<td>00</td>
<td>00</td>
</tr>
<tr>
<td>7.</td>
<td>EEC</td>
<td>00</td>
<td>00</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>22</td>
<td>24</td>
</tr>
<tr>
<td>8.</td>
<td>Non Credit / Mandatory</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

12
COURSE DESCRIPTION:
This course aims at developing the language skills necessary for the first year students of Engineering and Technology.

OBJECTIVES:
- To develop the four language skills – Listening, Speaking, Reading and Writing.
- To improve the students’ communicative competence in English.
- To teach students the various aspects of English language usage.

CONTENTS

UNIT I GREETING AND INTRODUCING ONESELF
Listening - Types of listening – Listening to short talks, conversations; Speaking – Speaking about one’s place, important festivals etc. – Introducing oneself, one’s family/ friend; Reading – Skimming a passage – Scanning for specific information; Writing - Guided writing - Free writing on any given topic (My favourite place/ Hobbies/ School life, writing about one’s leisure time activities, hometown, etc.); Grammar – Tenses (present and present continuous) -Question types - Regular and irregular verbs; Vocabulary – Synonyms and Antonyms.

UNIT II GIVING INSTRUCTIONS AND DIRECTIONS
Listening – Listening and responding to instructions; Speaking – Telephone etiquette - Giving oral instructions/ Describing a process – Asking and answering questions; Reading – Reading and finding key information in a given text - Critical reading - Writing –Process description( non-technical)- Grammar – Tense (simple past & past continuous) - Use of imperatives – Subject – verb agreement – Active and passive voice; - Vocabulary – Compound words – Word formation – Word expansion ( root words).

UNIT III READING AND UNDERSTANDING VISUAL MATERIAL
Listening- Listening to lectures/ talks and completing a task; Speaking – Role play/ Simulation – Group interaction; Reading – Reading and interpreting visual material; Writing- Jumbled sentences – Discourse markers and Cohesive devices – Essay writing (cause & effect/narrative); Grammar – Tenses (perfect), Conditional clauses –Modal verbs; Vocabulary – Cause and effect words; Phrasal verbs in context.

UNIT IV CRITICAL READING AND WRITING
Listening- Watching videos/ documentaries and responding to questions based on them; Speaking Informal and formal conversation; Reading –Critical reading (prediction & inference); Writing–Essay writing (compare & contrast/ analytical) – Interpretation of visual materials; Grammar – Tenses (future time reference); Vocabulary – One word substitutes (with meanings) – Use of abbreviations & acronyms – Idioms in sentences.

UNIT V LETTER WRITING AND SENDING E-MAILS
Listening- Listening to programmes/broadcast/ telecast/ podcast; Speaking – Giving impromptu talks, Making presentations on given topics - Discussion on the presentation; Reading –Extensive reading; Writing- Poster making – Letter writing (Formal and E-mail); Grammar – Direct and Indirect speech – Combining sentences using connectives; Vocabulary –Collocation.

TEACHING METHODS:
Interactive sessions for the speaking module.
Use of audio – visual aids for the various listening activities.
Contextual Grammar Teaching.
EVALUATION PATTERN:
Internals – 50%
End Semester – 50%

TOTAL: 60 PERIODS

OUTCOMES:
- Students will improve their reading and writing skills
- Students will become fluent and proficient in communicative English
- Students will be able to improve their interpersonal communication

TEXTBOOK:

REFERENCES:
3. Redston, Chris & Gillies Cunningham Face2Face (Pre-intermediate Student’s Book & Workbook) Cambridge University Press, New Delhi: 2005

MA7151  MATHEMATICS I  L T P C
(Common to all branches of B.E. / B.Tech. Programmes in 4 0 0 4 1 Semester)

OBJECTIVES:
- The goal of this course is for students to gain proficiency in calculus computations.
- In calculus, we use three main tools for analyzing and describing the behavior of functions: limits, derivatives, and integrals. Students will use these tools to solve application problems in a variety of settings ranging from physics and biology to business and economics.
- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

UNIT I  DIFFERENTIAL CALCULUS  12
Representation of functions - New functions from old functions - Limit of a function - Limits at infinity - Continuity - Derivatives - Differentiation rules - Polar coordinate system - Differentiation in polar coordinates - Maxima and Minima of functions of one variable.

UNIT II  FUNCTIONS OF SEVERAL VARIABLES  12
UNIT III INTEGRAL CALCULUS
Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

UNIT IV MULTIPLE INTEGRALS

UNIT V DIFFERENTIAL EQUATIONS
Method of variation of parameters – Method of undetermined coefficients – Homogenous equation of Euler’s and Legendre’s type – System of simultaneous linear differential equations with constant coefficients.

TOTAL: 60 PERIODS

OUTCOMES:
- Understanding of the ideas of limits and continuity and an ability to calculate with them and apply them.
- Improved facility in algebraic manipulation.
- Fluency in differentiation.
- Fluency in integration using standard methods, including the ability to find an appropriate method for a given integral.
- Understanding the ideas of differential equations and facility in solving simple standard examples.

TEXTBOOKS:

REFERENCES:
OBJECTIVE:

- To introduce the concept and different ways to determine moduli of elasticity and applications.
- To instill the concept of sound, reverberation, noise cancellation, and ultrasonic generation, detection, and applications.
- To inculcate an idea of thermal properties of materials, heat flow through materials, and quantum physics.
- To promote the basic understanding of interferometers, principles, and applications of lasers, optical fibers, and sensors.
- To establish a sound grasp of knowledge on the basics, significance, and growth of single crystals.

UNIT I  PROPERTIES OF MATTER


UNIT II  ACOUSTICS AND ULTRASONICS


UNIT III  THERMAL AND MODERN PHYSICS


UNIT IV  APPLIED OPTICS


UNIT V  CRYSTAL PHYSICS

Single crystalline, polycrystalline and amorphous materials – Single crystals: unit cell, crystal systems, Bravais lattices, ditections and planes in a crystal, Miller indices - interplanar distance for a cubic crystal - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - structure and significance of NaCl, CsCl, ZnS and graphite - crystal imperfections: point defects, line defects – Burger vectors, dislocations and stacking faults – Growth of single crystals: Bridgman and Czochralski methods.

TOTAL: 45 PERIODS
OUTCOME:
- The students will understand different moduli of elasticity, their determination and applications.
- The students will gain knowledge on the properties of sound, noise cancellation, and production, detection and applications of ultrasonics.
- The students will acquire sound knowledge on thermal expansion and thermal conductivity of materials. Further, they will gain an idea of quantum physics.
- The students will gain knowledge on interferometers, lasers, and fiber optics.
- The students will secure knowledge on the basics of crystal structures and their significance. Further, they will gain basic ideas of growing single crystals.

TEXTBOOKS:

REFERENCES:

CY7151 ENGINEERING CHEMISTRY

OBJECTIVE
- To develop an understanding about fundamentals of polymer chemistry.
- Brief elucidation on surface chemistry and catalysis.
- To develop sound knowledge photochemistry and spectroscopy.
- To impart basic knowledge on chemical thermodynamics.
- To understand the basic concepts of nano chemistry.

UNIT I POLYMER CHEMISTRY
Introduction: Functionality-degree of polymerization. Classification of polymers- natural and synthetic, thermoplastic and thermostable. Types and mechanism of polymerization: addition (free radical, cationic, anionic and living); condensation, and copolymerization. Properties of polymers: T_g, tacticity, molecular weight-weight average, number average and polydispersity index. Techniques of polymerization: Bulk, emulsion, solution, and suspension.

UNIT II SURFACE CHEMISTRY AND CATALYSIS

UNIT III PHOTOCHEMISTRY AND SPECTROSCOPY
UNIT IV CHEMICAL THERMODYNAMICS
Second law: Entropy-entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Free energy and work function: Helmholtz and Gibbs free energy functions; Criteria of spontaneity; Gibbs-Helmholtz equation; Clausius Clapeyron equation; Maxwell relations-Van’t Hoff isotherm and isochore. Chemical potential; Gibbs-Duhem equation- variation of chemical potential with temperature and pressure.

UNIT V NANOCHEMISTRY

OUTCOME
- Will be familiar with polymer chemistry, surface chemistry and catalysis.
- Will know the photochemistry, spectroscopy and chemical thermodynamics.
- Will know the fundamentals of nano chemistry.

TEXTBOOKS

REFERENCES

GE7152 ENGINEERING GRAPHICS

OBJECTIVES
- To develop in students, graphic skills for communication of concepts, ideas and design of engineering products and 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 HANDSKETCHING
UNIT II  PROJECTION OF POINTS, LINES AND PLANE SURFACES  14
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 trapezoidal
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  14
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when
the axis is inclined to both the principal planes by rotating object method and auxiliary plane
method.

UNIT IV  PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF  14
SURFACES
Sectioning of 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  15
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
and vanishing point method.

COMPUTER AIDED DRAFTING (DEMONSTRATION ONLY)  3
Introduction to drafting packages and demonstration of their use.

L=45+T=30, TOTAL: 75 PERIODS

OUTCOMES:
On Completion of the course the student will be able to
- Perform free hand sketching of basic geometrical shapes and multiple views of
  objects.
- Draw orthographic projections of lines, planes and solids
- Obtain development of surfaces.
- Prepare isometric and perspective views of simple solids.

TEXT BOOK:

REFERENCES:
1. K.R.Gopalakrishna., “Engineering Drawing” (Vol I&II combined) Subhas Stores,
   Bangalore, 2007
   introduction to Interactive Computer Graphics for Design and Production", Eastern
   Economy Edition, Prentice Hall of India Pvt Ltd, New Delhi, 2005
   Company Limited, New Delhi, 2008.
7. N.S Parthasarathy and Vela Murali, “ Engineering Drawing”, Oxford University Press,
   2015
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.

BS7161                                BASIC SCIENCES LABORATORY                     L  T  P  C
(Common to all branches of B.E. / B.Tech. Programmes)  0 0 4 2

PHYSICS LABORATORY: (Any Seven Experiments)

OBJECTIVE:

- To inculcate experimental skills to test basic understanding of physics of materials including properties of matter, thermal and optical properties.
- To induce the students to familiarize with experimental determination of velocity of ultrasonic waves, band gap determination and viscosity of liquids.

1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of disc
2. Non-uniform bending - Determination of young’s modulus
3. Uniform bending – Determination of young’s modulus
4. Lee’s disc Determination of thermal conductivity of a bad conductor
5. Potentiometer-Determination of thermo e.m.f of a thermocouple
6. Laser- Determination of the wave length of the laser using grating
7. Air wedge - Determination of thickness of a thin sheet/wire
8. a) Optical fibre - Determination of Numerical Aperture and acceptance angle
    b) Compact disc- Determination of width of the groove using laser.
10. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids
11. Post office box - Determination of Band gap of a semiconductor.
13. Viscosity of liquids - Determination of co-efficient of viscosity of a liquid by Poiseuille’s flow

OUTCOME:

- To determine various moduli of elasticity and also various thermal and optical properties of materials.
- To determine the velocity of ultrasonic waves, band gap determination and viscosity of liquids.
CHEMISTRY LABORATORY:
(Minimum of 8 experiments to be conducted)

1. Estimation of HCl using Na$_2$CO$_3$ as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler’s method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by Iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline/thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
12. Pseudo first order kinetics-ester hydrolysis.
14. Determination of CMC.
15. Phase change in a solid.

TOTAL: 60 PERIODS

TEXTBOOKS
1. Vogel’s Textbook of Quantitative Chemical Analysis (8$^{th}$ edition, 2014)

GE7162 ENGINEERING PRACTICES LABORATORY (Common to all Branches of B.E. / B.Tech. Programmes) 0 0 4 2

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 & ELECTRICAL) 15

PLUMBING
Basic pipe connections involving the fittings like valves, taps, coupling, unions, reducers, elbows and other components used in household fittings. Preparation of plumbing line sketches.
• Laying pipe connection to the suction side of a pump.
• Laying pipe connection to the delivery side of a pump.
• Practice in connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

WOOD WORK
• Sawing, planing and making joints like T-Joint, Mortise and Tenon joint and Dovetail joint.

STUDY
• Study of joints in door panels and wooden furniture
• Study of common industrial trusses using models.
2. ELECTRICAL ENGINEERING PRACTICES 15
- Basic household wiring using Switches, Fuse, Indicator and Lamp etc.,
- Stair case light wiring
- Tube – light wiring
- Preparation of wiring diagrams for a given situation.
- Study of Iron-Box, Fan Regulator and Emergency Lamp

GROUP – B (MECHANICAL AND ELECTRONICS) 15
3. MECHANICAL ENGINEERING PRACTICES
WELDING
- Arc welding of Butt Joints, Lap Joints, and Tee Joints
- Gas welding Practice.
- Basic Machining - Simple turning, drilling and tapping operations.
- Study and assembling of the following:
  a. Centrifugal pump
  b. Mixie
  c. Air Conditioner.

DEMONSTRATION ON FOUNDRY OPERATIONS.
4. ELECTRONIC ENGINEERING PRACTICES 15
- Soldering simple electronic circuits and checking continuity.
- Assembling electronic components on a small PCB and Testing.
- Study of Telephone, FM radio and Low Voltage Power supplies.

