PROGRAMME EDUCATIONAL OBJECTIVES:
Post graduates of the product design and development engineering program are expected to:
1. Demonstrate technical competency in practice.
2. Function effectively in an industrial and academic environments.
3. Engage in professional ethics and development.
4. Enrich their society and environment through their skills.

PROGRAMME OUTCOMES:
The graduate will demonstrate:
1. an ability to apply knowledge of mathematics, science, and engineering;
2. an ability to design a system, component, or process to meet desired needs;
3. an ability to identify, formulate, and solve engineering problems;
4. an understanding of professional and ethical responsibility;
5. an ability to communicate effectively;
6. the broad education necessary to understand the impact of engineering solutions in a global and societal context;
7. a knowledge of contemporary issues;
8. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice;
9. an ability to select and apply materials and manufacturing processes: ability to design manufacturing processes that result in products that meet specific material and other requirements;
10. a knowledge of process, assembly and product engineering: ability to design products and the equipment, tooling, and environment necessary for their manufacture;

1. PEO / PO Mapping

<table>
<thead>
<tr>
<th>Programme Educational Objectives</th>
<th>Programme Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>PO1</td>
<td>PO2</td>
</tr>
<tr>
<td>I</td>
<td>✓</td>
</tr>
<tr>
<td>II</td>
<td>✓</td>
</tr>
<tr>
<td>III</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td></td>
</tr>
</tbody>
</table>
## 2. Semester Course wise PO mapping

<table>
<thead>
<tr>
<th>SEM 1</th>
<th></th>
<th></th>
<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>
</tr>
</thead>
<tbody>
<tr>
<td>YEAR 1</td>
<td>Applied Mathematics for Engineers</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>Introduction to Product Development</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 Applications in 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>Advanced Finite Element 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>Industrial 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>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>SEM 2</td>
<td>Integrated Product Design and Process Development</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>Product and Process Engineering Tools</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>Materials Selection for Product Development</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 Concepts in Product Development</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>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>SEM 3</td>
<td>Marketing Research</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>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>Project Work Phase 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>SEM 4</td>
<td>Project Work Phase 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>
</tbody>
</table>
## ANNA UNIVERSITY, CHENNAI
## AFFILIATED INSTITUTIONS
## REGULATIONS 2017
## M.E. PRODUCT DESIGN AND DEVELOPMENT
## CHOICE BASED CREDIT SYSTEM
## I TO IV SEMESTERS (FULL TIME) CURRICULUM AND SYLLABUS

### SEMESTER 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><strong>THEORY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>MA5156</td>
<td>Applied Mathematics for Engineers</td>
<td>FC</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>PD5101</td>
<td>Introduction to Product Development</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>ED5151</td>
<td>Computer Applications in Design</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>ED5153</td>
<td>Advanced Finite Element Analysis</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>PD5102</td>
<td>Industrial Design</td>
<td>PC</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>6.</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></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>ED5161</td>
<td>CAD 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>ED5162</td>
<td>Advanced Analysis and Simulation 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 CREDITS</strong></td>
<td></td>
<td>28</td>
<td>20</td>
<td>8</td>
<td>8</td>
<td>24</td>
</tr>
</tbody>
</table>

### SEMESTER 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><strong>THEORY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>PD5251</td>
<td>Integrated Product Design and Process Development</td>
<td>PC</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>PD5201</td>
<td>Product and Process Engineering Tools</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>PD5202</td>
<td>Materials Selection for Product Development</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>PD5203</td>
<td>Quality Concepts in Product Development</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>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></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>PD5211</td>
<td>Product Design Laboratory</td>
<td>PC</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>8.</td>
<td>PD5212</td>
<td>Design Project</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 CREDITS</strong></td>
<td></td>
<td>26</td>
<td>18</td>
<td>6</td>
<td>6</td>
<td>22</td>
</tr>
</tbody>
</table>
### 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>PD5301</td>
<td>Marketing Research</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 IV</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 V</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>PD5311</td>
<td>Project Work Phase I</td>
<td>EEC</td>
<td>12</td>
<td>0</td>
<td>0</td>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL CREDITS</strong></td>
<td></td>
<td>21</td>
<td>9</td>
<td>0</td>
<td>12</td>
<td>15</td>
</tr>
</tbody>
</table>

**TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE = 73**

### 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>PRACTICAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>PD5411</td>
<td>Project Work Phase II</td>
<td>EEC</td>
<td>24</td>
<td>0</td>
<td>0</td>
<td>24</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL CREDITS</strong></td>
<td></td>
<td>24</td>
<td>0</td>
<td>0</td>
<td>24</td>
<td>12</td>
</tr>
</tbody>
</table>

**TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE = 73**
### FOUNDATION COURSES (FC)

<table>
<thead>
<tr>
<th>SL. NO.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>CONTACT PERIODS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>MA5156</td>
<td>Applied Mathematics for Engineers</td>
<td>FC</td>
<td>4</td>
</tr>
</tbody>
</table>

### PROFESSIONAL CORE (PC)

<table>
<thead>
<tr>
<th>SL. NO.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>CONTACT PERIODS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>PD5101</td>
<td>Introduction to Product Development</td>
<td>PC</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>ED5151</td>
<td>Computer Applications in Design</td>
<td>PC</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>ED5153</td>
<td>Advanced Finite Element Analysis</td>
<td>PC</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>PD5102</td>
<td>Industrial Design</td>
<td>PC</td>
<td>4</td>
</tr>
<tr>
<td>5.</td>
<td>ED5161</td>
<td>CAD Laboratory</td>
<td>PC</td>
<td>4</td>
</tr>
<tr>
<td>6.</td>
<td>ED5162</td>
<td>Advanced Analysis and Simulation Laboratory</td>
<td>PC</td>
<td>4</td>
</tr>
<tr>
<td>8.</td>
<td>PD5201</td>
<td>Product and Process Engineering Tools</td>
<td>PC</td>
<td>3</td>
</tr>
<tr>
<td>9.</td>
<td>PD5202</td>
<td>Materials Selection for Product Development</td>
<td>PC</td>
<td>3</td>
</tr>
<tr>
<td>10.</td>
<td>PD5203</td>
<td>Quality Concepts in Product Development</td>
<td>PC</td>
<td>3</td>
</tr>
<tr>
<td>11.</td>
<td>PD5211</td>
<td>Product Design Laboratory</td>
<td>PC</td>
<td>2</td>
</tr>
<tr>
<td>12.</td>
<td>PD5301</td>
<td>Marketing Research</td>
<td>PC</td>
<td>3</td>
</tr>
</tbody>
</table>
## LIST OF ELECTIVES
### SEMESTER I (Elective 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>1.</td>
<td>PD5001</td>
<td>Creativity in Design</td>
<td>EEC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>PD5002</td>
<td>Enterprise Resource Planning</td>
<td>EEC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>ED5071</td>
<td>Optimization Techniques in Design</td>
<td>EEC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>CC5292</td>
<td>Additive Manufacturing and Tooling</td>
<td>EEC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>ED5073</td>
<td>Information Analytics</td>
<td>EEC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

### SEMESTER II (Elective II & 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>1.</td>
<td>PD5003</td>
<td>Design Thinking</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>CM5072</td>
<td>Micro Electro Mechanical Systems</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>CD5091</td>
<td>Industrial Robotics and Expert Systems</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>CC5291</td>
<td>Design for Manufacture, Assembly and Environments</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>ED5093</td>
<td>Computational Fluid Dynamics</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>PD5004</td>
<td>Reverse Engineering</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

### SEMESTER III (Elective IV & 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>1.</td>
<td>PD5091</td>
<td>Product Lifecycle 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>ED5075</td>
<td>Design for Internet of Things</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>PD5005</td>
<td>Intellectual Property Rights and Patent Laws</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>PD5006</td>
<td>Maintenance Engineering</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>PD5007</td>
<td>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>6.</td>
<td>ED5076</td>
<td>Product Design for Sustainability</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>PD5008</td>
<td>Product Testing and Qualification</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>PD5009</td>
<td>Financial Engineering</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>PD5212</td>
<td>Design Project</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>PD5311</td>
<td>Project Work Phase I</td>
<td>EEC</td>
<td>12</td>
<td>0</td>
<td>0</td>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td>3.</td>
<td>PD5411</td>
<td>Project Work Phase II</td>
<td>EEC</td>
<td>24</td>
<td>0</td>
<td>0</td>
<td>24</td>
<td>12</td>
</tr>
</tbody>
</table>
OBJECTIVES:
This course is designed to enrich the knowledge in various advanced mathematical
techniques such as matrix theory, calculus of variations, probability and random variables,
Laplace transforms and Fourier transforms. The fundamental concepts in these areas will be
more useful for the students to model the engineering problems and solving them by
applying these methods.