TOTAL: 60 PERIODS
OUTCOMES
- Ability to fabricate carpentry components and to lay pipe connections including plumbing works.
- Ability to use welding equipments to join the structures
- Ability to do wiring for electrical connections and to fabricate electronics circuits.

HS7251 TECHNICAL ENGLISH 4 0 0 4
OBJECTIVES
- To enable students acquire proficiency in technical communication.
- To enhance their reading and writing skills in a technical context.
- To teach various language learning strategies needed in a professional environment.

CONTENTS
UNIT I ANALYTICAL READING 12
Listening- Listening to informal and formal conversations; Speaking – Conversation Skills(opening, turn taking, closing )-explaining how something works-describing technical functions and applications; Reading –Analytical reading, Deductive and inductive reasoning; Writing- vision statement–structuring paragraphs.

UNIT II SUMMARISING 12
Listening- Listening to lectures/ talks on Science & Technology; Speaking –Summarizing/ Oral Reporting, Reading – Reading Scientific and Technical articles; Writing- Extended definition –Lab Reports – Summary writing.
UNIT III   DESCRIBING VISUAL MATERIAL
Listening- Listening to a panel discussion; Speaking – Speaking at formal situations; Reading – Reading journal articles - Speed reading; Writing-data commentary-describing visual material-writing problem-process- solution-the structure of problem-solution texts- writing critiques

UNIT IV   WRITING/ E-MAILING THE JOB APPLICATION
Listening- Listening to/ Viewing model interviews; Speaking –Speaking at different types of interviews – Role play practice (mock interview); Reading – Reading job advertisements and profile of the company concerned; Writing- job application – cover letter –Résumé preparation.

UNIT V   REPORT WRITING
Listening- Viewing a model group discussion; Speaking – Participating in a discussion-Presentation; Reading – Case study - analyse -evaluate – arrive at a solution; Writing– Recommendations- Types of reports (feasibility report)- designing and reporting surveys- – Report format.- writing discursive essays.

TEACHING METHODS:
Practice writing
Conduct model and mock interview and group discussion.
Use of audio – visual aids to facilitate understanding of various forms of technical communication. Interactive sessions.

EVALUATION PATTERN:
Internals – 50%  
End Semester – 50%  
TOTAL:60 PERIODS

OUTCOMES
- Students will learn the structure and organization of various forms of technical communication.
- Students will be able to listen and respond to technical content.
- Students will be able to use different forms of communication in their respective fields.

TEXTBOOK:

REFERENCES:
OBJECTIVES:
- To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
- 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 of the 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
MATRICES
12

UNIT II
VECTOR CALCULUS
12
Gradient and directional derivative – Divergence and Curl – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral - Area of a curved surface - Volume integral - Green’s, Gauss divergence and Stoke’s theorems – Verification and application in evaluating line, surface and volume integrals.

UNIT III
ANALYTIC FUNCTION
12
Analytic functions – Necessary and sufficient conditions for analyticity - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions $w = z+c, \frac{az}{z^2}, \frac{1}{z^2}$ - Bilinear transformation.

UNIT IV
COMPLEX INTEGRATION
12

UNIT V
LAPLACE TRANSFORMS
12

TOTAL: 60 PERIODS

OUTCOMES:
- Upon successful completion of the course, students should be able to:
  - Evaluate real and complex integrals using the Cauchy integral formula and the residue theorem
  - Appreciate how complex methods can be used to prove some important theoretical results.
  - Evaluate line, surface and volume integrals in simple coordinate systems
  - Calculate grad, div and curl in Cartesian and other simple coordinate systems, and establish identities connecting these quantities
  - Use Gauss, Stokes and Greens theorems to simplify calculations of integrals and prove simple results.
TEXTBOOKS:

REFERENCES:

GE7151 COMPUTING TECHNIQUES
(Common to all branches of Engineering and Technology) 3 0 0 3

OBJECTIVE
• To learn programming using a structured programming language.
• To provide C programming exposure.
• To introduce foundational concepts of computer programming to students of different branches of Engineering and Technology.

UNIT I INTRODUCTION
Introduction to Computers – Computer Software – Computer Networks and Internet - Need for logical thinking - Problem formulation and development of simple programs - Pseudo code - Flow Chart and Algorithms.

UNIT II C PROGRAMMING BASICS

UNIT III ARRAYS AND STRINGS

UNIT IV POINTERS
Macros - Storage classes –Basic concepts of Pointers– Pointer arithmetic - Example Problems - Basic file operations

UNIT V FUNCTIONS AND USER DEFINED DATA TYPES

TOTAL : 45 PERIODS

OUTCOME
At the end of the course, the student should be able to:
• Write C program for simple applications
• Formulate algorithm for simple problems
• Analyze different data types and arrays
• Perform simple search and sort.
• Use programming language to solve problems.

TEXTBOOKS:

REFERENCES:

EE7253  FUNDAMENTALS OF ELECTRICAL ENGINEERING  L T P C
3 0 0 3

OBJECTIVE:
To impart knowledge on
• Electric circuits
• Working principles of Electrical Machines
• Various measuring instruments

UNIT I  ELECTRIC CIRCUITS
Introduction to electric circuits – Ohms Law – Kirchhoff’s Law – series and parallel networks, alternating voltage and current - waveform, RMS value, average value power, power factor, single phase circuit

UNIT II  DC MACHINES

UNIT III  TRANSFORMER AND THREE-PHASE CIRCUITS

UNIT IV  AC MACHINES

UNIT V  MEASUREMENTS
Classification of instruments – moving coil and moving iron voltmeters and ammeters – Multimeters – dynamometer type wattmeter– energy meter – Megger – Instrument transformers (CT & PT)

TOTAL : 45 PERIODS

OUTCOMES:
• Ability to understand the working concepts of electrical machines and measurement devices
• Ability to identify suitable machines and measuring devices for particular application.
TEXT BOOKS:

REFERENCES

ME7252 MANUFACTURING TECHNOLOGY – I L T P C
3 0 0 3

OBJECTIVE:
• To introduce the students to the concepts of basic manufacturing processes and fabrication techniques, such as metal casting, metal joining, metal forming and manufacture of plastic components.

UNIT I METAL CASTING PROCESSES 9

UNIT II METAL JOINING PROCESSES 9

UNIT III BULK DEFORMATION PROCESSES 9

UNIT IV SHEET METAL PROCESSES 9

UNIT V MANUFACTURE OF PLASTIC COMPONENTS 9

TOTAL: 45 PERIODS
OUTCOMES:
- Upon completion of this course, the students can able to apply the different manufacturing process and use this in industry for component production.

TEXT BOOKS:

REFERENCES:

PH7251 MATERIALS SCIENCE L T P C
(Common to Manufacturing, Industrial, Mining, Aeronautical, Automobile and Production Engineering) 3 0 0 3

OBJECTIVE:
- To impart knowledge on the basics of binary phase diagrams and their applications
- To learn the phase diagram, effect of alloying elements and various transformations in the Fe-C system, and also the heat treatment of steels.
- To introduce various strengthening methods of materials, and also various mechanical properties and their measurement
- To instill the types, properties and applications of magnetic, dielectric and superconducting materials.
- To introduce the preparation, properties and applications of various new materials

UNIT I PHASE DIAGRAMS 9
Solid solutions - Hume Rothery's rules - The phase rule - single component system - one-component system of iron - binary phase diagrams - isomorphous systems - the tie-line rule - the lever rule - application to isomorphous system - eutectic phase diagram - peritectic phase diagram - other invariant reactions – free energy composition curves for binary systems - microstructural change during cooling.

UNIT II FERROUS ALLOYS AND HEAT TREATMENT 9
UNIT III MECHANICAL PROPERTIES

UNIT IV MAGNETIC, DIELECTRIC AND SUPERCONDUCTING MATERIALS

UNIT V NEW MATERIALS

OUTCOME:
Upon completion of this course, the students will
- gain knowledge on the basics of binary phase diagrams and the use of lever rule
- learn about the Fe-C phase diagram, effect of alloying elements, TTT in the Fe-C system, and also the heat treatment of steels.
- understand the significance of dislocations, strengthening mechanisms, and tensile, creep, hardness and fracture behavior of materials
- acquire knowledge on the types, properties and applications of magnetic, dielectric and superconducting materials.
- get adequate understanding on the preparation, properties and applications of ceramics, composites, metallic glasses, shape-memory alloys and nanomaterials.

TEXTBOOKS:

REFERENCES:
GE7161  COMPUTER PRACTICES LABORATORY  L  T  P  C
0  0  4  2

OBJECTIVES
• To understand the basic programming constructs and articulate how they are used to
develop a program with a desired runtime execution flow.
• To articulate where computer programs fit in the provision of computer-based solutions
to real world problems.
• To learn to use user defined data structures.

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
9. Program using Recursive Function
10. Program using structures and unions.

TOTAL: 60 PERIODS

OUTCOMES
At the end of the course, the student should be able to:

ME7261  MANUFACTURING TECHNOLOGY LAB I  L  T  P  C
0  0  4  2

OBJECTIVES
• To give the students hands on experience in the basic manufacturing processes like
metal casting, metal joining, metal forming and manufacture of plastic components.

LIST OF EXPERIMENTS
1. Fabrication of simple structural shapes using Gas Metal Arc Welding
2. Joining of plates and pipes using Submerged arc welding
3. Friction stir welding of aluminium plates
4. Preparation of green sand moulds
5. Casting of aluminium components
6. Die casting of aluminium components
7. Stir casting of aluminium components
8. Open and closed die forging of light metal components
9. Reducing the thickness of the plates using two-high rolling process
10. Reducing the diameter of using Wire drawing
11. Extrusion of metal components of simple shapes
12. Manufacturing of simple sheet metal components using shearing and bending operations.
13. Drawing of cup shaped products
14. Manufacturing of sheet metal components using metal spinning on a lathe
15. Forming of simple sheet metal parts by Water hammer forming process
16. Extrusion of plastic components

TOTAL: 60 PERIODS

OUTCOMES
• Upon completion of this course the students can demonstrate the capability to fabricate
metal / plastic components using basic manufacturing processes.
• Write and compile programs using C programs.
• Write program with the concept of Structured Programming
• Identify suitable data structure for solving a problem
• Demonstrate the use of conditional statement.

LABORATORY REQUIREMENTS FOR BATCH OF 30 STUDENTS
30 Systems with C compiler

CE7251 STRENGTH OF MATERIALS

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

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS

UNIT II TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM

UNIT III TORSION
Torsion formulation stresses and deformation in circular and hollows shafts – Stepped shafts – Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs, carriage springs.

UNIT IV DEFLECTION OF BEAMS
Double Integration method – Macaulay’s method – Area moment Theorems for computation of slopes and deflections in beams - Conjugate beam and strain energy – Maxwell’s reciprocal theorems.

UNIT V THIN CYLINDERS, SPHERES AND THICK CYLINDERS
Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and deformation in thin cylinders – spherical shells subjected to internal pressure – Deformation in spherical shells – Lame’s theory – Application of theories of failure.

TOTAL: 45 PERIODS

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:

GE7153 ENGINEERING MECHANICS

OBJECTIVE:
- The objective of this course is to inculcate in the student the ability to analyze any problem in a simple and logical manner and to predict the physical phenomena and thus lay the foundation for engineering applications.

UNIT I  STATICS OF PARTICLES 12

UNIT II  EQUILIBRIUM OF RIGID BODIES 12

UNIT III  DISTRIBUTED FORCES 16
Centroids of lines and areas – symmetrical and unsymmetrical shapes, Determination of Centroids by Integration, Theorems of Pappus-Guldinus, Distributed Loads on Beams, Center of Gravity of a Three-Dimensional Body, Centroid of a Volume, Composite Bodies, Determination of Centroids of Volumes by Integration, Moments of Inertia of Areas and Mass - Determination of the Moment of Inertia of an Area by Integration, Polar Moment of Inertia, Radius of Gyration of an Area, Parallel-Axis Theorem, Moments of Inertia of Composite Areas, Moments of Inertia of a Mass - Moments of Inertia of Thin Plates, Determination of the Moment of Inertia of a Three-Dimensional Body by Integration.

UNIT IV  FRICTION 8

UNIT V  DYNAMICS OF PARTICLES 12

(L – 45 + T – 15) TOTAL: 60 PERIODS

32
OUTCOMES:
- Upon completion of this course, students will be able to construct meaningful mathematical models of physical problems and solve them.

TEXT BOOK

REFERENCES

IE7301 ENGINEERING ECONOMY AND COST ESTIMATION L T P C 3 0 0 3

OBJECTIVES:
- To study and understand the concept of Engineering Economics and apply in the real world.
- To gain knowledge in the field of cost estimation to enable the students to estimate the cost of various manufacturing processes.

UNIT I INTRODUCTION TO MANAGERIAL ECONOMICS AND DEMAND ANALYSIS 9

UNIT II PRODUCTION AND COST ANALYSIS 9

UNIT III PRICING 9

UNIT IV ESTIMATION OF MATERIAL AND LABOUR COSTS 9

UNIT V ESTIMATION OF OPERATIONAL COST 9

TOTAL: 45 PERIODS
OUTCOMES:
CO1: Students will become familiar with principles of micro economics and demand forecasting
CO2: Good understanding and knowledge in production and detailed cost analysis
CO3: The principles of pricing methodologies are familiarized
CO4: Estimation of Material and Labor cost procedure are known
CO5: Determination of Operational cost in industries are practiced

<table>
<thead>
<tr>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

TEXT BOOKS:

REFERENCES:

MA7357 PROBABILITY AND STATISTICS

OBJECTIVES:
- To make the students acquire a sound knowledge in statistical techniques that model engineering problems.
- The Students will have a fundamental knowledge of the concepts of probability.

UNIT I RANDOM VARIABLES
Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma, Weibull and Normal distributions - Functions of a random variable.

UNIT II TWO-DIMENSIONAL RANDOM VARIABLES
Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III TESTS OF SIGNIFICANCE

UNIT IV DESIGN OF EXPERIMENTS
Completely randomized design – Randomized block design – Latin square design - $2^2$ - factorial design - Taguchi’s robust parameter design.
UNIT V  STATISTICAL QUALITY CONTROL
Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

OUTCOMES:
- Students will be able characterize probability models using probability mass (density) functions & cumulative distribution functions.
- The students can independently participate in the processes of analysis, planning, formulating strategies of development, decision-making, governing and management, and independent making of tactical and strategic decisions related to the statistics.

TEXT BOOKS:

REFERENCES:

ME7352  MANUFACTURING TECHNOLOGY – II

OBJECTIVES:
- To understand the concept and basic mechanics of metal cutting, working of standard machine tools such as lathe, shaping and allied machines, milling, drilling and allied machines, grinding and allied machines and broaching.
- To understand the basic concepts of Computer Numerical Control (CNC) of machine tools and CNC Programming.

UNIT I  THEORY OF METAL CUTTING
Mechanics of chip formation, single point cutting tool, forces in machining, Types of chip, cutting tools – nomenclature, orthogonal, oblique metal cutting, thermal aspects, cutting tool materials, tool wear, tool life, surface finish, cutting fluids and Machinability.

UNIT II  TURNING MACHINES

UNIT III  RECIPROCATING, MILLING AND GEAR CUTTING MACHINES
Reciprocating machine tools: shaper, planer, slotter: Types and operations- Hole making: Drilling, reaming, boring, tapping, type of milling operations-attachments- types of milling cutter– machining time calculations - Gear cutting, gear hobbing and gear shaping – gear finishing methods.
UNIT IV  ABRASIVE PROCESSES AND BROACHING

Abrasive processes: grinding wheel – specifications and selection, types of grinding process – cylindrical grinding, surface grinding, centreless grinding, internal grinding - micro finishing methods - Typical applications – concepts of surface integrity, broaching machines: broach construction – push, pull, surface and continuous broaching machines

UNIT V  COMPUTER NUMERICAL CONTROL MACHINE TOOLS

Numerical Control (NC) machine tools – CNC types, constructional details, special features, machining centre and part programming fundamentals – manual part programming and computer assisted part programming.

TOTAL: 45 PERIODS

OUTCOME:
- Upon completion of this course, the students will be able to understand and compare the functions and applications of different metal cutting operations, machine tools and gain knowledge in programming of CNC machines.

TEXT BOOKS:

REFERENCES:

CE7261  STRENGTH OF MATERIALS LABORATORY

OBJECTIVES:
- To study the mechanical properties of materials subjected to different types of loading.

LIST OF EXPERIMENTS
1. Tension test on mild steel rod
2. Compression test on wood
3. Double shear test on metal
4. Torsion test on mild steel rod
5. Impact test on metal specimen (Izod and Charpy)
6. Hardness test on metals (Rockwell and Brinell Hardness Tests)
7. Deflection test on metal beam
8. Compression test on helical spring
9. Deflection test on carriage spring

TOTAL: 60 PERIODS

OUTCOMES:
- The students will have the knowledge in the area of testing of materials

REFERENCES:
2. IS 432(Part I ) -1992 – Specification for mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement
ME7361 MANUFACTURING TECHNOLOGY LABORATORY - II

OBJECTIVE:
- To study and acquire knowledge on various basic machining operations and special purpose machines and their applications.

LIST OF EXPERIMENTS
1. Taper Turning and Eccentric Turning using lathe
2. External and Internal Thread cutting using lathe
3. Knurling
4. Shaping – Square and Hexagonal Heads
5. Drilling and Reaming
6. Contour milling - vertical milling machine
7. Spur and helical gear cutting using milling machine
8. Gear generation using gear hobber
9. Gear generation using gear shaper
10. Grinding – Cylindrical, Surface and Centerless grinding
11. Tool angle grinding with tool and Cutter Grinder
12. Spline Broaching
13. Measurement of cutting forces in Milling /Turning Process
14. CNC Part Programming

TOTAL: 60 PERIODS

OUTCOME:
Upon completion of this course, the students will be to:
- Utilise various machine tools
- Develop CNC part programs.

CE 7352 FLUID MECHANICS AND MACHINERY

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

UNIT I FLUID PROPERTIES AND FLOW CHARACTERISTICS
Units and dimensions- Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, capillarity and surface tension. Flow characteristics – concept of control volume - application of control volume to continuity equation, energy equation and momentum equation.

UNIT II FLOW THROUGH CIRCULAR CONDUITS

UNIT III DIMENSIONAL ANALYSIS
Need for dimensional analysis – methods of dimensional analysis – Similitude –types of similitude - Dimensionless parameters- application of dimensionless parameters – Model analysis.

UNIT IV PUMPS
Impact of jets - Euler’s equation - Theory of rotodynamic machines – various efficiencies– velocity components at entry and exit of the rotor- velocity triangles - Centrifugal pumps- working principle - work done by the impeller - performance curves - Reciprocating pump.

TOTAL: 60 PERIODS

UNIT V TURBINES

TOTAL: 45 PERIODS

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

- Apply mathematical knowledge to predict the properties and characteristics of a fluid.
- Critically analyse the performance of pumps and turbines.

TEXT BOOKS:

REFERENCES:

EC7354 ELECTRONICS ENGINEERING L T P C
3 0 0 3

OBJECTIVES:
- To provide knowledge in the basic concepts of Electronics Engineering including semiconductors, transistors, electronic devices, signal generators, transducers and digital electronics.

UNIT I SEMICONDUCTORS AND RECTIFIERS
P-N junction, VI Characteristics of PN junction diode, Zener diode, Zener diode Characteristics, Zener diode as a regulator, BJT and N-MOSFET working and V-I characteristics.

UNIT II AMPLIFIERS AND OSCILLATORS

UNIT III LINEAR INTEGRATED CIRCUITS
Operational amplifier – Inverting and Non-inverting amplifiers, Adder, integrator and differentiator, Instrumentation amplifier, Digital to Analog converters - R-2R and weighted resistor types, Analog to Digital converters - Successive approximation and Flash types, IC 555 based Astable and Monostable Multivibrators,

UNIT IV DIGITAL ELECTRONICS
###OUTCOME:
- Ability to identify electronics components and use of them to design circuits

###REFERENCES:
5. Transducers in Mechanical and Electronic Design by Trietley.

###GE7251 ENVIRONMENTAL SCIENCE AND ENGINEERING

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

###OBJECTIVES:
To the study of 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
Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: 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
Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards— soil waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.
Field study of local polluted site – Urban / Rural / Industrial / Agricultural.
UNIT III  NATURAL RESOURCES

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 over-utilization of surface and ground water, floods, drought, conflicts over 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. 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. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV  SOCIAL ISSUES AND THE ENVIRONMENT


UNIT V  HUMAN POPULATION AND THE ENVIRONMENT


TOTAL: 45 PERIODS

OUTCOME:
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 environment at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions.
- Development and improvement in standard of living has lead to serious environmental disasters.

TEXT BOOKS:


REFERENCES:

OBJECTIVE:
- To impart knowledge in the area of Method study and Time study so that students can implement these principles and techniques to improve productivity in manufacturing and Service sectors.

UNIT I PRODUCTIVITY
Total time for a job or operation, total work content and ineffective time, – Production and Productivity - Productivity and standard of living, Factors affecting Productivity, Introduction to Productivity measurement Models.

UNIT II METHODS ENGINEERING

UNIT III WORK MEASUREMENT

UNIT IV APPLIED WORK MEASUREMENT
Work sampling - Group Timing Technique (GTT) - predetermined time systems, types, Methods Time Measurement (MTM) - Introduction to MOST standard - Wage incentive plans.

UNIT V WORK DESIGN FOR OFFICE WORK
Organization and methods (O & M) - Work measurement of office work - Work Analysis Techniques applied to support staff - Form design and Control.

TOTAL: 45 PERIODS

OUTCOMES:
Students will be able to
- CO1: Record and analyze selected tasks using different flowcharts
- CO2: Apply method study to improve a task. Apply principles of motion economy to improve performance
- CO3: Conduct a time study to improve the efficiency of the system.
- CO4: Estimate Rating factors, allowances and standard times to assess the work condition and environment.

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TEXT BOOK:

REFERENCES:
AIM:
- To impart knowledge in the areas of production and Operations management applicable to various types of manufacturing and service systems.

OBJECTIVES
- To understand and appreciate the concept of Production and Operations Management in creating and enhancing a firm’s competitive advantages.
- To understand the concept and contribution of various constituents of Production and Operations Management (both manufacturing and service).
- To understand the interdependence of the operations function with the other key functional areas of a firm.
- To apply analytical skills and problem-solving tools to the analysis of the operations problems.

UNIT I INTRODUCTION

UNIT II FORECASTING
Need, Determinants of Demand, Demand Patterns, Measures of forecast error, Qualitative Forecasting Methods-Delphi techniques. Market Research, Nominal Group Technique Quantitative Forecasting methods – Moving Average Methods, Exponential Smoothing Methods, Regression methods, Monitoring and Control of Forecasts, Requirements and Selection of Good forecasting methods.

UNIT III AGGREGATE PLANNING AND MATERIAL REQUIREMENT PLANNING
Role of aggregate Product planning, Managerial inputs to Aggregate planning, Pure and Mixed strategies, Mathematical Models for Aggregate planning – Transportation Method, Linear programming Formulation, Linear Decision Rules, Master Production Schedule (MPS), Procedure for developing MPS, MRP, Lot sizing methods of MRP, MRP Implementation issues.

UNIT IV CAPACITY MANAGEMENT

UNIT V PRODUCTION ACTIVITY CONTROL AND LEAN MANUFACTURING
Objectives and Activities of Production Activity Control - Introduction to Scheduling in different types of Production Systems.
Lean Manufacturing-Principles – Activities - Tools and techniques - Case studies.

OUTCOMES
- CO1: To understand the various parts of the operations and production management processes and their interaction with other business functions.
- CO2: To develop the ability to identify operational methodologies to assess and improve an organizations performance.
- CO3: To develop essential skills of modelling, managing and optimizing operations decisions in manufacturing and service organizations.
- CO4: Utilize a variety of quantitative and qualitative methods and tools used in managing and improving operations decisions.
REFERENCES:

ME7353 MECHANICS OF MACHINES

OBJECTIVE:
- To understand the principles in the formation of mechanisms and their kinematics.
- To understand the effect of friction in different machine elements.
- To analyze the forces and torque acting on simple mechanical systems.
- To understand the importance of balancing and vibration.

UNIT I KINEMATICS OF MECHANISMS

UNIT II GEAR AND GEAR TRAINS

UNIT III FRICTION IN MACHINE ELEMENTS
Surface contacts – Sliding and Rolling friction – Friction drives – Friction in screw threads – Bearings and lubrication – Friction clutches – Belt and rope drives – Friction aspects in brakes – Friction in vehicle propulsion and braking.

UNIT IV FORCE ANALYSIS

UNIT V BALANCING AND VIBRATION

TOTAL: 45 PERIODS

OUTCOME:
- The course will enable the student to understand the forces and torque acting on simple mechanical systems and also the importance of balancing and vibration and the effect of friction in different machine parts of practical significance.
TEXT BOOK:

REFERENCES:

CE7361 FLUID MECHANICS AND MACHINERY LABORATORY L T P C
0 0 4 2

OBJECTIVE:
- Students should be able to verify the principles studied in theory by performing the experiments in lab.