UNIT I  MATRIX THEORY  12
The Cholesky decomposition - Generalized Eigenvectors - Canonical basis - QR
factorization - Least squares method - Singular value decomposition.

UNIT II  CALCULUS OF VARIATIONS  12
Concept of variation and its properties – Euler’s equation – Functional dependant on first
and higher order derivatives – Functionals dependant on functions of several independent
variables – Variational problems with moving boundaries – Isoperimetric problems - Direct
methods : Ritz and Kantorovich methods.

UNIT III PROBABILITY AND RANDOM VARIABLES  12
Probability – Axioms of probability – Conditional probability – Baye’s theorem - Random
variables - Probability function – Moments – Moment generating functions and their
properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal
distributions – Function of a random variable.

UNIT IV LAPLACE TRANSFORM TECHNIQUES FOR PARTIAL
DIFFERENTIAL EQUATIONS  12
Laplace transform - Definitions - Properties – Transform error function - Bessel’s function -
Dirac delta function - Unit step functions – Convolution theorem – Inverse Laplace transform :
Complex inversion formula – Solutions to partial differential equations : Heat equation -
Wave equation.

UNIT V FOURIER TRANSFORM TECHNIQUES FOR PARTIAL DIFFERENTIAL
EQUATIONS  12
Fourier transform : Definitions - Properties – Transform of elementary functions - Dirac delta
function – Convolution theorem – Parseval’s identity – Solutions to partial differential
equations : Heat equation - Wave equation - Laplace and Poisson’s equations.

TOTAL : 60 PERIODS

OUTCOMES:
After completing this course, students should demonstrate competency in the following skills:

- Apply various methods in matrix theory to solve system of linear equations.
- Maximizing and minimizing the functional that occur in various branches of
  engineering disciplines.
- Computation of probability and moments, standard distributions of discrete and
  continuous random variables and functions of a random variable.
- Application of Laplace and Fourier transforms to initial value, initial–boundary value
  and boundary value problems in Partial Differential Equations.

REFERENCES:
1. Andrews L.C. and Shivamoggi, B. "Integral Transforms for Engineers", Prentice Hall of
OBJECTIVE:
• This course aims at introducing the students to the basic concepts of engineering design and product development with focus on the front end processes. At the end of this course the student is expected to demonstrate an understanding of the overview of all the product development processes and knowledge of concept generation and selection tools.

UNIT I
Need for developing products – the importance of engineering design – types of design – the design process – relevance of product lifecycle issues in design – designing to codes and standards- societal considerations in engineering design – generic product development process – various phases of product development-planning for products – establishing markets- market segments- relevance of market research

UNIT II
Identifying customer needs – voice of customer – customer populations- hierarchy of human needs- need gathering methods – affinity diagrams – needs importance- establishing engineering characteristics- competitive benchmarking- quality function deployment- house of quality- product design specification-case studies

UNIT III

UNIT IV

UNIT V

TOTAL: 45 PERIODS

Note: Since the idea is to provide an overview of the design process, the questions in the examination should have more number of sub-divisions leading to not more than 4 or 5 marks each and need to be generic in the Part-B part.
REFERENCES

ED5151 COMPUTER APPLICATIONS IN DESIGN L T P C
3 0 0 3

OBJECTIVE:
- To impart knowledge on computer graphics which are used routinely in diverse areas as science, engineering, medicine, etc.

UNIT I INTRODUCTION TO COMPUTER GRAPHICS FUNDAMENTALS 9
Output primitives (points, lines, curves etc.), 2-D & 3-D transformation (Translation, scaling, rotation) windowing - view ports - clipping transformation.

UNIT II CURVES AND SURFACES MODELING 9
Introduction to curves - Analytical curves: line, circle and conics – synthetic curves: Hermite cubic spline- Bezier curve and B-Spline curve – curve manipulations.

UNIT III NURBS AND SOLID MODELING 9

UNIT IV VISUAL REALISM 9
Hidden – Line – Surface – solid removal algorithms shading – coloring. Introduction to parametric and variational geometry based software's and their principles creation of prismatic and lofted parts using these packages.

UNIT V ASSEMBLY OF PARTS AND PRODUCT DATA EXCHANGE 9

TOTAL : 45 PERIODS

OUTCOMES:
- It helps the students to get familiarized with the computer graphics application in design.
- This understanding reinforces the knowledge being learned and shortens the overall learning curve which is necessary to solve CAE problems that arise in engineering.
REFERENCES:

ED5153 ADVANCED FINITE ELEMENT ANALYSIS L T P C 3 0 0 3

OBJECTIVE:
- To develop a thorough understanding of the advanced finite element analysis techniques with an ability to effectively use the tools of the analysis for solving practical problems arising in engineering design

UNIT I BENDING OF PLATES AND SHELLS 9
Review of Elasticity Equations – Bending of Plates and Shells – Finite Element Formulation of Plate and Shell Elements - Conforming and Non-Conforming Elements – C0 and C1 Continuity Elements – Degenerated shell elements- Application and Examples.

UNIT II NON-LINEAR PROBLEMS 9

UNIT III DYNAMIC PROBLEM 9

UNIT IV FLUID MECHANICS AND HEAT TRANSFER 9

UNIT V ERROR ESTIMATES AND ADAPTIVE REFINEMENT 9
Error norms and Convergence rates – h-refinement with adaptivity – Adaptive refinement.

OUTCOMES:
1. The students will understand the Finite Element Formulation of Plate and Shell Elements and its application.
2. The students will be able to gain knowledge in material & geometric non and plasticity.
3. The students will be able to solve problems under dynamic conditions by applying various techniques.
4. The students can arrive at the solutions for fluid mechanics and heat transfer problems.
5. The students will acquire knowledge in error norms, convergence rates and refinement.
6. The students will solve the real world engineering problems using FEA.

TOTAL: 45 PERIODS
REFERENCES:

PD5102 INDUSTRIAL DESIGN L T P C
4 0 0 4

OBJECTIVE:
To expose the students to the various aspects of Industrial Design so as to develop new products considering aesthetics, ergonomics, environment and other human factors.

UNIT I INTRODUCTION 12

UNIT II WORK PLACE AND EQUIPMENT DESIGN 12
Applied anthropometry, Workspace design and seating, arrangement of components within a physical space, interpersonal aspects of work place design, and design of repetitive task, design of manual handling activity task, work capacity, stress, and fatigue. Design of Equipment : Ergonomic factors to be considered in the design of displays and control, design for maintainability, design of human computer interaction.