LIST OF EXPERIMENTS
1. Flow Measurement 32
   1. a. Calibration of Rotometer
   2. Flow through a circular Orifice
   3. Determination of mean velocity by Pitot tube
   4. Verification of Bernoulli’s Theorem
   5. a. Flow through a Triangular Notch
   b. Flow through a Rectangular Notch
2. Losses in Pipes 8
   6. Determination of friction coefficient in pipes
   7. Determination of losses due to bends, fittings and elbows
3. Pumps 16
   8. Characteristics of Centrifugal pumps
   9. Characteristics of Submersible pump
   10. Characteristics of Reciprocating pump
4. Determination of Metacentric height 4
   Demonstration Only

TOTAL: 60 PERIODS

OUTCOMES:
- The students will be able to measure flow in pipes and determine frictional losses.
- The students will be able to develop characteristics of pumps and turbines
REFERENCES:

IE7411 WORK SYSTEM DESIGN LABORATORY

OBJECTIVE:
- To understand the theory better and apply in practice, practical training is given in the following areas:
  1. Graphic tools for method study
  2. Peg board experiment
  3. Stop watch time study
  4. Performance rating exercise
     a. Walking rating
     b. Card dealing
  5. Work sampling
  6. Methods Time Measurement
  7. Video Based Time Study

OUTCOMES:
Students should be able
CO1: To record and analyze selected tasks using different flowcharts
CO2: To conduct a time study to improve the efficiency of the system.
CO3: To design, analyze and apply the above mentioned techniques to measure Productivity.

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TOTAL: 60 PERIODS

IE7501 OPERATIONS RESEARCH - I

OBJECTIVE:
- To learn the basics of deterministic optimization methods.

UNIT I LINEAR PROGRAMMING

UNIT II ADVANCES IN LINEAR PROGRAMMING – I
UNIT III ADVANCES IN LINEAR PROGRAMING – II 9
Integer Programming – Branch and bound algorithm – Gomory’s cutting plane method-Additive algorithm – mixed integer programming – Benders partitioning algorithm- Goal programming

UNIT IV NETWORK ANALYSIS – I 9

UNIT V NETWORK ANALYSIS - II 9

OUTCOME:
CO1: Understand how to translate a real-world problem, given in words, into a mathematical formulation
CO2: An understanding of the role of algorithmic thinking in the solution of operations research problems;
CO3: Be able to build and solve Transportation Models and Assignment Models.
CO4: Understand Operations Research models and apply them to real-life problems;

TEXT BOOKS:

REFERENCES:

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

IE7502 QUALITY CONTROL AND ASSURANCE L T P C 3 0 0 3

OBJECTIVES:
- To impart knowledge to enable the students to design and implement Statistical Process Control in any industry.
- To design and implement acceptance sampling inspection methods in industry.

UNIT I QUALITY FUNDAMENTALS 9
Importance of quality- evolution of quality- definitions of quality- dimensions of quality- quality control- quality assurance- areas of quality- quality planning- quality objectives and policies- quality costs- economics of quality- quality loss function- quality Vs productivity- Quality Vs reliability.

UNIT II CONTROL CHARTS FOR VARIABLES 9
Process variation- preliminary decisions- control limits and their computation- construction and application of X bar, R and S charts- warning and modified control limits- process adjustment for trend- Comparison of process variation with specification limits- O.C. curve for X bar chart.
UNIT III  STATISTICAL PROCESS CONTROL  
Process stability - process capability study using control charts - capability evaluation - Cp, Cpk and Cpm – capability analysis using histogram and normal probability plot - machine capability study - gauge capability study - setting statistical tolerances for components and assemblies - individual measurement charts - X-chart, moving average and moving range chart, multi-vari chart.

UNIT IV  CONTROL CHARTS FOR ATTRIBUTES  
Limitations of variable control charts - Control charts for fraction non-conforming - p and np charts, variable sample size, operating characteristic function, run length - Control chart for nonconformities (defects) - c, u, ku charts, demerits control chart - applications.

UNIT V  ACCEPTANCE SAMPLING  
Need- economics of sampling - sampling procedure - single and double sampling - O.C. curves - Average outgoing quality - Average sample number - Average total inspection - Multiple and sequential sampling - Standard sampling plans - Military, Dodge-Roming, IS 2500.

TOTAL: 45 PERIODS

OUTCOMES:  
CO1: Students will become familiar with details of quality costs, economies and planning  
CO2: Control the quality of processes using control charts for variables in manufacturing /service industries.  
CO3: Good understanding and in depth knowledge has been imparted in the process capability study.  
CO4: Control the occurrence of defects in product or services industries  
CO5: Determination of acceptance sampling procedures are practiced

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

TEXT BOOK:  

REFERENCES:  

ME7451  MACHINE DESIGN
Use of P S G Design Data Book is permitted in the University examination

OBJECTIVE  
• To familiarize the various steps involved in the Design Process  
• To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.  
• To learn to use standard practices and standard data  
• To learn to use catalogues and standard machine components
UNIT I  STEADY STRESSES IN MACHINE MEMBERS  12
Introduction to the design process - factor influencing machine design, selection of materials based on mechanical properties - Preferred numbers, fits and tolerances – Direct, Bending and torsional stress equations – Impact and shock loading – calculation of principle stresses for various load combinations, eccentric loading -Factor of safety – Curved beams - theories of failure – Design for finite and infinite life under variable loading.

UNIT II  SHAFTS, COUPLINGS, JOINTS AND BEARINGS  12
Design of solid and hollow shafts based on strength, rigidity and critical speed –Keys, key ways and splines –Rigid and flexible couplings. Welded joints and riveted joints for structures, Sliding contact and rolling contact bearings (Simple problems).

UNIT III  ENERGY STORING ELEMENTS AND ENGINE COMPONENTS  12
Types of springs, Design of helical springs - Flywheels considering stresses in rims and arms for engines and punching machines- Connecting Rods and crank shafts.

UNIT IV  DESIGN FOR FLEXIBLE ELEMENTS  12
Design of Flat belts and pulleys - Selection of V belts and pulleys – Design of Transmission chains and Sprockets.

UNIT V  SPUR GEARS, HELICAL GEARS AND GEAR BOXES  12

OUTCOME
• Upon completion of this course, the students can able to successfully design machine components

TEXTBOOKS

REFERENCES
OBJECTIVES:
• To understand the basic laws of Thermodynamics and Heat transfer.
• To understand the principle of operation of thermal equipments like IC engine, boilers, turbine and refrigerator etc.

UNIT I BASIC CONCEPTS OF THERMODYNAMICS

UNIT II FIRST AND SECOND LAW OF THERMODYNAMICS

UNIT III HEAT ENGINES

UNIT IV GASES AND VAPOUR MIXTURES
Ideal and Real gases - Vander waals equations - Reduced property - Compressibility chart - Properties of mixture of gases - Dalton’s law and Gibbs - Internal energy, Enthalpy and specific heats of gas mixtures.

UNIT V HEAT TRANSFER

OUTCOMES:
• Upon completion of this course, the students can able to understand different gas power cycles and use of them in IC and R&AC applications.

TEXT BOOKS:

REFERENCES:
IE7511 OPTIMIZATION LABORATORY

OBJECTIVES:
- To give adequate exposure to applications of software packages in the area of Operations Research.
  - Problem Formulation, Solving Using C, C++, Excel and Optimization Package (TORA/Lindo/Lingo)
  - LP Models Transportation
  - Problem Assignment
  - Problems Maximal Flow
  - Minimal Spanning Tree
  - Shortest route
  - Project Management- PERT and CPM
  - Goal Programming

OUTCOMES:
- CO1: Use computer tools to solve a mathematical model for practical problems.
- CO2: Acquire knowledge in using Optimization software Package (TORA/Lindo/Lingo)
- CO3: Ability to develop C++ programming for solving optimization problem.
- CO4: Able to design new simple models, like: CPM, MSPT to improve decision –making
devlop critical thinking and objective analysis of decision problems

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TOTAL: 60 PERIODS

ME 7561 COMPUTER AIDED MACHINE DRAWING

OBJECTIVES:
- To make the students understand and interpret drawings of machine components
- To prepare assembly drawings both manually and using standard CAD packages
- To familiarize the students with Indian Standards on drawing practices and standard components
- To gain practical experience in handling 2D drafting and 3D modeling software systems.

UNIT I DRAWING STANDARDS & FITS AND TOLERANCES

UNIT II INTRODUCTION TO 2D DRAFTING
- Drawing, Editing, Dimensioning, Layering, Hatching, Block, Array, Detailing, Detailed drawing.
- Bearings - Bush bearing, Plummer block
- Valves – Safety and non-return valves.
UNIT III 3D GEOMETRIC MODELING AND ASSEMBLY

- Couplings – Flange, Universal, Oldham’s, Muff, Gear couplings
- Joints – Knuckle, Gib & cotter, strap, sleeve & cotter joints
- Engine parts – Piston, connecting rod, cross-head (vertical and horizontal), stuffing box, multi-plate clutch
- Miscellaneous machine components – Screw jack, machine vice, tail stock, chuck, vane and gear pumps

Total: 20% of classes for theory classes and 80% of classes for practice

Note: 25% of assembly drawings must be done manually and remaining 75% of assembly drawings must be done by using any CAD software. The above tasks can be performed manually and using standard commercial 2D / 3D CAD software.

OUTCOMES:
Upon completion of this course, the students will be able to:
- Appreciate the functions of various machine assemblies,
- Draw part drawings, sectional views and assembly drawings as per standards

TEXT BOOK:

REFERENCES:

IE7601 APPLIED ERGONOMICS

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

UNIT I INTRODUCTION

UNIT II HUMAN PERFORMANCE

UNIT III PHYSIOLOGICAL ASPECTS OF HUMAN AT WORK

UNIT IV WORK PLACE DESIGN
Problems of body size, Anthropometry measures, Work posture – Work space layout and work station design – Design of displays, controls and VDT work stations – Hand tool design, illumination.
UNIT V OCCUPATIONAL HEALTH AND SAFETY
Industrial accidents, Personnel Protective devices, Safety Management practices – Effect of Environment – heat, cold & noise – NIOSH regulations and Factories Act

TOTAL: 45 PERIODS

OUTCOMES:
The Student should be able

CO1: To apply Knowledge of basic human science and Engineering science
CO2: To apply ergonomic principles to design workplaces for the improvement of human performance
CO3: To conduct an ergonomic analysis and ergonomic recommendations for a modern work environment problems
CO4: Apply skills associated with ergonomic measurement methods and analytical techniques to workplace ergonomic problems.
CO5: To implement latest occupational health and safety to improve the work place.

<table>
<thead>
<tr>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TEXT BOOKS:

REFERENCES:

IE7602 FACILITY LAYOUT AND MATERIALS HANDLING

OBJECTIVE:
• To explain the basic principles in facilities planning, location, layout designs and material handling systems

UNIT I PLANT LOCATION

UNIT II FACILITY LAYOUT DESIGN
Need for Layout study , Factors influencing plant layout ,Objectives of a good facility layout, Classification of layout , Layout procedure – Nadler’s ideal system approach, Immer’s basic steps, Apple’s layout procedure, Reed’s layout procedure –Layout planning – Systematic Layout Planning – Information gathering, flow analysis and activity analysis, relationship diagram, space requirements and availability, designing the layout. Utilities planning

52
UNIT III COMPUTERISED LAYOUT PLANNING

UNIT IV DESIGNING PRODUCT LAYOUT
Line balancing - Objectives, Line balancing techniques – Largest Candidate rule- Kilbridge and Wester method- RPW method- COMSOAL.

UNIT V MATERIAL HANDLING AND PACKAGING
Objectives and benefits of Material handling, Relationship between layout and Material handling, Principles of material handling, Unit load concept, Classification of material handling equipments, Equipment selection, Packaging.

TOTAL: 45 PERIODS

OUTCOMES:
Students should be able to
CO1 – apply and evaluate appropriate facility location models.
CO2 – Effectively design and analyze facility layouts.
CO3 – design, measure, and analyze material flow to improve the efficiency of the system
CO4 – implement cost effective and improved the system.

<table>
<thead>
<tr>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TEXT BOOK:

REFERENCES:

IE7603 OPERATIONS RESEARCH - II L T P C
3 0 0 3

OBJECTIVE:
- To impart knowledge about dynamic programming, inventory models, waiting line models, Decision and game theory techniques.

UNIT I DETERMINISTIC INVENTORY MODELS
Purchase model with no shortages – Manufacturing model with no shortages – purchase model with shortages – Manufacturing model with shortages – Model with price breaks.

UNIT II PROBABILISTIC INVENTORY MODELS
Probabilistic inventory model – Single period model – A lot size, Reorder point model – Variable lead time - Multiproduct-selective inventory control

UNIT III QUEUING THEORY
Queuing theory terminology – Single server, multi server, limited queue capacity, limited population capacity

53
UNIT IV  DECISION AND GAME THEORY  9
Decision making under certainty – Decision making under risk – Decision making under uncertainty – Decision tree analysis - Game Theory – Two person zero sum games, pure and mixed strategies – Theory of dominance - Graphical Solution – Solving by LP

UNIT V  DYNAMIC PROGRAMMING  9

OUTCOMES:
CO1: The students will be able to handle issues in Inventory management.
CO2: The students acquire capability in applying dynamic program and using of queuing models for day today problem
CO3: Students will be able to estimate the solution to a problem, apply appropriate techniques to arrive at a solution, test the correctness of the solution, and interpret their results
CO4: An ability to use visualization and optimization tools to expose ideas and solutions.

TEXT BOOKS:

REFERENCES:

<table>
<thead>
<tr>
<th>CO1</th>
<th>CO2</th>
<th>CO3</th>
<th>CO4</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

IE7604  RELIABILITY ENGINEERING  L T P C
3 0 0 3

OBJECTIVE:
To impart knowledge in reliability concepts, reliability estimation methods and reliability improvement methods

UNIT I  RELIABILITY CONCEPT  9
Reliability definition –Reliability parameters- f(t), F(t) and R(t) functions- Measures of central tendency – Bath tub curve – A priori and posteriori probabilities of failure – Component mortality - Useful life.

UNIT II  LIFE DATA ANALYSIS  9

UNIT III  RELIABILITY ESTIMATION  9
Series parallel configurations – Parallel redundancy – m/n system – Complex systems: RBD approach – Baye’s method – Minimal path and cut sets - Fault Tree analysis – Standby system.
UNIT IV RELIABILITY MANAGEMENT

UNIT V RELIABILITY IMPROVEMENT

TOTAL: 45 PERIODS

OUTCOMES:
1. Students will be able to conduct failure data analysis.
2. Students will be able to estimate reliability of standard systems as well as complex systems.
3. Students will be able to explore reliability management tools and techniques.
4. Students will be able to contribute in maintainability and availability demonstration programs.

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

REFERENCES:

IE7611 DATA ANALYTICS LABORATORY

AIM:
To carry out exercises with the help of software packages in the areas of linear and multivariate regression, factor analysis, discriminant analysis, reliability and design of experiments

OBJECTIVES:
- To understand how the analysis of data derives from the statement of a problem or hypothesis and the availability of data
- To understand how to conduct a variety of statistical analyses, including testing of statistical assumptions, data transformations, and validation of statistical findings
- To be able to design a data analysis strategy that answers a hypothesis, including specifications for data elements, requirements of the statistic, and limitations to the interpretation.
- To understand how to present and interpret the results of statistical analyses.

1. Determine the linear regression model for fitting a straight line and calculate the least squares estimates, the residuals and the residual sum of squares.
2. Determine the multivariate regression model for fitting the straight line.
3. Perform the Correlation analysis to determine the relationships among the variables.
4. Perform the factor analysis for the given set of model data using both Exploratory and Confirmatory methods and evaluate the model adequacy.
5. Determine which continuous variable discriminate among the given group and determine which variable is the best predictor.
6. Determine the process is within the control or not by developing the control charts for attributes and variables and estimate the process capability.
7. Estimate the parameters (MTTF, MTBF, failure rate, bathtub curve etc) of components and systems to predict its reliability.
8. Develop the single factor and two factor design of experiment model to predict the significance factor.
9. Develop $2^k$ factorial and $2^{k-p}$ fractional factorial experiment to determine the parameters which affect the system.

TOTAL: 60 PERIODS

OUTCOMES:
- CO1: Ability to independently formulate, perform and assess hypothesis
- CO2: Ability to apply various data analysis techniques
- CO3: Ability to interpret the results
- CO4: Ability to present the results properly to extract meaningful information from data sets for effective decision making

### IE7612 ERGONOMICS LABORATORY

L T P C
---
0 0 4 2

**OBJECTIVE:**
To test the principles of human factors engineering in a laboratory
1. Effect of speed of walking on tread mill using heart rate and energy expenditure
2. Effect of workload on heart rate using Ergo cycle.
3. Evaluation of physical fitness using step test
4. Effect of work-rest schedule on physical performance (Ergo cycle / tread mill)
5. Development of anthropometric data for male and female.
6. Application of anthropometric data for the design of desk for students
7. Evaluation of physical facilities (chairs, tables etc.) through comfort rating.
8. Analysis of noise level in different environment
9. Study of Illumination of work places.
10. Evaluation of physical fitness using metabolic Analyzer.

TOTAL: 60 PERIODS

OUTCOMES:
The Students should be able to
- CO1: Design equipment and the workplace to fit people
- CO2: Design the industry with ergonomics consideration
- CO3: Conduct an ergonomic analysis for physical ergonomics topics

### Table

<table>
<thead>
<tr>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td></td>
<td></td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
<td>✔</td>
</tr>
</tbody>
</table>
OBJECTIVE
To cover various aspects of discrete dynamic, stochastic systems modeling and conducting experiments with those models on a computer.

UNIT I  INTRODUCTION AND RANDOM NUMBERS
9

UNIT II  RANDOM VARIATES GENERATION AND TESTING
9

UNIT III  DESIGN OF SIMULATION EXPERIMENTS
9
Steps on Design of Simulation Experiments – Development of models using of High level language for systems like Queing, Inventory, Replacement, Production etc., - Model validation and verification, Output analysis. Use of DOE tools.

UNIT IV  SIMULATION LANGUAGES
9
Need for simulation Languages – Study of GPSS and introduction to ARENA.

UNIT V  CASE STUDIES USING SIMULATION LANGUAGES
9
Waiting line models, inventory models, and production models.

OUTCOMES:
1. Will be able to generate random numbers and variates.
2. Will be able to test the statistical stability of random variates
3. Will be able to develop simulation models for real life systems
4. Will be able use simulation language to simulate and analyze systems

<table>
<thead>
<tr>
<th>CO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TEXT BOOK:

REFERENCES:
IE7702 SUPPLY CHAIN AND LOGISTICS MANAGEMENT L T P C 3 0 0 3

AIM
- To provide broad knowledge on Supply Chain and Logistics Management

OBJECTIVES
- To understand the role of logistics and supply, Competitive and Supply chain Strategies and Drivers of Supply Chain
- To understand about the distribution networks, network Design and Transportation in Supply Chain.
- To learn about Sourcing and coordination in Supply Chain
- To understand about supply chain IT framework and emerging issues in supply chain

UNIT I INTRODUCTION 9
Role of Logistics and Supply chain Management: Scope and Importance - Evolution of Supply Chain –Examples of supply Chains - Decision Phases in Supply Chain - Competitive and Supply chain Strategies – Drivers of Supply Chain Performance and Obstacles

UNIT II SUPPLY CHAIN NETWORK DESIGN 9

UNIT III LOGISTICS IN SUPPLY CHAIN 9
Role of transportation in supply chain – factors affecting transportation decision – Design option for transportation network – Tailored transportation – Routing and scheduling in transportation - 3PL- 4PL- Global Logistics - Reverse Logistics; Reasons, Activities and issues.

UNIT IV SOURCING AND COORDINATION IN SUPPLY CHAIN 9
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 coordination in supply chain and obstacles – Building strategic partnerships and trust within a supply chain

UNIT V IT AND EMERGING CONCEPTS IN SUPPLY CHAIN 9
The role IT in supply chain-The supply chain IT framework -Customer Relationship Management – Internal supply chain management – supplier relationship management – future of IT in supply chain –E-Business in supply chain
Introduction to Warehouse Management, Risk in Supply Chain, Lean supply Chains, Sustainable supply Chains

TOTAL: 45 PERIODS

OUTCOMES:
CO1: Ability to understand the framework and scope of supply chain networks and functions.
CO2: Ability to design Distribution, Transportation and network design principles in a selected enterprise.
CO3: Ability to understand Sourcing, Coordination, Information Technology and current issues in SCM.
CO4: Ability to apply SCM concepts in a selected enterprise.

<table>
<thead>
<tr>
<th>CO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

58
TEXT BOOKS:

IE7751 DESIGN OF EXPERIMENTS

L T P C
3 0 0 3

AIM:
- This course aims to introduce students how to statistically plan, design and execute industrial experiments for process understanding and improvement in both manufacturing and service environments

OBJECTIVES:
- To demonstrate knowledge and understanding of Classical Design of Experiments (DOE)
- To demonstrate knowledge and understanding of Taguchi’s approach
- To develop skills to design and conduct experiments using DOE and Taguchi’s approach
- To develop competency for analysing the data to determine the optimal process parameters that optimize the process.

UNIT I FUNDAMENTALS OF EXPERIMENTAL DESIGNS
Hypothesis testing – single mean, two means, dependant/ correlated samples – confidence intervals, Experimentation – need, Conventional test strategies, Analysis of variance, F-test, terminology, basic principles of design, steps in experimentation – choice of sample size – Normal and half normal probability plot – simple linear and multiple linear regression, testing using Analysis of variance.

UNIT II SINGLE FACTOR EXPERIMENTS
Completely Randomized Design- effect of coding the observations- model adequacy checking - estimation of model parameters, residuals analysis- treatment comparison methods- Duncan’s multiple range test, Newman-Keuel’s test, Fisher’s LSD test, Tukey’s test- testing using contrasts- Randomized Block Design – Latin Square Design- Graeco Latin Square Design – Applications.

UNIT III FACTORIAL DESIGNS
Main and Interaction effects - Two and three factor full factorial designs- Fixed effects and random effects model - Rule for sum of squares and Expected Mean Squares- $2^K$ Design with two and three factors- Yate’s Algorithm- fitting regression model- Randomized Block Factorial Design - Practical applications.

UNIT IV SPECIAL EXPERIMENTAL DESIGNS
Blocking and Confounding in $2^K$ Designs- blocking in replicated design- $2^K$ Factorial Design in two blocks- Complete and partial confounding- Confounding $2^K$ Design in four blocks- Two level Fractional Factorial Designs- one-half fraction of $2^K$ Design, design resolution, Construction of one-half fraction with highest design resolution, one-quarter fraction of $2^K$ Design- introduction to response surface methods, central composite design.
UNIT V  
TAGUCHI METHODS

Design of experiments using Orthogonal Arrays, Data analysis from Orthogonal experiments- 
Response Graph Method, ANOVA- attribute data analysis- Robust design- noise factors, Signal 
to noise ratios, Inner/outer OA design- case studies.

TOTAL : 45 PERIODS

OUTCOMES:
- CO1: To understand the fundamental principles of Classical Design of Experiments
- CO2: To apply DOE for process understanding and optimisation
- CO3: To describe the Taguchi’s approach to experimental design for process performance robustness
- CO4: To apply Taguchi based approach to evaluate quality

<table>
<thead>
<tr>
<th>CO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

TEXT BOOK:

REFERENCES:

HS7561  
COMMUNICATION SKILLS AND SOFT SKILLS

COURSE DESCRIPTION
This course aims to help engineering students acquire the employability skills necessary for the workplace. It also attempts to meet the expectations of the employers by giving special attention to presentation skills, group discussion skills and soft skills. This aim will be achieved through expert guidance and teaching activities focusing on the above listed skills and language skills in the Language Laboratory.

OBJECTIVES
- To enhance the employability skills of students with a special focus on presentation skills, group discussion skills and interview skills and soft skills.
- To help them improve their writing skills necessary for the workplace situation.

CONTENTS
UNIT I  
WRITING SKILLS
Preparing job applications – writing the cover letter and resume – applying for jobs online – e-mail etiquette – writing reports – collecting, analyzing and interpreting data.
UNIT II  SOFT SKILLS

UNIT III  PRESENTATION SKILLS
Preparing slides using the computer– structuring the content (parts of a presentation)- body language – answering questions – individual presentation practice — mini presentation (practice sessions)

UNIT IV  GROUP DISCUSSION SKILLS
Participating in group discussions – understanding group dynamics – brainstorming – questioning and clarifying – GD strategies (expressing opinions, accepting or refusing others opinions, turn taking) – activities to improve GD skills – viewing recorded GD – mock GD.

UNIT V  INTERVIEW SKILLS
Interview etiquette–technical Interview/HR Interview/body language – mock interview – attending job interviews – Types of interviews- telephone/skype interview – stress interview, one to one/panel interview – FAQs related to job interview.

TOTAL: 45 PERIODS

OUTCOMES:
- Students will be able to make presentations and participate in group discussions with confidence.
- Students will be able to perform well in interviews.
- They will have adequate writing skills.

REFERENCES:

EXTENSIVE READERS

WEB RESOURCES
1. www.humanresources.about.com
2. www.careerride.com
IE7711  DISCRETE SIMULATION LABORATORY  L T P C  0 0 4 2

OBJECTIVE:
To give hands on experience with reference to computer based discrete system simulation experiments

1. Random Number Generation
   - Mid Square, Constant Multiplier, Congruential
2. Random variates Generation
   - Exponential, Poisson, Normal, Binomial
3. Testing of Random variates
   - Chi-Square, KS, Run, Poker
4. Monte Carlo Simulation: Random Walk Problem
5. Monte Carlo Simulation: Paper vendor problem
6. Single Server Queuing Model
7. Multi Server Queuing Model
8. Alternate service queueing model
9. Inventory Model
10. Use of Simulation Language: Servers in series queueing system
11. Use of Simulation Model: Queue with balking

TOTAL: 60 PERIODS

OUTCOMES
1. Will have hands on experience in generation of random numbers and variates.
2. Will have hands on experience in testing the statistical stability of random variates
3. Will have hands on experience in developing simulation models for real life systems
4. Will have hands on experience in the use simulation language to simulate and analyze systems

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

IE7712  INDUSTRIAL TRAINING / MINI PROJECT / INTERNSHIP  L T P C  0 0 4 2

OBJECTIVE:
• The student has the option of undergoing either industrial training or can carry out a mini project.