UNIT III ENVIRONMENTAL DESIGN 12
Vision and illumination design – Climate, Noise, Motion, Sound, and Vibration.

UNIT IV BIOMECHANICS, BIO THERMODYNAMICS, BIOENERGETICS 12
Biostatic mechanics, statics of rigid bodies, upper extremity of hand, lower extremity and foot, bending, lifting and carrying, biodynamic mechanics, human body kinematics, kinetics, impact and collision, human activity analysis, ergonomic tools, RULA, REBA, NOISH lifting equation – Biothermal fundamentals, human operator heat transfer, human system bioenergetics, thermoregulatory physiology, human operator thermo regularity, passive operator, active operator, heat stress.

UNIT V COGNITIVE ERGONOMICS & HUMAN FACTOR APPLICATION 12
Information Theory Information processing, Signal detection theory, Human response, human errors, cognitive task analysis. Human factors applications: Human error, accidents, human factors and the automobile, organizational and social aspects, steps according to ISO.DIS6385, OSHA’s approach, virtual environments.

OUTCOMES:
Upon completion of the course, the students will be able to
1. Get knowledge in manual, mechanical and automated systems.
2. Understand the importance of ergonomics in the design of new products.
3. Carry out environmental friendly design.
4. Gain knowledge on the effect of biomechanics, bio thermodynamics, bioenergetics on the design and development of new products
5. Do information processing.
6. Understand the effects of other human factors.

TOTAL: 60 PERIODS
REFERENCES:

ED5161 CAD LABORATORY

OBJECTIVE:
- To impart knowledge on how to prepare drawings for various mechanical components using any commercially available 3D modelling software’s
  - CAD Introduction.
  - Sketcher
  - Solid modeling – Extrude, Revolve, Sweep, etc and Variational sweep, Loft, etc
  - Surface modeling – Extrude, Sweep, Trim ..etc and Mesh of curves, Free form etc
  - Feature manipulation – Copy, Edit, Pattern, Suppress, History operations etc.
  - Assembly - Constraints, Exploded Views, Interference check
  - CAD data Exchange formats- IGES, PDES, PARASOLID, DXF and STL

Exercises in Modeling and drafting of Mechanical Components - Assembly using Parametric and feature based Packages like PRO-E / SOLID WORKS /CATIA / NX etc

OUTCOME:
- With laboratory classes, it helps the students to get familiarized with the computer applications in design and preparing drawings for various mechanical components.

TOTAL: 60 PERIODS

ED5162 ADVANCED ANALYSIS AND SIMULATION LABORATORY

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

A. SIMULATION
1. MATLAB basics, Dealing with matrices, Graphing-Functions of one variable and two variables
2. Use of Matlab to solve simple problems in vibration
3. Mechanism Simulation using Multibody Dynamic software

B. ANALYSIS
1. Force and Stress analysis using link elements in Trusses, cables etc.
2. Stress and deflection analysis in beams with different support conditions.
3. Stress analysis of flat plates and simple shells.
5. Thermal stress and heat transfer analysis of plates.
7. Vibration analysis of spring-mass systems.
8. Model analysis of Beams.
9. Harmonic, transient and spectrum analysis of simple systems.

TOTAL: 60 PERIODS

OUTCOME:
- Upon completion of this course, the Students can model, analyse and simulate experiments to meet real world system and evaluate the performance.

PD5251 INTEGRATED PRODUCT DESIGN AND PROCESS DEVELOPMENT

L T P C
3 2 0 4

OBJECTIVE
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 INTRODUCTION
Need for IPPD-Strategic importance of Product development - integration of customer, designer, material supplier and process planner, Competitor and customer - behavior analysis. Understanding customer-promoting customer understanding-involve customer in development and managing requirements - Organization process management and improvement

UNIT II CONCEPT GENERATION, SELECTION AND TESTING

UNIT III PRODUCT ARCHITECTURE
Product development management - establishing the architecture - creation - clustering - geometric layout development - Fundamental and incidental interactions - related system level design issues - secondary systems -architecture of the chunks - creating detailed interface specifications-People Architecture.

UNIT IV INDUSTRIAL DESIGN

UNIT V DESIGN FOR MANUFACTURING AND PRODUCT DEVELOPMENT
Definition - Estimation of Manufacturing cost-reducing the component costs and assembly costs – Minimize system complexity - Prototype basics - Principles of prototyping - Planning for prototypes - Economic Analysis - Understanding and representing tasks-baseline project planning - accelerating the project-project execution.

T= 15, TOTAL: 60 PERIODS

** a Term Project/Presentation must be given for Assessment – 3 (Compulsory)
OUTCOMES:
On completion of the course the student will be able to
- understand the integration of customer requirements in product design
- Apply structural approach to concept generation, selection and testing
- Understand various aspects of design such as industrial design, design for manufacture, economic analysis and product architecture

TEXT BOOK

REFERENCES:
4. www.me.mit/2.7444

PD5201 PRODUCT AND PROCESS ENGINEERING TOOLS L T P C
3 0 0 3

OBJECTIVES
To study about the tools used for concept development, optimization, design verification, process improvement and control, benchmarking and project management.

OUTCOME:
On completion of the course the student will be able to
- understand and apply the various tools used for design development analysis and optimization.
- Learn about the various methodology for process improvement
- Use various statistical process control methods and control charts
- Appreciate the need for benchmarking and project management

UNIT I TOOLS FOR CONCEPT DEVELOPMENT

UNIT II TOOLS FOR PROCESS IMPROVEMENT
Process improvement methodologies, The Deming Cycle-FADE-Basic tools for process improvement: flow charts, run charts and control charts, check sheets, histograms, Pareto diagrams, Cause and Effect Diagrams-Scatter Diagrams-Other tools for process improvement: Kaizen Blitz, Poka-yoke (mistake proofing), process simulation-Engaging the work force in process improvement.

UNIT III STATISTICAL PROCESS CONTROL
UNIT IV BENCH MARKING AND ESTABLISHING ENGINEERING SPECIFICATIONS


UNIT V PROJECT MANAGEMENT

Understanding and representing tasks: Tasks, charts- Baseline project planning – Accelerating projects-project execution- Postmortem execution.

TORAL: 45 PERIODS

TEXT BOOK:


REFERENCES:


PD5202 MATERIALS SELECTION FOR PRODUCT DEVELOPMENT

OBJECTIVE:

To expose to the material aspect of Product design, Process modelling, Design for assembly and newer material processing techniques

UNIT-I MATERIAL BEHAVIOUR AND SELECTION


UNIT-II PROCESS MODELING


UNIT-III NON METALS AND MANUFACTURING

UNIT-IV PRODUCT DESIGN AND ASSEMBLY REQUIREMENTS 9
Structural product analysis- End use behaviour- Effect of tooling in product design-Design for joining and assembling- Design for live hinges- Snap fits, design of corners, bushes and ribs- Design considerations- New product design Methods of decoration-Bonding and cementing techniques- Thermal bonding Machining of plastics-Parameters and effect- Case studies in material selection with relevance to product design and development.

UNIT-V DEVELOPMENT IN MATERIALS PROCESSING 9
Micro fabrication technologies- Tool for micro fabrication- Diamond and high speed machining- LIGA micro fabrication process- Multilayer X-ray lithography.

OUTCOMES:
On completion of the course the student will
1. Understand the behaviour of various metals and non-metals.
2. Learn about process modelling.
3. Learn about the selection of material for different applications.
4. Gain knowledge in new product design methods and requirements for assembly.
5. Get exposure to the manufacturing processes in micro fabrication.
6. Appreciate design for assembly.