INDUSTRIAL TRAINING:
The objective is to give an exposure to the industrial environment and learn how they function. A minimum of 4 weeks of industrial training is required. He/she can undergo training either at a stretch or in two spells of a minimum of two weeks each. The training should have been completed in the immediate preceding one or two summers. A comprehensive report is to be submitted at the beginning of the VIIth semester. A certificate from the industry signed by an appropriate authority should be submitted along with the report. It will be evaluated by a two member committee constituted by the Head of the Department based on the report and oral examination.

TOTAL: 60 PERIODS
OUTCOMES:
CO1. Able to be better prepared for the workplace and experience doing real work.
CO2. To get hands-on training about the skill sets required, Learn demands of the industry and also work ethics.
CO3. To develop leadership and mentoring skills,
CO4. Create exposure for the company, bring new perspectives and fresh ideas into the work environment.

<table>
<thead>
<tr>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MINI PROJECT

OBJECTIVE:
The objective is to develop skill in applying industrial engineering techniques to real/practical problems.

A student is expected to select a topic in the industrial engineering area such as forecasting, production planning, scheduling, operations research, facilities planning and layout, transportation and distribution, quality, supply chain, and simulation. Identify a problem and collect necessary data and analyse using appropriate tool/technique. Data can be collected from industry or standard data sets available in literature can be used.

A comprehensive report is to be submitted towards the end of the VIIth semester. It will be evaluated by a two member committee constituted by the Head of the Department based on the report and oral examination.

OUTCOMES:
CO1: The students will get practical exposure on industrial engineering techniques.
CO2: Analyze and Design the equipment and the workplace to fit people.
CO3: Study of Illumination of work places
CO4: Able to take up computational and experimental projects.

<table>
<thead>
<tr>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

IE7801 MANUFACTURING AUTOMATION

OBJECTIVES:
- To give a brief exposure to automation principles and control technologies.
- To introduce the concept of fixed automation using transfer lines.
- To train the students in the programmable automation such as CNC and industrial robotics.
- To provide knowledge on the use of automated material handling, storage and data capture.
UNIT I MANUFACTURING OPERATIONS
Automation in production systems, principles and strategies, Product/production relationships, Production concepts and mathematical models, manufacturing economics.

UNIT II CONTROL TECHNOLOGIES
Automated systems – elements, functions, levels, Continuous Vs discrete control, Computer process control, Sensors, Actuators, ADC, DAC, Programmable logic controllers – ladder logic diagrams.

UNIT III TRANSFER LINES
Automated production lines – applications, Analysis – with and without buffers, automated assembly systems, line unbalancing concept.

UNIT IV NUMERICAL CONTROL AND ROBOTICS

UNIT V AUTOMATED HANDLING AND STORAGE
Automated guided vehicle systems, AS/RS, Carousel storage, Automatic data capture - Bar code technology.

TOTAL: 45 PERIODS

OUTCOMES:
CO1: Selection of automated equipment with cost justification
CO2: Selection of buffer size and location in transfer lines.
CO3: Ability to prepare a simple CNC program, select a robot configuration for given application.
CO4: Recommend an appropriate automated material handling, storage and data capture method.

<table>
<thead>
<tr>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>☑</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>☑</td>
<td></td>
<td></td>
</tr>
<tr>
<td>☑</td>
<td>☑</td>
<td>☑</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>☑</td>
<td></td>
<td></td>
<td>☑</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>☑</td>
<td>☑</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TEXT BOOK:

REFERENCES:

IE7811 AUTOMATION LABORATORY

OBJECTIVE:
To give hands on experience on
- CNC programming on Lathe and Milling Machine
- Programming of Robotics
- Programming of PLC
1. Part programming and Machining of Simple Turning using CNC Lathe
2. Part programming and Machining of Taper Turning using CNC Lathe
3. Part programming and Machining using Multiple Turning cycle in CNC Lathe
4. Part programming and Simulation of Thread Cutting using CNC Lathe
5. Part programming and Machining of Contour using CNC Milling Machine
6. Part programming and Machining of Circular Pocket using CNC Milling Machine
7. Part programming and Machining of Rectangular Pocket using CNC Milling Machine
8. Part programming and Machining using Mirroring Cycle in CNC Milling Machine
9. Programming Exercise for Robots
10. Programming of PLC using Ladder Logic Diagram

TOTAL: 60 PERIODS

OUTCOMES:

CO1: Ability to write CNC programming using G-code and M-code
CO2: Ability to write programming for robot control
CO3: Ability to use PLC for actuation

<table>
<thead>
<tr>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

IE7812 COMPREHENSION

The objective of this comprehension is to achieve an understanding of the fundamentals of contemporary manufacturing systems including materials, manufacturing process, product and process control, computer integrated manufacture and quality. The students working groups and solve a variety of problems given to them. The problems given to the students should be of real like industrial problems selected by a group of faculty members of the concerned department. Minimum of three small problems have to be solved by each group of students. The evaluation is based on continuous assessment by a group of faculty members constituted by the professor in-charge of the course.

TOTAL: 60 PERIODS

IE7813 PROJECT WORK

A project topic must be selected either from published list sort he students themselves may propose suitable topics in consultation with the faculty/guide. It can be a theoretical research project oriented. The objective is to apply the principles/techniques they have learnt to a new or existing problem situation leading to a solution. Generally it is a group project.

The progress of the project is evaluated based on the guidelines provided in the regulation.

TOTAL: 300 PERIODS

GE7071 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  9
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)  9
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 stakeholders- 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  9
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  9
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.

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

GE7074  HUMAN RIGHTS  L  T  P  C  3 0 0 3
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

TOTAL : 45 PERIODS

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

REFERENCES:

GE7652  TOTAL QUALITY MANAGEMENT  L  T  P  C  3 0 0 3
AIM
- To provide comprehensive knowledge about the principles, practices, tools and techniques of Total quality management.

OBJECTIVES
- To understand the need for quality, its evolution, basic concepts, contribution of quality gurus, TQM framework, Barriers and Benefits of TQM.
- To understand the TQM Principles.
- To learn and apply the various tools and techniques of TQM.
- To understand and apply QMS and EMS in any organization.
UNIT I  INTRODUCTION
Introduction - Need for quality - Definition of quality - Dimensions of product and service quality –Definition of TQM – Basic concepts of TQM —Gurus of TQM (Brief introduction) -- TQM Framework- Barriers to TQM –Benefits of TQM.

UNIT II  TQM PRINCIPLES

UNIT III  TQM TOOLS & TECHNIQUES I

UNIT IV  TQM TOOLS & TECHNIQUES II

UNIT V  QUALITY MANAGEMENT SYSTEM

TOTAL: 45 PERIODS

OUTCOMES:
CO1: Ability to apply TQM concepts in a selected enterprise.
CO2: Ability to apply TQM principles in a selected enterprise.
CO3: Ability to apply the various tools and techniques of TQM.
CO4: Ability to apply QMS and EMS in any organization.

<table>
<thead>
<tr>
<th>CO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TEXT BOOK:

REFERENCE:
OBJECTIVES

- To understand the Basics of accounting and accounting standards.
- To understand how to prepare P&L statements, Balance sheets and other accounting statements.
- To learn and apply the various cost accounting methods.
- To understand how to prepare a budget and make investment decisions.

UNIT I INTRODUCTION

UNIT II FINANCIAL ACCOUNTING
Salient features of Balance Sheet and Profit and Loss statement, cash flow and Fund flow Analysis (Elementary), working capital management, ratio analysis – Depreciation.

UNIT III COST ACCOUNTING
Cost accounting systems: Job Costing, process costing, allocation of overheads, Activity based costing, variance analysis – marginal costing – Break even analysis.

UNIT IV BUDGETING
Requirements for a sound budget, fixed budget – preparation of sales and production budget, flexible budgets, zero based budgets and budgetary control.

UNIT V FINANCIAL MANAGEMENT
Investment decisions – Investment appraisal techniques – payback period method, accounting rate of return, net present value method, internal rate of return and profitability index method – cost of capital.

TOTAL: 45 PERIODS

OUTCOMES

CO1: Ability to apply accounting principles in a selected enterprise.
CO3: Ability to apply the various cost accounting methods.
CO4: Ability to prepare a budget and make investment decisions.

<table>
<thead>
<tr>
<th>CO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

REFERENCES:
OBJECTIVES:
- To gain knowledge about nonlinear and multi-objective optimization models.
- To get exposure to meta heuristic algorithms.

UNIT I  RANDOM PROCESS  9
Modeling the process – steady state probabilities - Reducible Markov chains – Absorbing Markov chains – Ergodic Markov chains

UNIT II  NON-LINEAR OPTIMIZATION - I  9
Types of Non-linear programming problems, unconstrained optimization, KKT conditions for constrained optimization, Quadratic programming

UNIT III  NON-LINEAR OPTIMIZATION - II  9
Separable programming, Convex programming, Non-convex programming, Geometric programming, Stochastic programming

UNIT IV  NON-TRADITIONAL OPTIMIZATION - I  9
Meta Heuristics like Genetic Algorithms, Simulated annealing, Tabu search, Ant Colony Optimization with applications to Industrial Engineering.

UNIT V  NON-TRADITIONAL OPTIMIZATION - II  9

TOTAL: 45 PERIODS

OUTCOMES:
- Students will have knowledge of various latest optimization techniques and will be able to select and apply suitable technique as warranted by real life situation.

TEXT BOOKS:

REFERENCES:

OBJECTIVE:
- To impart knowledge on the applications of multivariate statistical analysis

UNIT I  MULTIVARIATE METHODS  9
Review of basic matrix operations and random vectors, Eigen values and Eigen vectors. An overview of multivariate methods, Multivariate normal distribution.

UNIT II  REGRESSION  9
Inferences about population parameters - Simple Regression, and Correlation – Estimation using the regression line, correlation analysis, Multiple Regression– Logistic Regression - Canonical Correlation analysis-Multivariate analysis of variance.
UNIT III  FACTOR ANALYSIS  9
Principal components analysis – Objectives, estimation of principal components, testing for independence of variables, Factor analysis model – Method of estimation – Factor rotation – Factor Scores

UNIT IV  DISCRIMINANT ANALYSIS  9
Discriminant analysis – Classification with two multi Variate normal populations- Evaluating classification function – Classification with several populations – Fishers Method for Discriminating among several Populations.

UNIT V  CLUSTER ANALYSIS  9
Cluster analysis – Clustering methods, Hierarchical clustering methods – Single Linkage, Complete Linkage, Average Linkage, Ward's Hierarchical Clustering Method, Non Hierarchical Clustering methods - K-means Method, Validation and profiling of clusters

TOTAL: 45 PERIODS

OUTCOMES:

Students should be able to
CO1: Predict the values of one or more variables on the basis of observations on the other variables.
CO2: Formulate the specific statistical hypotheses, in terms of the parameters of multivariate populations
CO3: Data reduction or structural simplification as simply as possible without sacrificing valuable information and will make interpretation easier.
CO4: Sorting and Grouping “similar” objects or variables are created, based upon measured characteristics.

<table>
<thead>
<tr>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

IE7004  COMPUTATIONAL METHODS AND ALGORITHMS  L T P C  3 0 0 3

OBJECTIVE
- A brief introduction to algorithmic design tools with some applications.

UNIT I  REVIEW OF A LANGUAGE  9
Review of C/C++ - writing and debugging large programs - Controlling numerical errors.

UNIT II  ALGORITHM DESIGN METHODS  9
Greedy – Divide and conquer – Backtracking – Branch & bound – Heuristics- Meta heuristics

UNIT III  BASIC TOOLS  9
Structured approach – Networks – Trees – Data structures

UNIT IV  COMPUTATIONAL PERFORMANCE  9
Time complexity – Space complexity – Algorithm complexity

UNIT V  APPLICATIONS  9
Sorting – Searching - Networks – Scheduling – Optimization models – IE applications

TOTAL: 45 PERIODS
OUTCOMES
Student will be able to design algorithm computational tools used in manufacturing process.
- Will be able to use a structured language for programming
- Will be able to use various algorithm design methods
- Will be able to develop algorithms using various tools
- Will be able to develop algorithms for IE applications

<table>
<thead>
<tr>
<th>CO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>✔</td>
<td></td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
</tr>
</tbody>
</table>

TEXT BOOK:

REFERENCES:

IE7005 DECISION SUPPORT AND INTELLIGENT SYSTEMS

OBJECTIVE:
- To review and clarify the fundamental terms, concepts and theories associated with Decision Support Systems, computerized decision aids, expert systems, group support systems and executive information systems.
- To discuss and develop skills in the analysis, design and implementation of computerized Decision Support Systems.
- To examine the uses of various mathematical models, heuristics and simulation as a sub-system of DSS.
- To understand that most Decision Support Systems are designed to support rather than replace decision makers and the consequences of this perspective for designing DSS.

UNIT I INTRODUCTION
Managerial decision making, system modeling and support - preview of the modeling process-phases of decision making process.

UNIT II ANALYSIS
DSS components- Data warehousing, access, analysis, mining and visualization-modeling and analysis-DSS development.

UNIT III TECHNOLOGIES
Group support systems- Enterprise DSS- supply chain and DSS - Knowledge management methods, technologies and tools.

UNIT IV EXPERT SYSTEMS
Artificial intelligence and expert systems - Concepts, structure, types - Knowledge acquisition and validation - Difficulties, methods, selection.
UNIT V  SEMANTIC NETWORKS
Representation in logic and schemas, semantic networks, production rules and frames, inference techniques, intelligent system development, implementation and integration of management support systems.

OUTCOMES:
- CO1: Make decisions in the semi structured and unstructured problem situations.
- CO2: Able to apply data warehousing and data mining principles in basic applications.
- CO3: Develop knowledge management system with simple tools and techniques.
- CO4: Develop intelligent based DSS.

REFERENCES:

IE7006  EVOLUTIONARY OPTIMIZATION

OBJECTIVES:
- To introduce different evolutionary optimization techniques for the problems related to the manufacturing systems

UNIT I  9
Conventional Optimization techniques, Overview of evolutionary computation, Historical branches of evolutionary computation

UNIT II  3
Search operators, Selection schemes, Ranking methods, Importance of representation

UNIT III  9
Evolutionary combinatorial optimization: evolutionary algorithms, Constrained optimization, Evolutionary multi-objective optimization.

UNIT IV  9
Genetic programming – Steps, Search operators on trees, examples, Hybrid genetic algorithms, Combining choices of heuristics

UNIT V  9
Pareto optimality, Analysis of evolutionary algorithms

TOTAL: 45 PERIODS

OUTCOMES:
- The students will be able to make decisions in the semi structured and unstructured problem situations.
REFERENCES:
5. Ruhul sarker, Masoud Mohammadian, Yao, Evolutionary Optimization, Kluwers’s

IE7007 INFORMATION SYSTEMS ANALYSIS AND DESIGN

OBJECTIVES:
• To describe the design data flow and ER diagrams
• To effectively manage the management information systems
• To analyze the technology and information systems
• To study the applications, designs and models for business organization

UNIT I OVERVIEW
Information concepts, System concepts, Examples of Information systems, Information
Systems analysis overview, Information gathering – sources.

UNIT II DATA FLOW DIAGRAMS AND ER DIAGRAMS
System Requirements specifications, Feasibility analysis, Data flow diagrams – logical and
physical DFDs, Process specification methods, Decision tables. Logical database design – ER
model, Normalizing relations; Data input methods; Structured Systems Analysis and Design.

UNIT III MANAGEMENT INFORMATION SYSTEMS
Development of MIS, Choice of Information technology, Applications in manufacturing and
service sector, Enterprise management systems.

UNIT IV TECHNOLOGY AND INFORMATION SYSTEMS
Database management systems, Object oriented technology, Client-server architecture, Local area
network, network topology.

UNIT V APPLICATIONS
Data warehouse design and implementation, Models of E-business, MIS and E-business, Web
enabled business management, Introduction to ERP, Case studies.

TOTAL : 45 PERIODS

OUTCOMES:
• The Student must be able to design data flow and ER diagrams, manage information system
  and apply modern concepts to business organizations.
  CO1. Able to make an analysis on Information Systems
  CO2. To implement design data flow and ER diagrams
  CO3. Able to manage and analyze the technology and information systems
  CO4. Able to improve designs and models for business organization

74
IE7008 MAINTENANCE ENGINEERING AND MANAGEMENT

OBJECTIVE:
- To maximize profit and minimize downtime in maintenance
- To analyze the root cause for maintenance problems
- To effectively manage the spare parts for maintenance activity
- To reduce the losses and improve the Overall Equipment Effectiveness

UNIT I MAINTENANCE CONCEPT

UNIT II MAINTENANCE MODELS

UNIT III MAINTENANCE QUALITY

UNIT IV MAINTENANCE MANAGEMENT

UNIT V TOTAL PRODUCTIVE MAINTENANCE

OUTCOMES:
CO1. To implement maintenance policies for maximizing the profit
CO2. Able to make a diagnosis of maintenance problems
CO3. Able to improve uptime of machines by effective spare parts management
CO4. Able to improve the overall Equipment Effectiveness

REFERENCES:
REFERENCES:

IE7009 MODELING OF MANUFACTURING SYSTEMS 3 0 0 3

OBJECTIVES:
- To introduce the students different models used to describe the manufacturing systems and use of them for effective operations of manufacturing industries.

UNIT I INTRODUCTION
Manufacturing systems types and concepts, manufacturing automation, performance measures types, classification and uses of manufacturing system models FMS planning and scheduling – Part selection and loading problems.

UNIT II FOCUSED FACTORIES
Focused flow lines – Work cells- work centers, Group technology, General serial systems – Analysis of paced and unpaced lines, system effectiveness, impact of random processing times

UNIT III MARKOV MODELS
Stochastic processes in manufacturing, Markov chain models – DTMC and CTMC, steady state analysis, Transient Analysis of Manufacturing Systems

UNIT IV QUEUING MODELS OF MANUFACTURING
Basic queuing models, Queuing networks in manufacturing – Jackson and Gordon Newell, product form solution

UNIT V PETRINET MODEL

OUTCOMES:
CO1. Can evaluate a given automated manufacturing system based on performance measures
CO2. Can apply group technology concepts to form Machine cells
CO3. Can model the Assembly line using Markov, Queuing and Petri Net model
CO4. Can analyze and model production lines using Markov, Queuing and Petri Net model

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>CO2</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>CO3</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>CO4</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
</tr>
</tbody>
</table>
REFERENCES:

IE7010 OPERATIONS SCHEDULING L T P C
3 0 0 3

OBJECTIVE:
• To impart knowledge on various scheduling algorithms applicable to single machine, parallel machines, flow shop and job shop models.

UNIT I SCHEDULING THEORY 9

UNIT II SINGLE MACHINE SCHEDULING 9

UNIT III PARALLEL MACHINE SCHEDULING 9

UNIT IV FLOW SHOP SCHEDULING 9

UNIT V JOB SHOP SCHEDULING 9

OUTCOMES:
• Students will be able to solve single machine sequencing problems with an objective to minimize mean flow time or mean tardiness.
• Students will be able to design a parallel machine schedule which can minimize mean flow time, or makespan.
• Students will be able to determine an optimal schedule for a flow shop.
• Students will be able to solve complex job shop problems, design and evaluate various feasible job shop schedules.

TOTAL: 45 PERIODS
PROGRAMME OUTCOMES

<table>
<thead>
<tr>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

REFERENCES:

IE7011 PRINCIPLES OF COMPUTER INTEGRATED MANUFACTURING SYSTEMS

OBJECTIVE:
- To provide some basic aspects of flexible automation.
- To introduce the fundamentals of computer aided design.
- To gain knowledge in the basics of computer aided design.
- To get insights in to the enablers of CAD and CAM integration and business function.
- To introduce the fundamentals of integrated management systems such as communication, network and database management.

UNIT I GGT AND FMS
9
Part families, production flow analysis, cellular manufacturing, ROC, Flexible manufacturing systems- components, FMS applications, FMS analysis – Bottleneck model.

UNIT II COMPUTER- AIDED DESIGN
9
Fundamentals of CAD – design process, manufacturing database – Computer graphics – functions, constructing the geometry, transformation, wire frame Vs solid modelling.

UNIT III MANUFACTURING SUPPORT SYSTEMS
9
Product design and CAD, CAD/CAM and CIM, Computer aided process planning- Variant and generative approaches, Concurrent engineering and design for manufacture, Lean production, Agile manufacturing.

UNIT IV FUNDAMENTALS OF COMMUNICATIONS
9
Information, Communications matrix, Computer communications, Network architecture, Tools and techniques.

UNIT V DATABASE AND CIM MANAGEMENT
9
Manufacturing data, database technology, Database management, Management of CIM – role, cost justification, expert systems

TOTAL: 45 PERIODS

OUTCOMES:
- Analyze a cellular and flexible manufacturing system for its performance measures.
- Gain knowledge in the basics of computer aided design.
- Make competitive manufacturing systems with the use of appropriate tools and techniques.
- Develop integrated manufacturing system with the required network structure and manufacturing database.

78
REFERENCES:

IE7012 PRODUCT DESIGN AND VALUE ENGINEERING

OBJECTIVES:
• The course aims at providing the basic concepts of product design, product features and its architecture so that student can have a basic knowledge in the common features a product has and how to incorporate them suitably in product.

UNIT I VALUE ENGINEERING BASICS
Origin of Value Engineering, Meaning of value, Definition of Value Engineering and Value analysis, Difference between Value analysis and Value Engineering, Types of Value, function - Basic and Secondary functions, concept of cost and worth, creativity in Value Engineering.

UNIT II VALUE ENGINEERING JOB PLAN AND PROCESS
Seven phases of job plan, FAST Diagram as Value Engineering Tool, Behavioural and organizational aspects of Value Engineering, Ten principles of Value analysis, Benefits of Value Engineering.

UNIT III IDENTIFYING CUSTOMER NEEDS and PRODUCT SPECIFICATIONS

UNIT IV CONCEPT GENERATION, SELECTION AND PRODUCT ARCHITECTURE

UNIT V INDUSTRIAL DESIGN, PROTOTYPING AND ECONOMICS OF PRODUCT DEVELOPMENT

TOTAL: 45 PERIODS

OUTCOMES:
CO1. To learn Value Engineering Basics, Job Plan and Process
CO2. To implement Value Engineering Tools and analysis
CO3. To Identifying Customer Needs and Product Specifications
CO3. Able to improve uptime of machines by effective spare parts management

79
CO4. To analyze the need for industrial design, prototyping and economics of
Product development

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

TEXT BOOKS:

REFERENCES:

IE7013 PRODUCTIVITY MANAGEMENT AND RE-ENGINEERING

OBJECTIVE:
- To introduce the basic principles of Productivity Models and the applications of Re-Engineering Concepts required for various organizations.

UNIT I INTRODUCTION
Basic concept and meaning of Productivity – Significance of Productivity – Factors affecting Productivity – Productivity cycle, Scope of Productivity Engineering and Management.

UNIT II PRODUCTIVITY MEASUREMENT AND EVALUATION

UNIT III PRODUCTIVITY PLANNING AND IMPLEMENTATION
Need for Productivity Planning – Short term and long term productivity planning – Productivity improvement approaches, Principles - Productivity Improvement techniques – Technology based, Material based, Employee based, Product based techniques – Managerial aspects of Productivity Implementation schedule, Productivity audit and control.

UNIT IV REENGINEERING PROCESS

UNIT V BPR TOOLS AND IMPLEMENTATION
Analytical and Process Tools and Techniques - Role of Information and Communication Technology in BPR – Requirements and steps in BPR Implementation – Case studies.

TOTAL: 45 PERIODS

OUTCOMES:
The Student will be able to:
- CO1 - Measure and evaluate productivity
- CO2 - Plan and implement various productivity techniques.
- CO3 - Reengineer the process for improving the productivity
- CO4 - Implement BPR tools for improving the productivity.

<table>
<thead>
<tr>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

REFERENCES:

IE7014 ROBOTICS ENGINEERING

OBJECTIVES:
- To select the appropriate drives and grippers required based on application
- To specify the sensors for particular application
- To control various robot links using kinematic equations
- To perform a justification check before implementation of robots in industry

UNIT I FUNDAMENTALS OF ROBOT

UNIT II ROBOT DRIVE SYSTEMS AND END EFFECTORS

UNIT III SENSORS AND MACHINE VISION
Sensory Devices - Non optical - Position sensors - Optical position sensors - Velocity sensors- Proximity sensors - Contact and noncontact type - Touel and slip sensors - Force and torque sensors- Introduction to Image Processing

UNIT IV ROBOT KINEMATICS AND ROBOT PROGRAMMING
Forward Kinematics and Reverse Kinematics of Manipulators with Two, Three Degrees of Freedom (In 2 Dimensional)- Homogeneous Transformation- D-H Representation of forward kinematics. Teach Pendant Programming, Lead through programming, Robot programming Languages – VAL Programming – Motion Commands, Sensor Commands, End effector commands, and Simple programs.

UNIT V ROBOT CELL DESIGN, CONTROL AND ECONOMICS

TOTAL : 45 PERIODS
OUTCOMES:
CO1. Able to suggest a suitable robot drive, gripper and sensors required for particular application.
CO2. Perform selection of sensor for a particular task
CO3. Able to analyse robot arm kinematics and understand simple programs.
CO4. Able to analyse the robot cycle time and economics of robot implementation.

<table>
<thead>
<tr>
<th>CO1</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

TEXT BOOK :

REFERENCES :

IE7015 SYSTEMS ENGINEERING L T P C 3 0 0 3

OBJECTIVES:
- To introduce system engineering concepts to design the manufacturing system for optimum utilization of source for effective functioning.

UNIT I INTRODUCTION
Definitions of Systems Engineering, Systems Engineering Knowledge, Life cycles, Life-cycle phases, logical steps of systems engineering, Frame works for systems engineering.

UNIT II SYSTEMS ENGINEERING PROCESSES
Formulation of issues with a case study, Value system design, Functional analysis, Business Process Reengineering, Quality function deployment, System synthesis, Approaches for generation of alternatives.