REFERENCES
3. Harfold Belofsky- Plastic design and processing hand book, Hanser publication- 2005
5. Sami Franssile- Introduction to Micro Fabrication- John Wiley and Sons- UK 2004

PD5203 QUALITY CONCEPTS IN PRODUCT DEVELOPMENT L T P C 3 0 0 3

OBJECTIVE:
- To impart knowledge on various principles of implementing quality in a product or service through tools such as quality houses, control charts, statistical process control method, failure mode effect analysis
- To develop a thorough understanding of the strategies of designing experiments, methods to uphold the status of six sigma and improve the reliability of a product.

UNIT-I DESIGN FOR QUALITY 9
Quality Function Deployment -House of Quality-Objectives and functions Targets-Stakeholders-Measures and Matrices-Design of Experiments -design process- Identification of control factors, noise factors, and performance metrics - developing the experimental plan- experimental design -testing noise factors Running the experiments -Conducting the analysis-Selecting and conforming factor-Set points-reflecting and repeating.

UNIT-II FAILURE MODE EFFECT ANALYSIS 9
Basic methods: Refining geometry and layout, general process of product embodiment- Embodiment checklist- Advanced methods: systems modeling, mechanical embodiment principles-FMEA method- linking fault states to systems modeling-Case study- computer monitor stand for a docking station.
UNIT-III DESIGN OF EXPERIMENTS

Design of experiments - Basic methods - Two factorial experiments - Extended method reduced tests and fractional experiments, orthogonality, base design method, higher dimensional fractional factorial design - Statistical analysis of experiments: Degree of freedom, correlation coefficient, standard error of the residual t-test, ANOVA-ratio test, other indicators - residual plots, Advanced DOE method for product testing - Product applications of physical modeling and DOE, Blender panel display evaluation, coffee grinder experimental optimization - Taguchi method.

UNIT-IV STATISTICAL DESIGN AND RELIABILITY


UNIT-V DESIGN FOR SIX SIGMA

Basis of SIX SIGMA - Project selection for SIX SIGMA - SIX SIGMA problem solving - SIX SIGMA in service and small organizations - SIX SIGMA and lean production - Lean SIX SIGMA and services.

TOTAL: 45 PERIODS

OUTCOMES:

The student will

1. Understand about the quality function deployment, design process.
2. Be able to apply failure mode effect analysis adopting both basic methods and advanced methods.
3. Learn about design of experiments – ANOVA and Taguchi method.
4. Apply statistical design methods and reliability procedures.
5. Gain knowledge in Six Sigma.
6. Be able to apply the quality concepts for real-time situations.

REFERENCES:


PD5211 PRODUCT DESIGN LABORATORY

OBJECTIVE:
- To impart knowledge on the use of various media such as clay, wood and RP techniques for development of prototypes
- The students in a group have to develop digital and physical prototype models using RP machine / clay models of a new product/ existing product with enhanced feature involving the following areas:
  - Automotive components
  - Tool and die components
  - Press tool components
  - Consumer product
  - Injection moulded products.
The fabricated models may be in the form of RP models, clay models, sheet metal models or cardboard models etc…

The design and development of the product will be reviewed in two stages for awarding internal marks. The end semester examination mark will be based on the demonstration of the new product developed and oral examination on the same by internal examiners.

**TOTAL :30 PERIODS**

**OUTCOME:**
Upon conclusion of this course the student will be able to

- appreciate the use of physical prototype models for evaluating product concept
- apply theoretical knowledge to design and development of physical products using clay, wood, sheet metal and RP techniques

---

**PD5212 DESIGN PROJECT**

**OBJECTIVE:**
- It is proposed to carry out detailed design calculations and analysis of any mechanical component or mechanical system. This helps the students to get familiar with respect to the design methodologies applied to any component or mechanical system subjected to static, dynamic and thermo-mechanical loads.

Each student is required to select any new component or an integrated mechanical system that involves various sub components which are to be designed as per design standards and further required to be analyzed for optimum dimensions with respect to the strength and stiffness.

**OUTCOME:**
- It helps the students to get familiarized with respect to design standards, design calculations and analysis in designing any mechanical component or system.

**TOTAL: 60 PERIODS**

---

**PD5301 MARKETING RESEARCH**

**OBJECTIVE:**
To provide the student with an overview of marketing research techniques. At the end of this course the student will gain a fundamental knowledge marketing research and its application in the front end of product development.

**RECOMMENDED:**
Students should be encouraged to have hands on experience on the use of any of the software packages like SPSS, SAS, etc.

**UNIT I INTRODUCTION TO MARKETING RESEARCH**


**UNIT II EXPLORATORY RESEARCH DESIGN**

UNIT III  MEASUREMENT AND SCALING  9
Measurement and scaling – scale characteristics and levels of measurement – comparative scales – paired comparison, rank order, constant sum- non-comparative scales- continuous rating, itemized rating-questionnaire and form design – sampling design – sampling techniques – non-probability and probability techniques-sample size determination- sampling distribution-confident interval approach

UNIT IV  FREQUENCY DISTRIBUTION  9
Data analysis – univariate techniques- multivariate techniques – frequency distribution- measures of location- measures of variability- measures of shape- hypothesis testing-cross tabulations- Chi-square distribution- hypothesis testing related to differences-parametric tests- nonparametric tests-analysis software

UNIT V  DATA ANALYSIS  9
Analysis of variance and covariance– one way analysis of variance – analysis of covariance-correlation and regression- product moment correlation- partial correlation- regression analysis-bivariate regression- basic concepts of cluster analysis-very brief introduction to multi-dimensional scaling and conjoint analysis (not for examination purposes)
TOTAL: 45 PERIODS

REFERENCES:

PD5311  PROJECT WORK PHASE I  L T P C
0 0 12 6

OBJECTIVES:
- To identify a specific problem for the current need of the society and collecting information related to the same through detailed review of literature.
- To develop the methodology to solve the identified problem.
- To train the students in preparing project reports and to face reviews and viva-voce examination.

SYLLABUS: The student individually works on a specific topic approved by the head of the division under the guidance of a faculty member who is familiar in this area of interest. The student can select any topic which is relevant to the area of engineering design. The topic may be theoretical or case studies. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work. The students will be evaluated through a viva-voce examination by a panel of examiners including one external examiner.
TOTAL: 180 PERIODS

OUTCOME:
- At the end of the course the students will have a clear idea of their area of work and they will be in a position to carry out the remaining phase II work in a systematic way.
OBJECTIVES:
- To solve the identified problem based on the formulated methodology.
- To develop skills to analyze and discuss the test results, and make conclusions.

SYLLABUS:
The student should continue the phase I work on the selected topic as per the formulated methodology under the same supervisor. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department. The students will be evaluated based on the report submitted and the viva-voce examination by a panel of examiners including one external examiner

TOTAL: 360 PERIODS

OUTCOME:
- On completion of the project work students will be in a position to take up any challenging practical problem in the field of engineering design and find better solutions to it.

OBJECTIVE:
- To highlight the importance of creativity for new product development and impart the skills needed for enhancing creative thinking and encouraging innovation.

UNIT I INTRODUCTION
Need for design creativity – creative thinking for quality – essential theory about directed creativity –

UNIT II MECHANISM OF THINKING AND VISUALIZATION
Definitions and theory of mechanisms of mind heuristics and models : attitudes, Approaches and Actions that support creative thinking - Advanced study of visual elements and principles- line, plane, shape, form, pattern, texture gradation, color symmetry. Spatial relationships and compositions in 2 and 3 dimensional space - procedure for genuine graphical computer animation – Animation aerodynamics – virtual environments in scientific Visualization – Unifying principle of data management for scientific visualization – Unifying principle of data management for scientific visualization - Visualization benchmarking

UNIT III CREATIVITY
Methods and tools for Directed Creativity – Basic Principles – Tools of Directed Creativity – Tools that prepare the mind for creative thought – stimulation of new ideas – Development and Actions: - Processes in creativity ICEDIP – Inspiration, Clarification, Distillation, Perspiration, Evaluation and Incubation – Creativity and Motivation The Bridge between man creativity and the rewards of innovativeness – Applying Directed Creativity to the challenge of quality management

UNIT IV DESIGN
Process Design, Emotional Design – Three levels of Design – Viceral, Behavioral and Reflective- Recycling and availability-Creativity and customer needs analysis – Innovative product and service designs, future directions in this application of creativity thinking in quality management
OUTCOMES:
Upon completion of the course, the students will be able to
- understand the various techniques adopted for stimulating creativity and innovation
- apply the techniques to the design and development of new products

REFERENCES
School Press Boston, USA, 2003
3. Geoffrey Petty," how to be better at Creativity", The Industrial Society 1999
1999

PD5002 ENTERPRISE RESOURCE PLANNING

OBJECTIVE:
- To impart to students the basic concepts of Enterprise Resource Planning and its role in
improving the business dynamics

UNIT I ENTERPRISE RESOURCE PLANNING
Principle – ERP framework – Business Blue Print – Business Engineering vs Business
process Re-Engineering – Tools – Languages – Value chain – Supply and Demand chain –
Extended supply chain management – Dynamic Models –Process Models

UNIT II TECHNOLOGY AND ARCHITECTURE
Client/Server architecture – Technology choices – Internet direction – Evaluation framework

UNIT III ERP SYSTEM PACKAGES
SAP, People soft, Baan and Oracle – Comparison – Integration of different ERP applications
– ERP as sales force automation – Integration of ERP and Internet – ERP Implementation
strategies – Organisational and social issues.

UNIT IV ERP ARCHITECTURE
applications -Before and after Y2k – critical issues – Training on various modules of IBCS
ERP Package-Oracle ERP and MAXIMO, including ERP on the NET

UNIT V ERP PROCUREMENT ISSUES
Market Trends – Outsourcing ERP – Economics – Hidden Cost Issues – ROI – Analysis of
cases from five Indian Companies.

TOTAL: 45 PERIODS
OUTCOMES:
Upon completion of the course, the students will be able
- To provide an integrated view of the various facets of business, including planning, manufacturing, sales, finance and marketing.
- To understand the development of software to integrate business activities such as inventory management and control, order tracking, customer service, finance and human resources.
- To become aware of the software applications and tools that are available to business to use to drive out costs and improve efficiency.

REFERENCES:

ED5071 OPTIMIZATION TECHNIQUES IN DESIGN L T P C
3 0 0 3

OBJECTIVE:
- To impart knowledge on various categories of existing engineering problems and solutions to such problems through different optimization techniques and approaches.

UNIT I UNCONSTRAINED OPTIMIZATION TECHNIQUES
Introduction to optimum design - General principles of optimization – Problem formulation & their classifications - Single variable and multivariable optimization, Techniques of unconstrained minimization – Golden section, Random, pattern and gradient search methods – Interpolation methods.

UNIT II CONSTRAINED OPTIMIZATION TECHNIQUES
Optimization with equality and inequality constraints - Direct methods – Indirect methods using penalty functions, Lagrange multipliers - Geometric programming

UNIT III ADVANCED OPTIMIZATION TECHNIQUES
Multi stage optimization – dynamic programming; stochastic programming; Multi objective optimization, Genetic algorithms and Simulated Annealing techniques; Neural network & Fuzzy logic principles in optimization.

UNIT IV STATIC APPLICATIONS

UNIT V DYNAMIC APPLICATIONS
Dynamic Applications – Optimum design of single, two degree of freedom systems, vibration absorbers. Application in Mechanisms – Optimum design of simple linkage mechanisms.

TOTAL: 45 PERIODS
OUTCOME:
- It helps the students to get familiarized with the different approaches of optimizing (maximizing or minimizing) an engineering problem or a function.

REFERENCES:

CC5292 ADDITIVE MANUFACTURING AND TOOLING

OBJECTIVE:
To educate students with fundamental and advanced knowledge in the field of Additive manufacturing technology and the associated Aerospace, Architecture, Art, Medical and industrial applications

UNIT I INTRODUCTION:

UNIT II REVERSE ENGINEERING AND CAD MODELING:

UNIT III LIQUID BASED AND SOLID BASED ADDITIVE MANUFACTURING SYSTEMS

UNIT IV POWDER BASED ADDITIVE MANUFACTURING SYSTEMS

UNIT V TOOLING
Classification, Soft tooling, Production tooling, Bridge tooling, direct and indirect tooling, Fabrication processes, Applications Case studies automotive, aerospace and electronics industries

TOTAL: 45 PERIODS
OUTCOMES:
The students will be able to
1. Understand history, concepts and terminology of additive manufacturing
2. Apply the reverse engineering concepts for design development
3. Understand the variety of additive manufacturing techniques
4. Design and develop newer tooling models
5. Analyse the cases relevant to mass customization and some of the important research challenges associated with AM and its data processing tools

REFERENCES:

ED5073 INFORMATION ANALYTICS L T P C 3 0 0 3

OBJECTIVE:
- To expose the students with fundamental concepts and the tools needed to understand emerging role of information analytics in the organisation.

UNIT – I DATA ANALYTICS LIFE CYCLE
Introduction to Big data Business Analytics - State of the practice in analytics role of data scientists - Key roles for successful analytic project - Main phases of life cycle - Developing core deliverables for stakeholders.

UNIT – II STATISTICS
Sampling Techniques - Data classification, Tabulation, Frequency and Graphic representation - Measures of central value - Arithmetic mean, Geometric mean, Harmonic mean, Mode, Median, Quartiles, Deciles, Percentile - Measures of variation – Range, IQR, Quartile deviation, Mean deviation, standard deviation, coefficient variance, skewness, Moments & Kurtosis.

UNIT – III PROBABILITY AND HYPOTHESIS TESTING

UNIT – IV PREDICTIVE ANALYTICS
Predictive modeling and Analysis - Regression Analysisis, Multicollinearity , Correlation analysis, Rank correlation coefficient, Multiple correlation, Least square, Curve fitting and goodness of fit.
UNIT – V  TIME SERIES FORECASTING AND DESIGN OF EXPERIMENTS
Forecasting Models for Time series: MA, SES, TS with trend, season - Design of Experiments, one way classification, two way classification, ANOVA, Latin square, Factorial Design.

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to
1. Understand the importance of data analysis in the design of new products.
2. Carry out statistical analysis.
3. Do probability analysis and hypothesis testing.
4. Perform predictive analysis.
5. Learn the effect of forecasting methods and to apply for business process.
6. Build a reliable, scalable, distributed information system.

REFERENCES:

PD5003 DESIGN THINKING

OBJECTIVE:
• To highlight the importance of thinking and creativity for new product development and impart the skills needed for enhancing creative thinking and encouraging innovation.

UNIT I INTRODUCTION
Need for design creativity – creative thinking for quality – essential theory about directed creativity

UNIT II MECHANISM OF THINKING AND VISUALIZATION
Definitions and theory of mechanisms of mind heuristics and models: attitudes, Approaches and Actions that support creative thinking - Advanced study of visual elements and principles- line, plane, shape, form, pattern, texture gradation, color symmetry. Spatial relationships and compositions in 2 and 3 dimensional space - procedure for genuine graphical computer animation – Animation aerodynamics – virtual environments in scientific Visualization – Unifying principle of data management for scientific visualization – Unifying principle of data management for scientific visualization - Visualization benchmarking

UNIT III CREATIVITY
Methods and tools for Directed Creativity – Basic Principles – Tools of Directed Creativity – Tools that prepare the mind for creative thought – stimulation of new ideas – Development and Actions, Processes in creativity ICEDIP – Inspiration, Clarification, Distillation, Perspiration, Evaluation and Incubation – Creativity and Motivation The Bridge between man creativity and the rewards of innovativeness – Applying Directed Creativity to the challenge of quality management
UNIT IV  DESIGN  9
Process Design, Emotional Design – Three levels of Design – Viceral, Behavioral and Reflective-Recycling and availability-Creativity and customer needs analysis – Innovative product and service designs, future directions in this application of creativity thinking in quality management

UNIT V  INNOVATION  10

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to
1. Understand the various techniques adopted for stimulating creativity.
2. Improve their visualization.
3. Motivate and Implement their creativity.
4. Apply the techniques to the design and development of new products.
5. Present innovative products as required by the customers.
6. Improve their creativity and innovation.

REFERENCES
3. Geoffrey Petty,” how to be better at Creativity”, The Industrial Society 1999
5. Semyon D. Savransky,” Engineering of Creativity – TRIZ”, CRC Press New York ,USA,

CM5072  MICRO ELECTRO MECHANICAL SYSTEMS  L T P C
3 0 0 3

OBJECTIVE:
- To impart knowledge of design, fabrication and characterization of Micro Electro Mechanical systems.

UNIT I  INTRODUCTION  9

UNIT II  MECHANICS, SCALING AND DESIGN  9
UNIT III MICRO SYSTEM FABRICATION PROCESSES

Introduction - Photolithography - Ion implantation - Chemical Vapor Deposition - Physical Vapor Deposition - clean room - Bulk micromachining - etching, isotropic and anisotropic etching, wet and dry etching - Surface micro machining - process, mechanical problems associated with surface micro machining - LIGA process - general description, materials for substrates and photo resists - SLIGA process - Abrasive jet micro machining - Laser beam micro machining - Micro Electrical Discharge Micro Machining - Ultrasonic Micro Machining - Electro chemical spark micro machining - Electron beam micro machining - Focused Ion Beam machining

UNIT IV MICROSYSTEMS PACKAGING

Introduction - Microsystems Packaging - Interfaces in Microsystems Packaging - Essential Packaging Technologies - Die preparation, surface bonding, wire bonding, sealing - Three dimensional Packaging - Assembly of Microsystems, Signal Mapping and Transduction

UNIT V MICROMETROLOGY AND CHARACTERIZATION


OUTCOME:
At the end of this course the student will be able to apply the knowledge in mechanics, scaling, design, fabrication and characterization of micro systems.

REFERENCES

CD5091 INDUSTRIAL ROBOTICS AND EXPERT SYSTEMS

OBJECTIVES:
- To teach students the basics of robotics, construction features, sensor applications, robot cell design, robot programming and application of artificial intelligence and expert systems in robotics.

UNIT I INTRODUCTION AND ROBOT KINEMATICS

UNIT II ROBOT DRIVES AND CONTROL
UNIT III ROBOT SENSORS

UNIT IV ROBOT CELL DESIGN AND APPLICATION

UNIT V ROBOT PROGRAMMING, ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS

TOTAL: 45 PERIODS

OUTCOME:
- The student will be able to design robots and robotic work cells and write program for controlling the robots.
- The student will be able to apply artificial intelligence and expert systems in robotics.

REFERENCES

CC5291 DESIGN FOR MANUFACTURE, ASSEMBLY AND ENVIRONMENTS L T P C 3 0 0 3

OBJECTIVE:
- To know the concept of design for manufacturing, assembly and environment.
- To know the computer application in design for manufacturing and assembly.

UNIT I INTRODUCTION
General design principles for manufacturability - strength and mechanical factors, mechanisms selection, evaluation method, Process capability - Feature tolerances Geometric tolerances - Assembly limits -Datum features - Tolerance stacks.

UNIT II FACTORS INFLUENCING FORM DESIGN
Working principle, Material, Manufacture, Design- Possible solutions - Materials choice – Influence of materials on form design - form design of welded members, forgings and castings.
UNIT III  COMPONENT DESIGN - MACHINING CONSIDERATION   8
Design features to facilitate machining - drills - milling cutters - keyways - Dowel
Drilling procedures, counter sunk screws - Reduction of machined area- simplification by separation
- simplification by amalgamation - Design for machinability - Design for economy - Design for clampability - Design for accessibility - Design for assembly - Product design for manual
assembly - Product design for automatic assembly – Robotic assembly.

UNIT IV  COMPONENT DESIGN – CASTING CONSIDERATION   10
Redesign of castings based on Parting line considerations - Minimizing core requirements, 
machined holes, redesign of cast members to obviate cores. Identification of uneconomical
design - Modifying the design - group technology - Computer Applications for DFMA

UNIT V  DESIGN FOR THE ENVIRONMENT   9
Introduction – Environmental objectives – Global issues – Regional and local issues – Basic
DFE methods – Design guide lines – Example application – Lifecycle assessment – Basic
method –AT&T's environmentally responsible product assessment - Weighted sum
assessment method – Lifecycle assessment method – Techniques to reduce environmental
impact – Design to minimize material usage – Design for disassembly – Design for
recyclability – Design for manufacture – Design for energy efficiency – Design to regulations
and standards.

OUTCOME:
- To make the students get acquainted with the design for manufacturing, assembly
and environment.

REFERENCES:
Marcel Dekker.
and Structural Approach, Field Stone Publisher, USA, 1995.
Reason Pub., 1996.
2009.

ED5093  COMPUTATIONAL FLUID DYNAMICS   L T P C
3 0 0 3

OBJECTIVES
- This course aims to introduce numerical modeling and its role in the field of heat, fluid
flow and combustion it will enable the students to understand the various
discretisation methods and solving methodologies and to create confidence to solve
complex problems in the field of heat transfer and fluid dynamics.
- To develop finite volume discretized forms of the CFD equations.
- To formulate explicit & implicit algorithms for solving the Euler Equations & Navier
Strokes Equations.
UNIT I  GOVERNING DIFFERENTIAL EQUATIONS AND DISCRETISATION TECHNIQUES  8

UNIT II  DIFFUSION PROCESSES : FINITE VOLUME METHOD  10

UNIT III  CONVECTION-DIFFUSION PROCESSES: FINITE VOLUME METHOD  9
One dimensional convection – diffusion problem, Central difference scheme, upwind scheme – Hybrid and power law discretization techniques – QUICK scheme.

UNIT IV  FLOW PROCESSES : FINITE VOLUME METHOD  8
Discretisation of incompressible flow equations – Pressure based algorithms, SIMPLE, SIMPLER & PISO algorithms

UNIT V  MODELING OF COMBUSTION AND TURBULENCE  10
Mechanisms of combustion and Chemical Kinetics, Overall reactions and intermediate reactions, Reaction rate, Governing equations for combusting flows. Simple Chemical Reacting System (SCRS), Turbulence - Algebraic Models, One equation model & k – ε, k – ω models - Standard and High and Low Reynolds number models.

TOTAL: 45 PERIODS

OUTCOME:
• On successful completion of this course the student will be able to apply the concepts of CFD to analyse the fluid flow and heat transfer in thermal systems.

REFERENCES:

PD5004  REVERSE ENGINEERING  L T P C  3 0 0 3
OBJECTIVE:
To impart knowledge to the students about the need for and the various tools required for reverse engineering with exposure to the software needed for implementing reverse engineering.

UNIT I  INTRODUCTION  5
Scope and tasks of RE - Domain analysis- process of duplicating
UNIT II TOOLS FOR RE
Functionality - dimensional - developing technical data - digitizing techniques - construction of surface model - solid-part material - characteristics evaluation - software and application - prototyping - verification

UNIT III CONCEPTS
History of Reverse Engineering – Preserving and preparation for the four stage process – Evaluation and Verification - Technical Data Generation, Data Verification, Project Implementation

UNIT IV DATA MANAGEMENT

UNIT V INTEGRATION
Cognitive approach to program understated – Integrating formal and structured methods in reverse engineering – Integrating reverse engineering, reuse and specification tool environments to reverse engineering --coordinate measurement – feature capturing – surface and solid members

OUTCOME:
Upon completion of the course, the students will be able to
- Understand the basic principles of reverse engineering
- Select the suitable tools and methodology for reverse engineering any product

REFERENCES

PD5091 PRODUCT LIFECYCLE MANAGEMENT

OBJECTIVES:
To understand history, concepts and terminology of PLM
To understand functions and features of PLM/PDM
To understand different modules offered in commercial PLM/PDM tools
To understand PLM/PDM implementation approaches
To understand integration of PLM/PDM with other applications

UNIT I HISTORY, CONCEPTS AND TERMINOLOGY OF PLM
Introduction to PLM, Need for PLM, opportunities of PLM, Different views of PLM - Engineering Data Management (EDM), Product Data Management (PDM), Collaborative Product Definition Management (CPDM), Collaborative Product Commerce (CPC), Product Lifecycle Management (PLM), PLM/PDM Infrastructure – Network and Communications, Data Management, Heterogeneous data sources and applications.
UNIT II PLM/PDM FUNCTIONS AND FEATURES

UNIT III DETAILS OF MODULES IN A PDM/PLM SOFTWARE
Case studies based on top few commercial PLM/PDM tools.

UNIT IV ROLE OF PLM IN INDUSTRIES
Case studies on PLM selection and implementation (like auto, aero, electronic) - other possible sectors, PLM visioning, PLM strategy, PLM feasibility study, change management for PLM, financial justification of PLM, barriers to PLM implementation, ten step approach to PLM, benefits of PLM for–business, organisation, users, product or service, process performance.

UNIT V BASICS ON CUSTOMISATION/INTEGRATION OF PDM/PLM SOFTWARE
PLM Customization, use of EAI technology (Middleware), Integration with legacy data base, CAD, SLM and ERP.

OUTCOMES:
The students will be able to
1. Understand history, concepts and terminology of PLM.
2. Apply the functions and features of PLM/PDM.
3. Understand different modules offered in commercial PLM/PDM tools.
4. Understand PLM/PDM implementation approaches.
5. Integrate PLM/PDM with other applications.
6. Analyse the case studies.

REFERENCES

ED5075 DESIGN FOR INTERNET OF THINGS
OBJECTIVE:
- To impart knowledge on state of art IoT architecture, data and knowledge management and use of devices in IoT technology

UNIT I INTRODUCTION
Machine to Machine (M2M) to IoT-The Vision-Introduction, From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing Characteristics.
UNIT-II IoT STRUCTURE

UNIT-III IoT NETWORKING
M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service (XaaS), M2M and IoT Analytics, Knowledge Management.

UNIT-IV IoT ARCHITECTURE

UNIT-V ARCHITECTURE MODELING

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course the student will be able to:
1. Understand the vision of IoT from a global context.
2. Determine the Market perspective of IoT.
3. Use of Devices, Gateways and Data Management in IoT.
4. Build state of the art architecture in IoT.
5. Understand the design constraints in the real world.
6. Apply of IoT in Industrial and Commercial Building Automation and Real World Design Constraints.

REFERENCES:
OBJECTIVE:
- To impart the knowledge about the Intellectual property rights and patent registering

UNIT I  INTELLECTUAL PROPERTY (IP) FUNDAMENTALS  9
Introduction – Legal concept of Property – Kinds of properties - Movable Property - Immovable Property. IP and Classification of IP– Patents, Industrial Designs, Copy Right, Trade Mark - Importance of IP and Terms of protection

UNIT II  PATENTS  12

UNIT III  INDUSTRIAL DESIGNS  9

UNIT IV  COPY RIGHT AND TRADEMARKS  9
Copyright subsists – Meaning of word ‘Original’ – Fair dealing - Rights of Owners of Copy Rights – Procedures - Authorities and Institutions under the Copy Right Act – Infringement and remedies.
Trademarks (TM) – Different types of Trade marks – Service Mark – Classification Mark – Collective Mark - Importance of TM – Difference between registered TM and TM in use – Basic requirements for the registration of TM – Procedure for registration – Rights of registered TM owners – Infringement and remedies

UNIT V  INTELLECTUAL PROPERTY MANAGEMENT  6
Introduction to Intellectual Property Management (IPM) – Need for IP management - Interrelationships between legal advocacy and IPM – Role of Legal Practioners – Role of Managers – IP Commercialisation – IP Audit and its Importance

TOTAL: 45 PERIODS

OUTCOME:
Upon completion of the course, the students will
- Understand the procedures involved in obtaining Patent Rights
- Understand the rules and regulations involved in Copyrights and Trade Marks and infringement of the same
- Be exposed to the legal issues involved in New Product development

REFERENCES
OBJECTIVE:
- To impart knowledge on various aspects of Maintenance and condition monitoring of equipments and safety engineering.

OUTCOME:
Upon completion of the course, the students will
- Be exposed to maintenance systems and reliability based design
- Gain knowledge about the various techniques of condition monitoring of systems
- Learn about reliability based maintenance, safety engineering and Asset planning

UNIT I  INTRODUCTION TO MAINTENANCE SYSTEMS  8
Introduction to repair and Maintenance - Maintenance as business - Maintenance systems such as reactive, preventive, predictive or proactive systems - Human resources management in Maintenance management - maintainability - Inherent and overall availability. - Mean time between failures, mean time to repairs and mean down time - Testability and supportability - “Design for Maintenance” - Poor maintainability aspects - Design for reliability.

UNIT II  CONDITION BASED MAINTENANCE  7
Condition based monitoring of equipment and systems - condition monitoring techniques such as a) Vibration analysis, b) Ultrasonic detection techniques, c) Thermography, d) Oil and lubricant analysis, e) Motor condition monitoring (MCM) - Shaft alignments through laser - Vibration instruments - Outline on Thermography

UNIT III  MAINTENANCE TECHNIQUES SUCH AS RELIABILITY CENTRED MAINTENANCE (RCM), TOTAL PRODUCTIVE MAINTENANCE (TPM) & CMMS  10
Reliability centered Maintenance-Failure Mode and Effect Analysis-Root cause Analysis-logic tree analysis-Criticality matrix - Total Productive Maintenance, Overall Equipment Effectiveness-Lean manufacturing- TPM and TPO- Relationship between OEE and world-class Maintenance- Ladder of Maintenance improvement- Computerized Maintenance management system in a business scenario- data acquisition for effective management of CMMS.

UNIT IV  ASSET PLANNING AND SCHEDULING OF ACTIVITIES IN MAINTENANCE  10
Asset and spare part management. - Conventional spare Parts management techniques such as Economic Order Quantity, two bin systems - Latest trends in monitoring through bar codes, mobile computer and wireless data transmissions -. Different aspects of planning and scheduling of Maintenance, such as shutdowns- Critical aspects of both routine and shut down Maintenance -. bar charts - PERT network during shut down -Man power Training and utilization of skilled manpower - Sequencing of activities.

UNIT V  SAFETY AND OTHER ASPECTS OF MAINTENANCE FUNCTIONS  10

REFERENCES:
OBJECTIVE:
At the end of this course the students would have developed a thorough understanding of the group technology, manufacturing process planning and control, modern manufacturing systems.

UNIT I INTRODUCTION
Objectives of a manufacturing system-identifying business opportunities and problems classification production systems-linking manufacturing strategy and systems analysis of manufacturing operations.

UNIT II GROUP TECHNOLOGY AND COMPUTER AIDED PROCESS

UNIT III COMPUTER AIDED PLANNING AND CONTROL
Production planning and control-cost planning and control-inventory management-Material requirements planning (MRP)-shop floor control-Factory data collection system-Automatic identification system-barcode technology- automated data collection system.

UNIT IV COMPUTER MONITORING
Types of production monitoring systems-structure model of manufacturing process-process control & strategies- direct digital control-supervisory computer control-computer in QC - contact inspection methods non-contact inspection method - computer-aided testing - integration of CAQC with CAD/CAM.

UNIT V INTEGRATED MANUFACTURING SYSTEM
Definition - application - features - types of manufacturing systems-machine tools-materials handling system- computer control system - DNC systems manufacturing cell. Flexible manufacturing systems (FMS) - the FMS concept-transfer systems - head changing FMS - variable mission manufacturing system - CAD/CAM system - human labor in the manufacturing system-computer integrated manufacturing system benefits. Rapid prototyping - Artificial Intelligence and Expert system in CIM.

TOTAL: 45 PERIODS

OUTCOME:
It helps the students to get familiarized with the computer aided process planning, group technology, process planning and control and computer integrated manufacturing systems.

REFERENCES:
OBJECTIVE:

- To understand the basic concepts of sustainability.
- To gain knowledge about the tools and techniques for sustainable design.
- To improve the design by assessing the customer needs.

UNIT-I BASIC CONCEPTS IN SUSTAINABILITY
Understanding the language of sustainable engineering design, construction and operation. Natural resources terminology. Carrying capacity. Sustainable development, corporate responsibility, biophysical constraints, environmental management.

UNIT-II TOOLS AND TECHNIQUES

UNIT-III FOUNDATIONAL CONCEPTS & PRINCIPLES FOR SUSTAINABLE BREAKTHROUGH DESIGN
Infrastructure for managing flows of materials, energy and activities; sustainable value creation approaches for all stakeholders, environmental design characteristics; design changes & continual improvement; inclusive sustainable design principles, crowd sourcing, multiple-objective designs; infrastructures that support system thinking; knowledge management for sustainable design, learning systems and experimentation; smart data systems, understanding variation.

UNIT-IV SUSTAINABLE DESIGN
Industrial ecology, multiple life cycle design, principles of design, green engineering, cradle to cradle design, The Natural Step, biomimicry, design for reuse, dematerialization, modularization, design for flexibility, design for disassembly, design for inverse manufacturing, design for the environment, etc.

UNIT-V CUSTOMER AND USER NEEDS ASSESSMENT
Identification & breakdown structures that describe customers & stakeholders, green marketing, socially conscious consumerism, sources of customer information, collecting information, analyzing customer behavior, translating the voice of the customer, use analysis, structuring customer needs, service gap analysis, prioritizing customer needs, strategic design, Kano technique.

TOTAL: 45 PERIODS

OUTCOMES
The student will
1. Understand the concept of sustainability in terms of design, construction and development.
2. Gain knowledge in engineering design tools and life cycle assessment.
3. Be able to apply sustainable value creation approaches, design changes & continual improvement.
4. Carry out sustainable design, green engineering, flexible design etc.
5. Able to design according to the customer needs.
6. Design the products that are environmental friendly.
OBJECTIVES

- To gain knowledge about different types of product testing.
- To understand the type of testing required to be covered during product testing.
- To understand how testing need to be performed, understand importance of it and apply in future.
- To learn about product qualification and non-conformance investigation.

UNIT-I TESTS IN INTERACTIVE MODEL

Unit test process, Component test process, Integration test process, System integration test process, Acceptance test process, Test automation, Defect fixing and verification, waterfall methodology, Agile methodology.

UNIT-II TESTING PROCESS OVERVIEW

Testing process flow, Types, Unit testing, Environmental testing, Regression testing, Automated testing, Test claims to global platform, product testing agreement.

UNIT-III STATISTICAL CONSIDERATIONS AND RELIABILITY


UNIT-IV NON DESTRUCTIVE TESTING

Visual inspection and eddy current testing, Liquid penetrant testing, Magnetic particle testing, radio graphic testing, ultrasonic testing.

UNIT-V PRODUCT QUALIFICATION PROCESS OVERVIEW

Product qualification process flow, Test report generation, qualification and listing agreement form, analysis of non-conformances and rejection, Product qualification renewal.

OUTCOMES:

The student will

1. Gain knowledge in product testing – globalization and localization testing.
2. Learn about the different types of product testing.
3. Acquire knowledge in automated testing, analysis of results and test metrics.
4. Be able to apply the product qualification process, do test reports and renewal of product qualification.
5. Be able to do non-conformance investigation to products and tools.
6. Understand the methods to improve the product quality.
REFERENCES:

PD5009 FINANCIAL ENGINEERING L T P C
3 0 0 3

OBJECTIVE:
- To impart knowledge on use of financial ratios to analyze a company situation To identify companies' main sources of funds -ascertain the link between investors and managers -consider lenders' requirements and expectations.

UNIT-I OPTIMIZATION MODELS AND METHODS
Modeling financial decisions as constrained optimization problems, selecting appropriate optimization methods to solve these problems- linear programming, quadratic and general nonlinear programming, dynamic and stochastic programming; discrete optimization techniques.

UNIT-II STOCHASTIC MODELS
Introduction to stochastic processes/modeling - discrete-time Markov chains; Gambler's ruin problem, Binomial Lattice Model for stock and derivative pricing; exponential distribution and the Poisson process; other Point processes; Renewal processes, Renewal reward theorem; continuous-time Markov chains; introduction to martingales and applications of the optional stopping theorem; introduction to Brownian motion; geometric Brownian motion; black-Scholes option pricing formula.

UNIT-III CONTINUOUS TIME MODELS
Introduction to stochastic calculus and stochastic differential equations; the Black-Scholes model and framework; the volatility surface; foreign exchange models and pricing quanto options; and advanced models including local volatility, stochastic volatility and jump-diffusion models.

UNIT-IV STATISTICAL ANALYSIS AND TIME SERIES
Black-Litterman asset pricing model; empirical analysis of asset prices: heavy tails, test of the predictability of stock returns; financial time series: ARMA, stochastic volatility, and GARCH models. Stationary tests; inference for continuous-time models, Bayesian MCMC; time series regression and empirical test of CAPM.

UNIT-V PROFESSIONAL DEVELOPMENT
Recognize the skills necessary to compete effectively, increase student professional intelligence, develop own professional self and identify developmental needs, information on employment trends, resources and networking opportunities, refine resume writing, interviewing, and job search skills.

TOTAL: 45 PERIODS
OUTCOMES:
On the completion, the students possess knowledge of the following:
1. Basic principles, theories and applications in the field of financial engineering.
2. A range of quantitative financial disciplines, including risk management, fixed income analysis, investments and stochastic modelling in financial engineering.
3. Design mathematical models of the financial functions of organisations and solve the formulated problems by a range of quantitative techniques, including simulation and optimisation techniques.
4. Carry out risk assessment by disciplines of risk management and decision analysis.
5. Understand and carry out statistical analysis.
6. Adapt quickly to new problems and challenges arising in the context of financial engineering.

REFERENCES