UNIT III ANALYSIS OF ALTERNATIVES - I
Cross-impact analysis, Structural modeling tools, System Dynamics models with case studies, Economic models: present value analysis – NPV, Benefits and costs over time, ROI, IRR; Work and Cost breakdown structure,

UNIT IV ANALYSIS OF ALTERNATIVES – II
Reliability, Availability, Maintainability, and Supportability models; Stochastic networks and Markov models, Queuing network optimization, Time series and Regression models, Evaluation of large scale models.
UNIT V DECISION ASSESSMENT

Decision assessment types, Five types of decision assessment efforts, Utility theory, Group decision making and Voting approaches, Social welfare function; Systems Engineering methods for Systems Engineering Management,

TOTAL: 45 PERIODS

OUTCOMES:
- The Student will be able to apply systems engineering principles to make decision for optimization.
- Understanding of the systems engineering discipline and be able to use the core principles and processes for designing effective system.

TEXT BOOK:

REFERENCES:

IE7071 HUMAN RESOURCE MANAGEMENT

OBJECTIVE:
- To introduce the basic principles of group dynamics and associated concepts required for Human resource management in organizations

UNIT I INDIVIDUAL BEHAVIOR

UNIT II GROUP BEHAVIOR
Group Organization, Group Dynamics, Emergence of Informal Leader, Leadership Styles-theories, Group decision making, Inter personal Relations, Communication -Team.

UNIT III DYNAMICS OF ORGANIZATIONAL BEHAVIOR
Organizational Climate, the Satisfactory – Organizational change – The Change Process and Change Management.

UNIT IV HUMAN RESOURCES PLANNING
Requirements of Human Resources – HR audit, Recruitment-Selection-Interviews

UNIT V HUMAN RESOURCES DEVELOPMENT

TOTAL : 45 PERIODS

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

TEXT BOOK:
REFERENCES:

IE7072 METROLOGY AND INSPECTION

OBJECTIVE:
- To impart knowledge about linear and angular measuring Instruments.

UNIT I LINEAR MEASUREMENT AND ANGULAR MEASUREMENT

UNIT II STANDARDS FOR LINEAR AND ANGULAR MEASUREMENTS
Shop floor standards and their calibration, light interference, Method of coincidence, Slip gauge calibration, Measurement errors, Limits, fits, Tolerance, Gauges, Gauge design.

UNIT III MEASUREMENT APPLICATION

UNIT IV MODERN CONCEPTS
Image processing and its application in Metrology, Co-ordinate measuring machine, Types of CMM, Probes used, Application, Non-contact CMM using Electro-optical sensors for dimensional metrology.

UNIT V INTRODUCTION TO MEASUREMENT SYSTEMS
System configuration, basic characteristics of measuring devices, Displacement, force and torque measurement, standards, Calibration, Sensors, Basic principles and concepts of temperature, Pressure and flow measurement, Destructive testing – Nondestructive testing.

TOTAL: 45 PERIODS

OUTCOMES:
The student must be able to
- Understanding the basic theoretical technical and legislative aspects of metrology and testing.
- Measure a variety of engineering parts using a variety of measuring techniques.
- Present and analyze measurement results obtained.
- Acquire capability to select right method of non-destructive testing.

<table>
<thead>
<tr>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>
TEXT BOOK:

REFERENCES:

IE7073 PROJECT MANAGEMENT L T P C 3 0 0 3

OBJECTIVES:
- To outline the need for Project Management
- To highlight different techniques of activity planning

UNIT I INTRODUCTION TO PROJECT MANAGEMENT AND PROJECT SELECTION 9

UNIT II PROJECT PLANNING AND IMPLEMENTATION 9
Work break down structure- Estimate work packages – Identify task relationship – project schedule

UNIT III PROJECT MONITORING AND CONTROL 9
Resource aggregation - Resource leveling - limited resource allocation – project monitoring and control.

UNIT IV PROJECT CLOSURE 9

UNIT V SPECIAL TOPICS IN PROJECT MANAGEMENT 9
Project management for modern information system – critical success factors for IT project - software project selection and initiation - project management discipline – project overall planning

TOTAL : 45 PERIODS

OUTCOMES:
- Evaluate and select the most desirable projects.
- Apply appropriate approaches to plan a new project.
- Apply appropriate methodologies to develop a project schedule.
- Identify important risks facing a new project.

<table>
<thead>
<tr>
<th>CO1</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

REFERENCES:
OBJECTIVE:
- To impart knowledge on safety engineering fundamentals and safety management practices.

UNIT I  INTRODUCTION
Evolution of modern safety concepts – Fire prevention – Mechanical hazards – Boilers, Pressure vessels, Electrical Exposure.

UNIT II  CHEMICAL HAZARDS
Chemical exposure – Toxic materials – Radiation Ionizing and Non-ionizing Radiation - Industrial Hygiene – Industrial Toxicology.

UNIT III  ENVIRONMENTAL CONTROL
Industrial Health Hazards – Environmental Control – Industrial Noise - Noise measuring instruments, Control of Noise, Vibration, - Personal Protection.

UNIT IV  HAZARD ANALYSIS
System Safety Analysis –Techniques – Fault Tree Analysis (FTA), Failure Modes and Effects Analysis (FMEA), HAZOP analysis and Risk Assessment.

UNIT V  SAFETY REGULATIONS

TOTAL: 45 PERIODS

OUTCOMES:
Students will be able to
CO1 – Identify and prevent chemical, environmental mechanical, fire hazard
CO2 – Collect, analyze and interpret the accidents data based on various safety techniques.
CO3 – Apply proper safety techniques on safety engineering and management
CO4 – design the system with environmental consciousness by implementing safety regulation

<table>
<thead>
<tr>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

REFERENCES:

ME7077  ENTREPRENEURSHIP DEVELOPMENT
OBJECTIVES:
- The students will be provided with an understanding of the scope of an entrepreneur, key areas of development, financial assistance by the institutions, methods of taxation and tax benefits, etc.
UNIT I  ENTREPRENEURSHIP  9

UNIT II  MOTIVATION  9

UNIT III  BUSINESS  9

UNIT IV  FINANCING AND ACCOUNTING  9

UNIT V  SUPPORT TO ENTREPRENEURS  9

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

TEXT BOOKS:

REFERENCES:

MF7073  ELECTRONICS MANUFACTURING TECHNOLOGY  L T P C
3 0 0 3

OBJECTIVES:
• To understand wafer preparation and PCB fabrication, the types of Mounting Technologies and components for electronics assembly & SMT process in detail.
• To know various Defects, Inspection Equipments SMT assembly process and repair, rework and quality aspects of Electronics assemblies.

UNIT I  INTRODUCTION TO ELECTRONICS MANUFACTURING  9
History, definition, wafer preparation by growing, machining, and polishing, diffusion, microlithography, etching and cleaning, Printed circuit boards, types- single sided, double sided, multi layer and flexible printed circuit board, design, materials, manufacturing, inspection.
UNIT II COMPONENTS AND PACKAGING
Introduction to packaging, types - Through hole technology (THT) and Surface mount technology (SMT). Through hole components – axial, radial, multi leaded, odd form. Surface-mount components - active, passive. Interconnections - chip to lead interconnection, die bonding, wire bonding, TAB, flip chip, chip on board, multi chip module, direct chip array module, leaded, leadless, area array and embedded packaging, miniaturization and trends.

UNIT III SURFACE MOUNT TECHNOLOGY PROCESS
Introduction to the SMT Process, SMT equipment and material handling systems, handling of components and assemblies - moisture sensitivity and ESD, safety and precautions needed, IPC and other standards, stencil printing process - solder paste material, storage and handling, stencils and squeegees, process parameters, quality control. Component placement - equipment type, flexibility, accuracy of placement, throughput, packaging of components for automated assembly, CP and Cpk and process control. soldering - reflow process, process parameters, profile generation and control, solder joint metallurgy, adhesive, underfill and encapsulation process - applications, materials, storage and handling, process and parameters.

UNIT IV INSPECTION AND TESTING
Inspection techniques, equipment and principle - AOI, X-ray. Defects and Corrective action - stencil printing process, component placement process, reflow soldering process, underfill and encapsulation process, electrical testing of PCB assemblies - In circuit test, functional testing, fixtures and jigs.

UNIT V REPAIR, REWORK, QUALITY AND RELIABILITY OF ELECTRONICS ASSEMBLIES
Repair tools, methods, rework criteria and process, thermo-mechanical effects and thermal management, Reliability fundamentals, reliability testing, failure analysis, design for manufacturability, assembly, rework ability, testing, reliability, and environment.

OUTCOMES:
- Perform fabrication of PCBs and use of mounting technology for electronic assemblies.
- Perform quality inspection on the PCBs

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To understand the Modern manufacturing systems
- To understand the concepts and applications of flexible manufacturing systems

UNIT I
PLANNING, SCHEDULING AND CONTROL OF FLEXIBLE MANUFACTURING SYSTEMS

Introduction to FMS - development of manufacturing systems - benefits - major elements of FMS - types of flexibility - FMS application and flexibility –single product, single batch, n - batch scheduling problem - knowledge based scheduling system.

UNIT II
COMPUTER CONTROL AND SOFTWARE FOR FLEXIBLE MANUFACTURING SYSTEMS

Introduction - composition of FMS - hierarchy of computer control - computer control of work center and assembly lines - FMS supervisory computer control - types of software specification and selection - trends.

UNIT III
FMS SIMULATION AND DATA BASE


UNIT IV
GROUP TECHNOLOGY AND JUSTIFICATION OF FMS

Introduction - matrix formulation - mathematical programming formulation - graph formulation - knowledge based system for group technology - economic justification of FMS - application of possibility distributions in FMS systems justification.

UNIT V
APPLICATIONS OF FMS AND FACTORY OF THE FUTURE

FMS application in machining, sheet metal fabrication, prismatic component production - aerospace application - FMS development towards factories of the future - artificial intelligence and expert systems in FMS - design philosophy and characteristics for future.

TOTAL: 45 PERIODS

OUTCOMES:
CO1. Ability to perform Planning, Scheduling and control of FMS
CO2. Demonstrate the software requirements to control the FMS and select a software from various alternatives
CO3. Can perform simulation of FMS and also specify a Database scheme for FMS
CO4. Can classify the parts into part families using group technology

<table>
<thead>
<tr>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TEXT BOOK:

REFERENCES:

MG7451 PRINCIPLES OF MANAGEMENT

AIM:
To learn the different principles and techniques of management in planning, organizing, directing and controlling.

OBJECTIVES
• To study the Evolution of Management
• To study the functions and principles of management
• To learn the application of the principles in an organization

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS

UNIT II PLANNING

UNIT III ORGANISING

UNIT IV DIRECTING

UNIT V CONTROLLING
System and process of controlling – Budgetary and non - Budgetary control techniques – Use of computers and IT in Management control – Productivity problems and management – Control and performance – Direct and preventive control – Reporting.

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

TEXT BOOKS:
REFERENCES:

GE7072  FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT  

OBJECTIVES:
- To understand the global trends and development methodologies of various types of products and services
- To conceptualize, prototype and develop product management plan for a new product based on the type of the new product and development methodology integrating the hardware, software, controls, electronics and mechanical systems
- To understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them in to design specification
- To understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics
- To develop documentation, test specifications and coordinate with various teams to validate and sustain up to the EoL (End of Life) support activities for engineering customer

UNIT I  FUNDAMENTALS OF PRODUCT DEVELOPMENT
- Global Trends Analysis and Product decision
  - Social Trends
  - Technical Trends
  - Economical Trends
  - Environmental Trends
  - Political/Policy Trends
- Introduction to Product Development Methodologies and Management
  - Overview of Products and Services
  - Types of Product Development
  - Overview of Product Development methodologies
  - Product Life Cycle – Product Development Planning and Management

UNIT II  REQUIREMENTS AND SYSTEM DESIGN
- Requirement Engineering
  - Types of Requirements
  - Requirement Engineering - traceability Matrix and Analysis
  - Requirement Management
  - System Design & Modeling
  - Introduction to System Modeling
  - System Optimization
  - System Specification
  - Sub-System Design
  - Interface Design

UNIT III  DESIGN AND TESTING
- Conceptualization
  - Industrial Design and User Interface Design
  - Introduction to Concept generation Techniques
  - Challenges in Integration of Engineering Disciplines
  - Concept Screening & Evaluation
  - Detailed Design
  - Component Design and Verification
  - Mechanical, Electronics and Software Subsystems
  - High Level Design/Low Level Design of S/W Program
  - Types of Prototypes
  - S/W Testing
  - Hardware Schematic, Component design, Layout and Hardware Testing
  - Prototyping
  - Introduction to Rapid Prototyping and Rapid Manufacturing
  - System Integration, Testing, Certification and Documentation
UNIT IV  SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT  9

UNIT V  BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY  9

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to:
- Define, formulate and analyze a problem
- Solve specific problems independently or as part of a team
- Gain knowledge of the Innovation & Product Development process in the Business Context
- Work independently as well as in teams
- Manage a project from start to finish

TEXTBOOKS:
1. Book specially prepared by NASSCOM as per the MoU.

REFERENCES: