Vision

The Department of Rubber and Plastics Technology shall constantly strive to be renowned for its academic and research excellence with professionalism and social responsibilities.

Mission

The Mission of the Department of Rubber and Plastics Technology is to:

1. Equip its graduates to meet the expectations of Rubber, Plastics and allied industries and professional organizations.

2. Expand its knowledge base in collaboration with Rubber, Plastics and allied industries and research organizations.

3. Emphasize on product design aspects so as to enable graduates to be innovators in the field of Rubber, Plastics and allied areas of Technology.

4. Motivate students to become entrepreneurs.

5. Carry out inter-disciplinary research and development activities integrating Rubber and Plastics Technology with other Engineering disciplines.
1. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

**PEO 1:** Graduates of the programme, with the acquired knowledge and skills in Rubber, Plastics and allied domains, will provide quality services to Rubber and Plastics industries and professional organizations.

**PEO 2:** Graduates of the programme will be in the forefront of innovation, updating new knowledge through continuous learning, research and developmental activities.

**PEO 3:** Graduates of the programme, by keeping pace with changing technological developments, will provide leadership to industry and research organizations.

2. PROGRAMME OUTCOMES (POs)

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

### 3. PROGRAM SPECIFIC OUTCOMES (PSOs)

| PSO 1 | With the understanding of fundamental principles of polymers and working mechanisms, graduates will be able to design and develop rubber, plastics and composites products |
| PSO 2 | Graduates will be able to employ modern characterization techniques, design and analysis software for predicting the behavior of polymer systems in engineering and technology |
| PSO 3 | Graduates will be able to choose materials, design processes and products for environmental sustainability |
| PSO 4 | With sound industry experience, graduates will strive to be entrepreneurs |

### 4. MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVE WITH PROGRAMME OUTCOMES

<table>
<thead>
<tr>
<th>PROGRAMME EDUCATIONAL OBJECTIVES</th>
<th>PROGRAMME OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>


## 5. Mapping of Course Outcome, Programme Outcome and Programme Specific Outcome

<table>
<thead>
<tr>
<th>YEAR</th>
<th>SEM</th>
<th>Course Title</th>
<th>Programme Outcomes</th>
<th>Programme Specific Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>1 2 3 4 5 6 7 8 9 1 0 1 1 1 2 1 2 3 4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SEMESTER I</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Technical English</td>
<td>3 3 3 3 3 3 3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Engineering Mathematics I</td>
<td>3 3 3 2 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Engineering Physics</td>
<td>3 3 3 2 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Engineering Chemistry</td>
<td>3 3 3 2 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Engineering Graphics</td>
<td>3 3 3 3 3 3 1 2 3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Basic Sciences Lab</td>
<td>3 3 3 3 3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Workshop Practices Lab</td>
<td>3 3 3 3 3 2 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SEMESTER II</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Professional Communication</td>
<td>1 1 3 3 3 3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Engineering Mathematics II</td>
<td>3 3 3 3 3 1 3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Basics of Electrical and Electronics Engineering</td>
<td>3 2 2 1 1 1 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Problem Solving and Python Programming</td>
<td>3 3 3 3 3 3 3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Engineering Mechanics</td>
<td>3 3 3 2 3 1 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Materials Science</td>
<td>2 1 1 1 2 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Problem Solving and Python Programming Laboratory</td>
<td>3 3 3 3 3 3 3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Electrical and Electronics Engineering Lab</td>
<td>2 1 2 6 6 6 2 2 1</td>
<td></td>
</tr>
<tr>
<td>SEMESTER III</td>
<td>Probability and Statistics</td>
<td>Elective - Humanities I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------</td>
<td>---------------------------</td>
<td>------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mechanics of solid</td>
<td>3 3 3 3 2 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Introduction To Polymer Science</td>
<td>3 3 3 3 3 3 2 3 3 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thermodynamics and Thermal Engineering</td>
<td>3 3 3 3 3 1 1 2 2 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fluid Mechanics and Fluid Machines</td>
<td>2 2 1 2 1.6 1.2 1.4 1.4 1.2 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polymer Science Lab</td>
<td>3 3 3 3 1 3 3 2 3 3 3 3 3 2 2 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mechanical Sciences Laboratory</td>
<td>3 2 2 2 1 2 2 1 3 2 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SEMESTER IV</td>
<td>Principles of Management</td>
<td>Environmental Sciences</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Audit Course - I</td>
<td>2 2 2 2 2 2 2 2 3 3 2 2 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical Properties Of Polymers</td>
<td>3 3 3 3 2 2 2 1 2 2 3 2 2 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Introduction To Chemical Engineering</td>
<td>3 2 3 2 3 3 2 3 2 3 2 1 3 3 1 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rubber Materials</td>
<td>3 1 1 1 1</td>
<td>1 3 2 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plastics Materials</td>
<td>3 3 3 3 3 3</td>
<td>2 3 3 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cad Practice Lab</td>
<td>3 3 3 3 3 1</td>
<td>1 1 1 1 1 3 1 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rubber Materials Laboratory</td>
<td>3 3 2 3 2 1 2</td>
<td>2 3 1 2 3 2 2 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SEMESTER V</td>
<td>Electives - Humanities I</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------</td>
<td>-------------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rubber Compounding</td>
<td>3 3 3 2 2 2 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rubber Processing</td>
<td>3 3 3 2 2 2 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>And Product Manufacture</td>
<td>3 3 3 3 3 3 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polymer Composite Materials</td>
<td>3 3 3 3 3 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plastics Processing And Machinery</td>
<td>3 3 2 2 2 2 2 2 2 2 3 2 3 3 2 2 3 2 2 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Professional Elective - I</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Professional Elective - II</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rubber Processing Lab</td>
<td>1 3 3 2 2 2 1 1 1 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rubber And Plastics Laboratory</td>
<td>3 2 3 3 3 2 1 2 2 2 2 3 2 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SEMESTER VI</td>
<td>Plastics Product Design</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plastics Product Design</td>
<td>3 3 3 3 2 3 3 1 3 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rubber Product Design</td>
<td>3 3 3 3 2 3 3 1 3 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Composites Technology</td>
<td>3 3 3 3 3 3 2 3 3 3 2 3 3 3 2 3 3 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Professional Elective - III</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Professional Elective - IV</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open Elective - I</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product And Mould Design Laboratory</td>
<td>3 3 2 3 3 3 3 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plastics Processing lab</td>
<td>3 3 3 3 2 2 2 2 2 2 3 3 3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
- The table represents the course structure for two semesters.
- Each row indicates a course with its respective credits and contact hours.
- The columns are for different semesters (V and VI).
- The contact hours are listed as follows: 3 = 3 lecture hours, 2 = 2 practical hours, 1 = 1 seminar hour.
<table>
<thead>
<tr>
<th>SEMESTER VII</th>
<th>Technology Of Tyres And Tubes</th>
<th>3</th>
<th>3</th>
<th>3</th>
<th>3</th>
<th>2</th>
<th>2</th>
<th>3</th>
<th>3</th>
<th>3</th>
<th>3</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Audit Course - II</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>
</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>
</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>
</tr>
<tr>
<td></td>
<td>Comprehension</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Project I</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>SEMESTER VIII</td>
<td>Project II</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Internship/Training</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.
# ANNA UNIVERSITY, CHENNAI
# UNIVERSITY DEPARTMENTS
# B.TECH. RUBBER AND PLASTICS TECHNOLOGY
# REGULATIONS – 2019
# CHOICE BASED CREDIT SYSTEM
# CURRICULUM AND SYLLABI FOR I TO VIII SEMESTERS

## SEMESTER I

### Theory

<table>
<thead>
<tr>
<th>SI. NO.</th>
<th>CODE NO.</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>PERIODS PER WEEK</th>
<th>TOTAL CONTACT HRS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>HS5151</td>
<td>Technical English</td>
<td>HSMC</td>
<td>4 0 0</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>MA5158</td>
<td>Engineering Mathematics I</td>
<td>BSC</td>
<td>3 1 0</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>PH5151</td>
<td>Engineering Physics</td>
<td>BSC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>CY5151</td>
<td>Engineering Chemistry</td>
<td>BSC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>GE5151</td>
<td>Engineering Graphics</td>
<td>ESC</td>
<td>1 0 4</td>
<td>5</td>
<td>3</td>
</tr>
</tbody>
</table>

### Practicals

<table>
<thead>
<tr>
<th>SI. NO.</th>
<th>CODE NO.</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>PERIODS PER WEEK</th>
<th>TOTAL CONTACT HRS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>BS5161</td>
<td>Basic Sciences Lab</td>
<td>BSC</td>
<td>0 0 4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>GE5162</td>
<td>Workshop Practices Lab</td>
<td>ESC</td>
<td>0 0 4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>14</strong></td>
<td><strong>12</strong></td>
<td><strong>27</strong></td>
</tr>
</tbody>
</table>

### SEMESTER II

### Theory

<table>
<thead>
<tr>
<th>SI. NO.</th>
<th>CODE NO.</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>PERIODS PER WEEK</th>
<th>TOTAL CONTACT HRS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>HS5251</td>
<td>Professional Communication</td>
<td>HSMC</td>
<td>4 0 0</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>MA5252</td>
<td>Engineering Mathematics II</td>
<td>BSC</td>
<td>3 1 0</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>GE5153</td>
<td>Problem Solving and Python Programming</td>
<td>ESC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>EE5251</td>
<td>Basics of Electrical and Electronics Engineering</td>
<td>ESC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>GE5152</td>
<td>Engineering Mechanics</td>
<td>ESC</td>
<td>3 1 0</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>PH5251</td>
<td>Materials Science</td>
<td>BSC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

### Practicals

<table>
<thead>
<tr>
<th>SI. NO.</th>
<th>CODE NO.</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>PERIODS PER WEEK</th>
<th>TOTAL CONTACT HRS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>GE5161</td>
<td>Problem Solving and Python Programming Laboratory</td>
<td>ESC</td>
<td>0 0 4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>EE5261</td>
<td>Electrical &amp; Electronics Engineering Lab</td>
<td>ESC</td>
<td>0 0 4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>19</strong></td>
<td><strong>8</strong></td>
<td><strong>29</strong></td>
</tr>
</tbody>
</table>

---
### SEMESTER III

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>CODE NO.</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>PERIODS PER WEEK</th>
<th>TOTAL CONTACT HRS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L</td>
<td>T</td>
<td>P</td>
</tr>
<tr>
<td><strong>THEORY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>MA5354</td>
<td>Probability and statistics</td>
<td>BSC</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td>Elective - Humanities I</td>
<td>HSMC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3.</td>
<td>AU5352</td>
<td>Mechanics of solids</td>
<td>ESC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4.</td>
<td>RP5301</td>
<td>Introduction to Polymer Science</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5.</td>
<td>AU5351</td>
<td>Thermodynamics and Thermal engineering</td>
<td>ESC</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>6.</td>
<td>AE5351</td>
<td>Fluid Mechanics and Fluid Machines</td>
<td>ESC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>PRACTICALS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>RP5311</td>
<td>Polymer Science lab</td>
<td>PCC</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>8.</td>
<td>AU5361</td>
<td>Mechanical Sciences Laboratory</td>
<td>ESC</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td>18</td>
<td>2</td>
<td>8</td>
</tr>
</tbody>
</table>

### SEMESTER IV

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>CODE NO.</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>PERIODS PER WEEK</th>
<th>TOTAL CONTACT HRS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L</td>
<td>T</td>
<td>P</td>
</tr>
<tr>
<td><strong>THEORY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>MG5451</td>
<td>Principles of Management</td>
<td>HSMC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2.</td>
<td>GE5251</td>
<td>Environmental Sciences</td>
<td>BSC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td>Audit Course - I*</td>
<td>AC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4.</td>
<td>RP5401</td>
<td>Physical Properties of Polymers</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5.</td>
<td>RP5402</td>
<td>Introduction to Chemical Engineering</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6.</td>
<td>RP5403</td>
<td>Rubber Materials</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7.</td>
<td>RP5404</td>
<td>Plastics Materials</td>
<td>PCC</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>PRACTICALS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>RP5411</td>
<td>CAD Practice Lab</td>
<td>PCC</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>9.</td>
<td>RP5412</td>
<td>Rubber Materials Lab</td>
<td>PCC</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td>23</td>
<td>0</td>
<td>7</td>
</tr>
</tbody>
</table>

* Audit Courses optional.
### SEMESTER V

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Code No.</th>
<th>Course Title</th>
<th>Category</th>
<th>Periods Per Week</th>
<th>Total Contact Hrs</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L    T    P</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T</td>
<td></td>
<td></td>
<td></td>
<td>3    0    0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>1.</td>
<td>RP5501</td>
<td>Elective -Humanities I</td>
<td>HSMC</td>
<td>3    0    0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>RP5502</td>
<td>Rubber Compounding</td>
<td>PCC</td>
<td>3    0    0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>RP5503</td>
<td>Rubber Processing and Product Manufacture</td>
<td>PCC</td>
<td>3    0    0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>RP5504</td>
<td>Polymer Composite Materials</td>
<td>PCC</td>
<td>3    0    0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>RP5505</td>
<td>Plastics Processing and Machinery</td>
<td>PCC</td>
<td>3    0    0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td></td>
<td>Professional Elective - I</td>
<td>PEC</td>
<td>3    0    0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>7.</td>
<td></td>
<td>Professional Elective - II</td>
<td>PEC</td>
<td>3    0    0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>PRACTICALS</td>
<td></td>
<td></td>
<td></td>
<td>0    0    4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>8.</td>
<td>RP5511</td>
<td>Rubber Processing lab</td>
<td>PCC</td>
<td>0    0    4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>9.</td>
<td>RP5512</td>
<td>Rubber and Plastics testing lab</td>
<td>PCC</td>
<td>0    0    4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TOTAL</td>
<td></td>
<td>21   0    8</td>
<td>29</td>
<td>25</td>
</tr>
</tbody>
</table>

**Students shall undergo Internship/ Training for a minimum period of 4 weeks and assessment of the same will be done during sixth and seventh semester**

### SEMESTER VI

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Code No.</th>
<th>Course Title</th>
<th>Category</th>
<th>Periods Per Week</th>
<th>Total Contact Hrs</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L    T    P</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T</td>
<td></td>
<td></td>
<td></td>
<td>3    0    0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>1.</td>
<td>RP5601</td>
<td>Plastics Product Design</td>
<td>PCC</td>
<td>3    0    0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>RP5602</td>
<td>Rubber Product Design</td>
<td>PCC</td>
<td>3    0    0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>RP5603</td>
<td>Composites Technology</td>
<td>PCC</td>
<td>2    0    2</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>RP5604</td>
<td>Professional Elective - III</td>
<td>PEC</td>
<td>3    0    0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>RP5605</td>
<td>Professional Elective - IV</td>
<td>PEC</td>
<td>3    0    0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>RP5606</td>
<td>Open Elective - I</td>
<td>OEC</td>
<td>3    0    0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>PRACTICALS</td>
<td></td>
<td></td>
<td></td>
<td>0    0    4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>7.</td>
<td>RP5611</td>
<td>Product and Mould Design Lab</td>
<td>PCC</td>
<td>0    0    4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>8.</td>
<td>RP5612</td>
<td>Plastics Processing lab</td>
<td>PCC</td>
<td>0    0    4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>9.</td>
<td>RP5811</td>
<td>Internship/ Training**</td>
<td>EEC</td>
<td>-    -    -</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TOTAL</td>
<td></td>
<td>17   0    10</td>
<td>27</td>
<td>22</td>
</tr>
</tbody>
</table>
## SEMESTER VII

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Code No.</th>
<th>Course Title</th>
<th>Category</th>
<th>Periods Per Week</th>
<th>Total Contact Hrs</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L</td>
<td>T</td>
<td>P</td>
</tr>
<tr>
<td>1</td>
<td>RP5701</td>
<td>Technology of Tyres and Tubes</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Audit Course - II*</td>
<td>AC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Professional Elective - V</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Professional Elective - VI</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Professional Elective - VII</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>Open Elective - II</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

### PRACTICALS

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Code No.</th>
<th>Course Title</th>
<th>Category</th>
<th>Periods Per Week</th>
<th>Total Contact Hrs</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>RP5711</td>
<td>Comprehension</td>
<td>PCC</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>RP5712</td>
<td>Project I</td>
<td>EEC</td>
<td>0</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>8</td>
<td>RP5811</td>
<td>Internship/ Training**</td>
<td>EEC</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**TOTAL** | 18 | 0 | 10 | 28 |

* Audit Course is optional.

**Students shall undergo Internship/ Training for a minimum period of 4 weeks and assessment of the same will be done during seventh and eighth semester.

## SEMESTER VIII

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Code No.</th>
<th>Course Title</th>
<th>Category</th>
<th>Periods Per Week</th>
<th>Total Contact Hrs</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RP5811</td>
<td>Internship/ Training**</td>
<td>EEC</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>RP5812</td>
<td>Project II</td>
<td>EEC</td>
<td>0</td>
<td>0</td>
<td>16</td>
</tr>
</tbody>
</table>

**TOTAL** | 0 | 0 | 16 | 16 |

10
## HUMANITIES AND SOCIAL SCIENCES (HSMC) – MANAGEMENT AND OTHERS

<table>
<thead>
<tr>
<th>SL. NO.</th>
<th>CODE NO.</th>
<th>COURSE TITLE</th>
<th>PERIODS PER WEEK</th>
<th>CREDITS</th>
<th>SEMESTER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>L    T    P</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>HS5151</td>
<td>Technical English</td>
<td>4    0    0</td>
<td>4</td>
<td>I</td>
</tr>
<tr>
<td>2</td>
<td>HS5251</td>
<td>Professional Communication</td>
<td>4    0    0</td>
<td>4</td>
<td>II</td>
</tr>
<tr>
<td>3</td>
<td>MG5451</td>
<td>Principles of Management</td>
<td>3    0    0</td>
<td>3</td>
<td>IV</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total Credits</strong></td>
<td><strong>11</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### HSMC– ELECTIVES – HUMANITIES I (ODD SEMESTER)

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Periods per week</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>HU5171</td>
<td>Language and Communication</td>
<td>3    0    0</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>HU5172</td>
<td>Values and Ethics</td>
<td>3    0    0</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>HU5173</td>
<td>Human Relations at Work</td>
<td>3    0    0</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>HU5174</td>
<td>Psychological Process</td>
<td>3    0    0</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>HU5175</td>
<td>Education, Technology and Society</td>
<td>3    0    0</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>HU5176</td>
<td>Philosophy</td>
<td>3    0    0</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>HU5177</td>
<td>Applications of Psychology in Everyday Life</td>
<td>3    0    0</td>
<td>3</td>
</tr>
</tbody>
</table>

### LIST OF BASIC SCIENCE COURSES (BSC)

<table>
<thead>
<tr>
<th>SL. NO.</th>
<th>CODE NO.</th>
<th>COURSE TITLE</th>
<th>PERIODS PER WEEK</th>
<th>CREDITS</th>
<th>SEMESTER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>L    T    P</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>MA5158</td>
<td>Engineering Mathematics I</td>
<td>3    1    0</td>
<td>4</td>
<td>I</td>
</tr>
<tr>
<td>2</td>
<td>PH5151</td>
<td>Engineering Physics</td>
<td>3    0    0</td>
<td>3</td>
<td>I</td>
</tr>
<tr>
<td>3</td>
<td>CY5151</td>
<td>Engineering Chemistry</td>
<td>3    0    0</td>
<td>3</td>
<td>I</td>
</tr>
<tr>
<td>4</td>
<td>BS5161</td>
<td>Basic Sciences Lab</td>
<td>0    0    4</td>
<td>2</td>
<td>I</td>
</tr>
<tr>
<td>5</td>
<td>MA5252</td>
<td>Engineering Mathematics II</td>
<td>3    1    0</td>
<td>4</td>
<td>II</td>
</tr>
<tr>
<td>6</td>
<td>PH5251</td>
<td>Materials Science</td>
<td>3    0    0</td>
<td>3</td>
<td>II</td>
</tr>
<tr>
<td>7</td>
<td>MA5354</td>
<td>Probability and Statistics</td>
<td>3    1    0</td>
<td>4</td>
<td>III</td>
</tr>
<tr>
<td>8</td>
<td>GE5251</td>
<td>Environmental Sciences</td>
<td>3    0    0</td>
<td>3</td>
<td>IV</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total Credits</strong></td>
<td><strong>26</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sl. No.</td>
<td>CODE NO.</td>
<td>COURSE TITLE</td>
<td>PERIODS PER WEEK</td>
<td>CREDITS</td>
<td>SEMESTER</td>
</tr>
<tr>
<td>--------</td>
<td>----------</td>
<td>--------------</td>
<td>------------------</td>
<td>---------</td>
<td>----------</td>
</tr>
<tr>
<td>1</td>
<td>GE5151</td>
<td>Engineering Graphics</td>
<td>1 0 4</td>
<td>3</td>
<td>I</td>
</tr>
<tr>
<td>2</td>
<td>GE5162</td>
<td>Workshop Practices Lab</td>
<td>0 0 4</td>
<td>2</td>
<td>I</td>
</tr>
<tr>
<td>3</td>
<td>GE5153</td>
<td>Problem Solving and Python Programming</td>
<td>3 0 0</td>
<td>3</td>
<td>II</td>
</tr>
<tr>
<td>4</td>
<td>EE5251</td>
<td>Basics of Electrical and Electronics Engineering</td>
<td>3 0 0</td>
<td>3</td>
<td>II</td>
</tr>
<tr>
<td>5</td>
<td>GE5152</td>
<td>Engineering Mechanics</td>
<td>3 1 4</td>
<td>4</td>
<td>II</td>
</tr>
<tr>
<td>6</td>
<td>GE5161</td>
<td>Problem Solving and Python Programming Laboratory</td>
<td>0 0 4</td>
<td>2</td>
<td>II</td>
</tr>
<tr>
<td>7</td>
<td>EE5261</td>
<td>Electrical &amp; Electronics Engg Lab</td>
<td>0 0 4</td>
<td>2</td>
<td>II</td>
</tr>
<tr>
<td>8</td>
<td>AU5352</td>
<td>Mechanics of solids</td>
<td>3 0 0</td>
<td>3</td>
<td>III</td>
</tr>
<tr>
<td>9</td>
<td>AU5351</td>
<td>Thermodynamics and Thermal Engineering</td>
<td>3 1 0</td>
<td>4</td>
<td>III</td>
</tr>
<tr>
<td>10</td>
<td>AE5351</td>
<td>Fluid Mechanics and Fluid Machines</td>
<td>3 0 0</td>
<td>3</td>
<td>III</td>
</tr>
<tr>
<td>11</td>
<td>AU5361</td>
<td>Mechanical Sciences Lab</td>
<td>0 0 4</td>
<td>2</td>
<td>III</td>
</tr>
</tbody>
</table>

Total Credits: 31
<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Code No.</th>
<th>Course Title</th>
<th>Periods Per Week</th>
<th>Credits</th>
<th>Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>RP5301</td>
<td>Introduction to Polymer Science</td>
<td>3 L 0 T 0 P</td>
<td>3</td>
<td>III</td>
</tr>
<tr>
<td>2.</td>
<td>RP5311</td>
<td>Polymer Science lab</td>
<td>0 L 0 T 4 P</td>
<td>2</td>
<td>III</td>
</tr>
<tr>
<td>3.</td>
<td>RP5401</td>
<td>Physical Properties of Polymers</td>
<td>3 L 0 T 0 P</td>
<td>3</td>
<td>IV</td>
</tr>
<tr>
<td>4.</td>
<td>RP5402</td>
<td>Introduction to Chemical Engineering</td>
<td>3 L 0 T 0 P</td>
<td>3</td>
<td>IV</td>
</tr>
<tr>
<td>5.</td>
<td>RP5403</td>
<td>Rubber Materials</td>
<td>3 L 0 T 0 P</td>
<td>3</td>
<td>IV</td>
</tr>
<tr>
<td>6.</td>
<td>RP5404</td>
<td>Plastics Materials</td>
<td>4 L 0 T 0 P</td>
<td>4</td>
<td>IV</td>
</tr>
<tr>
<td>7.</td>
<td>RP5411</td>
<td>CAD Practice Lab</td>
<td>1 L 0 T 3 P</td>
<td>2</td>
<td>IV</td>
</tr>
<tr>
<td>8.</td>
<td>RP5412</td>
<td>Rubber Materials Lab</td>
<td>0 L 0 T 4 P</td>
<td>2</td>
<td>IV</td>
</tr>
<tr>
<td>9.</td>
<td>RP5501</td>
<td>Rubber Compounding</td>
<td>3 L 0 T 0 P</td>
<td>3</td>
<td>V</td>
</tr>
<tr>
<td>10.</td>
<td>RP5502</td>
<td>Rubber Processing and Manufacture</td>
<td>3 L 0 T 0 P</td>
<td>3</td>
<td>V</td>
</tr>
<tr>
<td>11.</td>
<td>RP5503</td>
<td>Polymer Composite Materials</td>
<td>3 L 0 T 0 P</td>
<td>3</td>
<td>V</td>
</tr>
<tr>
<td>12.</td>
<td>RP5504</td>
<td>Plastics Processing and Machinery</td>
<td>3 L 0 T 0 P</td>
<td>3</td>
<td>V</td>
</tr>
<tr>
<td>13.</td>
<td>RP5511</td>
<td>Rubber Processing lab</td>
<td>0 L 0 T 4 P</td>
<td>2</td>
<td>V</td>
</tr>
<tr>
<td>14.</td>
<td>RP5512</td>
<td>Rubber and Plastics Testing lab</td>
<td>0 L 0 T 4 P</td>
<td>2</td>
<td>V</td>
</tr>
<tr>
<td>15.</td>
<td>RP5601</td>
<td>Plastics Product Design</td>
<td>3 L 0 T 0 P</td>
<td>3</td>
<td>VI</td>
</tr>
<tr>
<td>16.</td>
<td>RP5602</td>
<td>Rubber Product Design</td>
<td>3 L 0 T 0 P</td>
<td>3</td>
<td>VI</td>
</tr>
<tr>
<td>17.</td>
<td>RP5603</td>
<td>Composites Technology</td>
<td>2 L 0 T 2 P</td>
<td>3</td>
<td>VI</td>
</tr>
<tr>
<td>18.</td>
<td>RP5611</td>
<td>Product and Mould Design Lab</td>
<td>0 L 0 T 4 P</td>
<td>2</td>
<td>VI</td>
</tr>
<tr>
<td>19.</td>
<td>RP5612</td>
<td>Plastics Processing lab</td>
<td>0 L 0 T 4 P</td>
<td>2</td>
<td>VI</td>
</tr>
<tr>
<td>20.</td>
<td>RP5701</td>
<td>Technology of Tyres and Tubes</td>
<td>3 L 0 T 0 P</td>
<td>3</td>
<td>VII</td>
</tr>
<tr>
<td>21.</td>
<td>RP5711</td>
<td>Comprehension</td>
<td>0 L 0 T 4 P</td>
<td>2</td>
<td>VII</td>
</tr>
</tbody>
</table>

Total Credits: 56
<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Code. No</th>
<th>Course Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MA5353</td>
<td>Numerical Methods</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>LT5071</td>
<td>Entrepreneurship Development</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>GE5074</td>
<td>Fundamentals of Nanoscience</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>GE5451</td>
<td>Total Quality Management</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>GE5552</td>
<td>Engineering Management</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>GE5551</td>
<td>Statistics for Production Management</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>RP5001</td>
<td>Adhesives and Paints</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>RP5002</td>
<td>Advanced Plastics Processing</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>RP5003</td>
<td>Biopolymers and Polymers from Renewable Resources</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>RP5004</td>
<td>Design of Machine Elements</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>11</td>
<td>RP5005</td>
<td>Engineering and High Performance Plastics</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>12</td>
<td>RP5006</td>
<td>Finite Element Analysis for Polymers</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>13</td>
<td>RP5007</td>
<td>Fracture and Failure in Polymers</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>14</td>
<td>RP5008</td>
<td>Latex Science and Technology</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>15</td>
<td>RP5009</td>
<td>Mould Engineering and Manufacture</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>16</td>
<td>RP5010</td>
<td>Polymers in Packaging Technology</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>17</td>
<td>RP5011</td>
<td>Polymer Recycling</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>18</td>
<td>RP5012</td>
<td>Polyurethane Science and Technology</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>19</td>
<td>RP5013</td>
<td>Product Development and Cost Estimation</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>20</td>
<td>RP5014</td>
<td>Rubber and Plastics Testing</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>21</td>
<td>RP5015</td>
<td>Rubber Components in Automobiles</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>22</td>
<td>RP5016</td>
<td>Technology of Polymer Blends</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>23</td>
<td>RP5017</td>
<td>Theory of Machines and Mechanisms</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>24</td>
<td>RP5018</td>
<td>Polymer Characterization Techniques</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>Code No.</th>
<th>Course Title</th>
<th>Periods per week</th>
<th>Credits</th>
<th>Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RP5811</td>
<td>Internship/ Training</td>
<td>-</td>
<td>2</td>
<td>VIII</td>
</tr>
<tr>
<td>2</td>
<td>RP5712</td>
<td>Project I</td>
<td>0</td>
<td>3</td>
<td>VII</td>
</tr>
<tr>
<td>3</td>
<td>RP5812</td>
<td>Project II</td>
<td>0</td>
<td>8</td>
<td>VIII</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total Credits</strong></td>
<td></td>
<td>13</td>
<td></td>
</tr>
</tbody>
</table>

### AUDIT COURSES (AC)

Registration for any of these courses is optional to students

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Periods per week</th>
<th>Credits</th>
<th>Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AD5091</td>
<td>Constitution of India</td>
<td>3</td>
<td>0</td>
<td>2/6</td>
</tr>
<tr>
<td>2</td>
<td>AD5092</td>
<td>Value Education</td>
<td>3</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>AD5093</td>
<td>Pedagogy Studies</td>
<td>3</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>AD5094</td>
<td>Stress Management by Yoga</td>
<td>3</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>AD5095</td>
<td>Personality Development Through Life Enlightenment Skills</td>
<td>3</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>AD5096</td>
<td>Unnat Bharat Abhiyan</td>
<td>3</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>AD5097</td>
<td>Essence of Indian Knowledge Tradition</td>
<td>3</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>AD5098</td>
<td>Sanga Tamil Literature Appreciation</td>
<td>3</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

### SUMMARY

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
<th>VI</th>
<th>VII</th>
<th>VIII</th>
<th>Total credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>HSMC</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>17</td>
</tr>
<tr>
<td>BSC</td>
<td>12</td>
<td>7</td>
<td>4</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>26</td>
</tr>
<tr>
<td>ESC</td>
<td>5</td>
<td>14</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>31</td>
</tr>
<tr>
<td>PCC</td>
<td>5</td>
<td>17</td>
<td>16</td>
<td>13</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td>56</td>
</tr>
<tr>
<td>PEC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6</td>
<td>6</td>
<td>9</td>
<td></td>
<td>21</td>
</tr>
<tr>
<td>OEC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td>06</td>
</tr>
<tr>
<td>EEC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>AC (NonCredit)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>13</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>Total 170</strong></td>
</tr>
</tbody>
</table>

16
OBJECTIVES:

The first semester English course entitled ‘Technical English’ aims to,

- Familiarise first year students of engineering and technology with the fundamental aspects of technical English.
- Develop all the four language skills by giving sufficient practice in the use of the skills in real life contexts.
- Enhance the linguistic and communicative competence of first year engineering and technology students.

UNIT I  INTRODUCING ONESELF  12

Listening: Listening and filling a form, listening to speeches by specialists from various branches of engineering and completing activities such as answering questions, identifying the main ideas of the listening text, style of the speaker (tone and tenor) –  Speaking: Introducing oneself –introducing friend/ family -  Reading: Descriptive passages (from newspapers / magazines)-  Writing: Writing a paragraph (native place, school life)-  Grammar: Simple present, present continuous –  Vocabulary Development: One word substitution

UNIT II  DIALOGUE WRITING  12

Listening: Listening to conversations (asking for and giving directions) –  Speaking: making conversation using (asking for directions, making an enquiry), Role plays-dialogues-  Reading: Reading a print interview and answering comprehension questions-  Writing: Writing a checklist, Dialogue writing-  Grammar: Simple past – question formation (Wh- questions, Yes or No questions, Tag questions)-  Vocabulary Development: Stress shift, lexical items related to the theme of the given unit.

UNIT III  FORMAL LETTER WRITING  12

Listening: Listening to speeches by famous people and identifying the central message of the speech – answering multiple-choice questions)-  Speaking: Giving short talks on a given topic-  Reading: Reading motivational essays on famous engineers and technologists (answering open-ended and closed questions)-  Writing: Writing formal letters/ emails (Complaint letters)-  Grammar: Future Tense forms of verbs, subject and verb agreement-  Vocabulary Development: Collocations – Fixed expressions

UNIT IV  WRITING COMPLAINT LETTERS  12

UNIT V WRITING DEFINITIONS AND PRODUCT DESCRIPTION

Listening: Listening to a product description (labeling and gap filling) exercises- Speaking: Describing a product and comparing and contrasting it with other products- Reading: Reading graphical material for comparison (advertisements)-Writing: Writing Definitions (short and long) – compare and contrast paragraphs- Grammar: Adjectives – Degrees of comparison - compound nouns- Vocabulary Development: Use of discourse markers – suffixes (adjectival endings).

TOTAL :60 PERIODS

Learning Outcomes

At the end of the course the students will have gained,

- Exposure to basic aspects of technical English.
- The confidence to communicate effectively in various academic situations.
- Learnt the use of basic features of Technical English.

Textbook:


Assessment Pattern

- Assessments will assess all the four skills through both pen and paper and computer based tests.
- Assessments can be pen and paper based, quizzes.

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Program outcome and Program Specific Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
</tr>
<tr>
<td>Overall CO</td>
<td>3</td>
</tr>
</tbody>
</table>
OBJECTIVES:

- To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
- To familiarize the students with differential calculus.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To make the students understand various techniques of integration.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.

UNIT I      MATRICES


UNIT II     DIFFERENTIAL CALCULUS


UNIT III     FUNCTIONS OF SEVERAL VARIABLES


UNIT IV     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 V     MULTIPLE INTEGRALS


TOTAL :60 PERIODS

OUTCOMES:

At the end of the course the students will be able to

- Use the matrix algebra methods for solving practical problems.
- Apply differential calculus tools n solving various application problems.
- Able to use differential calculus ideas on several variable functions.
- Apply different methods of integration in solving practical problems.
- Apply multiple integral ideas in solving areas, volumes and other practical problems.
TEXTBOOKS:

REFERENCES:

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Program outcome and Program Specific Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
</tr>
<tr>
<td>Overall CO</td>
<td>3</td>
</tr>
</tbody>
</table>
OBJECTIVE

- To make the students in understanding the importance of mechanics.
- To equip the students on the knowledge of electromagnetic waves.
- To introduce the basics of oscillations, optics and lasers.
- To enable the students in understanding the importance of quantum physics.
- To elucidate the application of quantum mechanics towards the formation of energy bands in crystalline materials.

UNIT I  MECHANICS


UNIT II  ELECTROMAGNETIC WAVES

Gauss’s law – Faraday’s law - Ampere’s law - The Maxwell’s equations - wave equation; Plane electromagnetic waves in vacuum, Conditions on the wave field - properties of electromagnetic waves: speed, amplitude, phase, orientation and waves in matter - polarization - Producing electromagnetic waves - Energy and momentum in EM waves: Intensity, waves from localized sources, momentum and radiation pressure - Cell-phone reception. Reflection and transmission of electromagnetic waves from a non-conducting medium-vacuum interface for normal incidence.

UNIT III  OSCILLATIONS, OPTICS AND LASERS


UNIT IV  BASIC QUANTUM MECHANICS

Photons and light waves - Electrons and matter waves - The Schrodinger equation (Time dependent and time independent forms) - meaning of wave function - Normalization - Particle in a infinite potential well - Normalization, probabilities and the correspondence principle.

UNIT V  APPLIED QUANTUM MECHANICS

The harmonic oscillator - Barrier penetration and quantum tunneling - Tunneling microscope - Resonant diode - Finite potential wells - particle in a three dimensional box - Bloch’s theorem for particles in a periodic potential, Kronig-Penney model and origin of energy bands.

TOTAL: 45 PERIODS

OUTCOME

After completion of this course, the students should able to

- Understanding the importance of mechanics.
- Express the knowledge of electromagnetic waves.
- Know the basics of oscillations, optics and lasers.
- Understanding the importance of quantum physics.
- Apply quantum mechanical principles towards the formation of energy bands in crystalline materials.
TEXT BOOKS

REFERENCES

<table>
<thead>
<tr>
<th>Course Outcome</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>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
<th>PSO4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</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>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</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>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</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>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</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>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall CO</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
OBJECTIVES:

- To introduce the basic concepts of polymers, their properties and some of the important applications.
- To impart knowledge on the basic principles and preparatory methods of nanomaterials.
- To facilitate the understanding of the laws of photochemistry, photoprocesses and instrumentation & applications of spectroscopic techniques.
- To familiarize the operating principles and applications of energy conversion, its processes and storage devices.
- To inculcate sound understanding of water quality parameters and water treatment techniques.

UNIT I POLYMER CHEMISTRY


UNIT II NANOCHEMISTRY


UNIT III PHOTOCHEMISTRY AND SPECTROSCOPY


UNIT IV ENERGY CONVERSIONS AND STORAGE

Nuclear fission - controlled nuclear fission - nuclear fusion - differences between nuclear fission and fusion - nuclear chain reactions - nuclear energy - light water nuclear power plant – fast breeder reactor. Solar energy conversion - solar cells. Wind energy. Batteries - types of batteries – primary battery (dry cell), secondary battery (lead acid, nickel-cadmium and lithium-ion-battery). Fuel cells – H₂-O₂ and microbial fuel cell. Explosives – classification, examples: TNT, RDX, Dynamite; Rocket fuels and propellants – definition and uses.
UNIT V WATER TECHNOLOGY


TOTAL: 45 PERIODS

OUTCOMES:

- To recognize and apply basic knowledge on different types of polymeric materials, their general preparation methods and applications to futuristic material fabrication needs.
- To identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.
- To identify and apply suitable spectroscopic technique for material analysis and study different forms of photochemical reactions.
- To recognize different forms of energy resources and apply them for suitable applications in energy sectors.
- To demonstrate the knowledge of water and their quality in using at different industries.

TEXT BOOKS:

REFERENCE BOOKS:

<table>
<thead>
<tr>
<th>Course Outcome</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>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
<th>PSO4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<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>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<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>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<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>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<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>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<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>
</tr>
<tr>
<td>Overall CO</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<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>
</tr>
</tbody>
</table>
COURSE OBJECTIVES: The main learning objective of this course is to prepare the students for:

1. Drawing free hand sketches of basic geometrical shapes and multiple views of objects.
2. Drawing orthographic projections of lines and planes.
3. Drawing orthographic projections of solids.
4. Drawing development of the surfaces of objects.
5. Drawing isometric and perspective views of simple solids.

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

Basic Geometrical constructions, Curves used in engineering practices-Conics – Construction of ellipse, parabola and hyperbola by different methods – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves. Visualization concepts and Free Hand sketching: Visualization principles – Representation of Three-Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES

Orthographic projection- principles-Principle 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

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 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 ISOOMETRIC AND PERSPECTIVE PROJECTIONS

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

COMPUTER AIDED DRAFTING (DEMONSTRATION ONLY)

Introduction to drafting packages and demonstration of their use

TOTAL (L: 15 + P: 60)=75 PERIODS
COURSE OUTCOMES: Upon completion of this course, the students will be able to:

1. Draw free hand sketching of basic geometrical shapes and multiple views of objects.
2. Draw orthographic projections of lines and planes
3. Draw orthographic projections of solids
4. Draw development of the surfaces of objects
5. Draw isometric and perspective views of simple solids.

TEXT BOOKS:


REFERENCES:


Publication of Bureau of Indian Standards:


Special points applicable to University Examinations on Engineering Graphics:

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

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Program outcome and Program Specific Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 PO12 PSO1 PSO2 PSO3 PSO4</td>
</tr>
<tr>
<td>CO1</td>
<td>3 3 3 3 3 3 3 1 2 3</td>
</tr>
<tr>
<td>CO2</td>
<td>3 3 3 3 3 3 1 2 3</td>
</tr>
<tr>
<td>CO3</td>
<td>3 3 3 3 3 3 1 2 3</td>
</tr>
<tr>
<td>CO4</td>
<td>3 3 3 3 3 3 1 2 3</td>
</tr>
<tr>
<td>CO5</td>
<td>3 3 3 3 3 3 1 3</td>
</tr>
<tr>
<td>Overall</td>
<td>3 3 3 3 3 3 1 2 3</td>
</tr>
</tbody>
</table>
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 and band gap determination.

LIST OF EXPERIMENTS:

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. Photoelectric effect
14. Michelson Interferometer.
16. Melde’s string experiment

TOTAL: 30 PERIODS

OUTCOME

Upon completion of the course, the students will be able

- CO1: To determine various moduli of elasticity.
- CO2: To determine the velocity of ultrasonic waves, band gap determination
- CO3: To determine various thermal and optical properties of materials.
- CO4: To determine the viscosity of liquids
- CO5: To determine the estimation of laser parameters

<table>
<thead>
<tr>
<th>Course Outcome</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>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
<th>PSO4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<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>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<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>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<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>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<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>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<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>
</tr>
<tr>
<td>Overall CO</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<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>
</tr>
</tbody>
</table>
CHEMISTRY LABORATORY: (Minimum of 8 experiments to be conducted)

OBJECTIVES:
- To inculcate experimental skills to test basic understanding of water quality parameters, such as, acidity, alkalinity, hardness, DO, chloride and copper.
- To induce the students to familiarize with electroanalytical techniques such as, pH metry, potentiometry and conductometry in the determination of impurities in aqueous solutions.
- To demonstrate the analysis of metals and polymers by spectroscopy and viscometry methods.

LIST OF EXPERIMENTS:
1. Estimation of HCl using Na₂CO₃ 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. Phase change in a solid.

TOTAL: 30 PERIODS

OUTCOMES:
- To analyse the quality of water samples with respect to their acidity, alkalinity, hardness and DO.
- To determine the amount of metal ions through volumetric and spectroscopic techniques.
- To determine the molecular weight of polymers by viscometric method.
- To quantitatively analyse the impurities in solution by electroanalytical techniques.
- To design and analyse the kinetics of reactions and corrosion of metals.

TEXTBOOKS:
COURSE OBJECTIVES: The main learning objective of this course is to provide hands on training to the students in:

1. Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planing; making joints in wood materials used in common household wood work.
2. Wiring various electrical joints in common household electrical wire work.
3. Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipments; Making a tray out of metal sheet using sheet metal work.
4. Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.

GROUP – A (CIVIL & ELECTRICAL)

PART I CIVIL ENGINEERING PRACTICES 15

PLUMBING WORK:

a) Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.
b) Preparing plumbing line sketches.
c) Laying pipe connection to the suction side of a pump
d) Laying pipe connection to the delivery side of a pump.
e) Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

WOOD WORK:

a) Sawing,
b) Planning and

  c) Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.

Wood Work Study:

a) Studying joints in door panels and wooden furniture
b) Studying common industrial trusses using models.

PART II ELECTRICAL ENGINEERING PRACTICES 15

WIRING WORK:

a) Wiring Switches, Fuse, Indicator and Lamp etc. such as in basic household,
b) Wiring Stair case light.
c) Wiring tube – light.
d) Preparing wiring diagrams for a given situation.

Wiring Study:

a) Studying an Iron-Box wiring.
b) Studying a Fan Regulator wiring.
c) Studying an Emergency Lamp wiring.
GROUP – B (MECHANICAL AND ELECTRONICS)

PART III MECHANICAL ENGINEERING PRACTICES

WELDING WORK:
  a) Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.
  b) Practicing gas welding.

BASIC MACHINING WORK:
  a) (simple)Turning.
  b) (simple)Drilling.
  c) (simple)Tapping.

ASSEMBLY WORK:
  a) Assembling a centrifugal pump.
  b) Assembling a household mixer.
  c) Assembling an air conditioner.

SHEET METAL WORK:
  a) Making of a square tray

FOUNDRY WORK:
  a) Demonstrating basic foundry operations.

PART IV ELECTRONIC ENGINEERING PRACTICES

SOLDERING WORK:
  a) Soldering simple electronic circuits and checking continuity.

ELECTRONIC ASSEMBLY AND TESTING WORK:
  a) Assembling and testing electronic components on a small PCB.

ELECTRONIC EQUIPMENT STUDY:
  a) Studying a FM radio.
  b) Studying an electronic telephone.

TOTAL (P: 60) = 60 PERIODS

COURSE OUTCOMES:

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

- Draw pipe line plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household wood work.
- Wire various electrical joints in common household electrical wire work.
- Weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipments; Make a tray out of metal sheet using sheet metal work.
- Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.
COURSE OBJECTIVES

The course entitles ‘professional communication’ aims to,

- Improve the relevant language skills necessary for professional communication.
- Develop linguistic and strategic competence in workplace context.
- Enhance language proficiency and thereby the employability of budding engineers and technologists.

UNIT I TECHNICAL COMMUNICATION 12

Listening: Listening to telephone conversations (intent of the speaker and note taking exercises)-Speaking: Role play exercises based on workplace contexts, introducing oneself- Reading: Reading the interview of an achiever and completing exercises (skimming, scanning and predicting)- Writing: Writing a short biography of an achiever based on given hints- Grammar: Asking and answering questions, punctuation in writing, prepositional phrases- Vocabulary Development: use of adjectives.

UNIT II SUMMARY WRITING 12

Listening: Listening to talks/lectures both general and technical and summarizing the main points- Speaking: Participating in debates- Reading: Reading technical essays/articles and answering comprehension questions- Writing: Summary writing-Grammar: Participle forms, relative clauses- Vocabulary Development: Use of compound words, abbreviations and acronyms.

UNIT III PROCESS DESCRIPTION 12

Listening: Listening to a process description and drawing a flowchart-Speaking: Participating in Group Discussions, giving instructions- Reading: Reading instruction manuals- Writing: Writing process descriptions- Writing instructions- Grammar: Use of imperatives, active and passive voice, sequence words- Vocabulary Development: Technical jargon
UNIT IV REPORT WRITING

Listening: Listening to a presentation and completing gap-filling exercises- Speaking: Making formal presentations- Reading: Reading and interpreting charts/tables and diagrams- Writing: Interpreting charts/tables and diagrams, writing a report- Grammar: Direct into indirect speech, use of phrases- Vocabulary Development: reporting words

UNIT V WRITING JOB APPLICATIONS

Listening: Listening to a job interview and completing gap-filling exercises- Speaking: Mock interview, telephone interviews- Reading: Reading a job interview, SOP, company profile and completing comprehension exercises- Writing: job applications and resumes and SOPs-Grammar: Present perfect and continuous tenses- Vocabulary Development: Technical vocabulary.

TOTAL :60 PERIODS

LEARNING OUTCOMES

At the end of the second semester the learners should be able to,

- Read and comprehend technical texts effortlessly.
- Write reports of a technical kind.
- Speak with confidence in interviews and thereby gain employability

Textbook


Assessment Pattern

- Assessment will assess all the four skills through both pen and paper and computer based tests.
- Assessments can be pen and paper based, quizzes.

<table>
<thead>
<tr>
<th>Course Outcome</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>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
<th>PSO4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>3</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>1</td>
<td>1</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall CO</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
MA5252 ENGINEERING MATHEMATICS – II
(Common to all branches of B.E. / B.Tech. Programmes in II Semester)

OBJECTIVES:

- To acquaint the students with the concepts of vector calculus which naturally arises in many engineering problems.
- To develop an understanding of the standard techniques of complex variable theory in particular analytic function and its mapping property.
- To familiarize the students with complex integration techniques and contour integration techniques which can be used in real integrals.
- To acquaint the students with Differential Equations which are significantly used in Engineering problems.
- To make the students appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

UNIT I  VECTOR CALCULUS  12

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

UNIT III  COMPLEX INTEGRATION  12

UNIT IV  DIFFERENTIAL EQUATIONS  12
Method of variation of parameters – Method of undetermined coefficients – Homogenous equations of Euler’s and Legendre’s type – System of simultaneous linear differential equations with constant coefficients.

UNIT V  LAPLACE TRANSFORMS  12

TOTAL : 60 PERIODS
OUTCOMES:
Upon successful completion of the course, students will be able to:

- Calculate grad, div and curl and use Gauss, Stokes and Greens theorems to simplify calculations of integrals.
- Construct analytic functions and use their conformal mapping property in application problems.
- Evaluate real and complex integrals using the Cauchy’s integral formula and residue theorem.
- Apply various methods of solving differential equation which arise in many application problems.
- Apply Laplace transform methods for solving linear differential equations.

TEXTBOOKS:

REFERENCES:

<table>
<thead>
<tr>
<th>Course Outcome</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>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
<th>PSO4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Overall CO</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>
OBJECTIVES:

- To know the basics of algorithmic problem solving.
- To develop Python programs with conditionals and loops.
- To define Python functions and use function calls.
- To use Python data structures - lists, tuples, dictionaries.
- To do input/output with files in Python.

UNIT I INTRODUCTION TO COMPUTING AND PROBLEM SOLVING  
9


Suggested Activities:

- Developing Pseudocodes and flowcharts for real life activities such as railway ticket booking using IRCTC, admission process to undergraduate course, academic schedules during a semester etc.
- Developing algorithms for basic mathematical expressions using arithmetic operations.
- Installing Python.
- Simple programs on print statements, arithmetic operations.

Suggested Evaluation Methods:

- Assignments on pseudocodes and flowcharts.
- Tutorials on Python programs.

UNIT II CONDITIONALS AND FUNCTIONS  
9


Suggested Activities:

- Simple Python program implementation using Operators, Conditionals, Iterative Constructs and Functions.
- Implementation of a simple calculator.
- Developing simple applications like calendar, phone directory, to-do lists etc.
- Flow charts for GCD, Exponent Functions, Fibonacci Series using conditionals and iterative statements.
- External learning - Recursion vs. Iteration.
Suggested Evaluation Methods:

- Tutorials on the above activities.
- Group Discussion on external learning.

**UNIT III SIMPLE DATA STRUCTURES IN PYTHON**


**Suggested Activities:**

- Implementing python program using lists, tuples, sets for the following scenario:
  Simple sorting techniques
  Student Examination Report
  Billing Scheme during shopping.
- External learning - List vs. Tuple vs. Set – Implementing any application using all the three data structures.

**Suggested Evaluation Methods:**

- Tutorials on the above activities.
- Group Discussion on external learning component.

**UNIT IV STRINGS, DICTIONARIES, MODULES**


**Suggested Activities:**

- Implementing Python program by importing Time module, Math package etc.
- Creation of any package (student’s choice) and importing into the application.

**Suggested Evaluation Methods:**

- Tutorials on the above activities.

**UNIT V FILE HANDLING AND EXCEPTION HANDLING**

Introduction to Files – File Path – Opening and Closing Files – Reading and Writing Files – File Position – Exception: Errors and Exceptions, Exception Handling, Multiple Exceptions.

**Suggested Activities:**

- Developing modules using Python to handle files and apply various operations on files.
- Usage of exceptions, multiple except blocks -for applications that use delimiters like age, range of numerals etc.
- Implementing Python program to open a non-existent file using exceptions.
Suggested Evaluation Methods:

- Tutorials on the above activities.
- Case Studies.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of the course, students will be able to:

1. Develop algorithmic solutions to simple computational problems.
2. Develop and execute simple Python programs.
3. Write simple Python programs for solving problems.
4. Decompose a Python program into functions.
5. Represent compound data using Python lists, tuples, dictionaries etc.
6. Read and write data from/to files in Python programs.

TEXT BOOK:


REFERENCES:


<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Program outcome and Program Specific Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>PO1  PO2  PO3  PO4  PO5  PO6  PO7  PO8  PO9  PO10  PO11  PO12  PSO1  PSO2  PSO3  PSO4</td>
</tr>
<tr>
<td>CO2</td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td></td>
</tr>
<tr>
<td>CO6</td>
<td></td>
</tr>
<tr>
<td>Overall CO</td>
<td></td>
</tr>
</tbody>
</table>
OBJECTIVES:

- To understand the basic concepts of electric circuits, magnetic circuits and wiring.
- To understand the operation of AC and DC machines.
- To understand the working principle of electronic devices and circuits.

UNIT I  BASIC CIRCUITS AND DOMESTIC WIRING  9


UNIT II  THREE PHASE CIRCUITS AND MAGNETIC CIRCUITS  9


UNIT III  ELECTRICAL MACHINES  9


UNIT IV  BASICS OF ELECTRONICS  9

Intrinsic semiconductors, Extrinsic semiconductors – P-type and N-type, P-N junction, VI Characteristics of PN junction diode, Zener effect, Zener diode, Zener diode Characteristics-Rectifier circuits-Wave shaping.

UNIT V  CURRENT CONTROLLED AND VOLTAGE CONTROLLED DEVICES  9

Working principle and characteristics - BJT, SCR, JFET, MOSFET.

TOTAL:  45 PERIODS

OUTCOMES:

CO1  To be able to understand the concepts related with electrical circuits and wiring.
CO2  To be able to study the different three phase connections and the concepts of magnetic circuits.
CO3  Capable of understanding the operating principle of AC and DC machines.
CO4  To be able to understand the working principle of electronic devices such as diode and zener diode.
CO5  To be able to understand the characteristics and working of current controlled and voltage controlled devices.
TEXT BOOKS:

REFERENCES:

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Program outcome and Program Specific Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
</tr>
<tr>
<td>Overall CO</td>
<td>3</td>
</tr>
</tbody>
</table>
COURSE OBJECTIVES: The main learning objective of this course is to prepare the students for:

1. Applying the various methods to determine the resultant forces and its equilibrium acting on a particle in 2D and 3D.
2. Applying the concept of reaction forces (non-concurrent coplanar and noncoplanar forces) and moment of various support systems with rigid bodies in 2D and 3D in equilibrium. Reducing the force, moment, and couple to an equivalent force - couple system acting on rigid bodies in 2D and 3D.
3. Applying the concepts of locating centroids/center of gravity of various sections / volumes and to find out area moments of inertia for the sections and mass moment of inertia of solids.
4. Applying the concepts of frictional forces at the contact surfaces of various engineering systems.
5. Applying the various methods of evaluating kinetic and kinematic parameters of the rigid bodies subjected to concurrent coplanar forces.

UNIT I  STATICS OF PARTICLES (9+3)

UNIT II  EQUILIBRIUM OF RIGID BODIES (9+3)

UNIT III  DISTRIBUTED FORCES (9+3)
Centroids of lines and areas – symmetrical and unsymmetrical shapes, Determination of Centroids by Integration , Theorems of Pappus-Guldinus, Distributed Loads on Beams, Centre 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 (9+3)

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

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

1. Apply the various methods to determine the resultant forces and its equilibrium acting on a particle in 2D and 3D.
2. Apply the concept of reaction forces (non-concurrent coplanar and noncoplanar forces) and moment of various support systems with rigid bodies in 2D and 3D in equilibrium. Reducing the force, moment, and couple to an equivalent force - couple system acting on rigid bodies in 2D and 3D.
3. Apply the concepts of locating centroids / center of gravity of various sections / volumes and to find out area moments of inertia for the sections and mass moment of inertia of solids.
4. Apply the concepts of frictional forces at the contact surfaces of various engineering systems.
5. Apply the various methods of evaluating kinetic and kinematic parameters of the rigid bodies subjected to concurrent coplanar forces.

TEXT BOOKS:


REFERENCES:

OBJECTIVE

- To make the students to understand the basics of crystallography and crystal imperfections.
- To introduce various strengthening methods of materials, and also various mechanical properties and their measurement.
- To impart knowledge on the basics of phase diagrams and their applications.
- To learn about iron-carbon system, and about various ferrous and non-ferrous alloys.
- To introduce the preparation, properties and applications of ceramics, composites and nanomaterials.

UNIT I  CRYSTALLOGRAPHY  9

UNIT II  MECHANICAL PROPERTIES  9

UNIT III  PHASE DIAGRAMS  9
Basic concepts - Gibbs phase rule – Unary phase diagram (iron) - Binary phase diagrams: isomorphous systems (Cu-Ni) – determination of phase composition and phase amounts – tieline and lever rule - binary eutectic diagram with no solid solution and limited solid solution (Pb-Sn) – eutectoid and peritectic reactions - other invariant reactions – microstructural development during the slow cooling: eutectic, hypereutectic and hypoeutectic compositions.

UNIT IV  FERROUS AND NONFERROUS ALLOYS  9

UNIT V  CERAMICS, COMPOSITES AND NANO MATERIALS  9

TOTAL: 45 PERIODS
OUTCOMES:
Upon completion of this course, the students will
- understand the basics of crystallography and its importance in materials properties
- understand the significance of dislocations, strengthening mechanisms, and tensile, creep, hardness and fracture behavior of materials
- gain knowledge on binary phase diagrams, and also will be able to determine the phase composition and phase amount.
- understand about the Fe-C system and various microstructures in it, and also about various ferrous and non-ferrous alloys.
- get adequate understanding on the preparation, properties and applications of ceramics, composites and nanomaterials.

REFERENCES

<table>
<thead>
<tr>
<th>Course Outcome</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>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
<th>PSO4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall CO</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

PROGRESS THROUGH KNOWLEDGE
OBJECTIVES:
- To understand the problem solving approaches.
- To learn the basic programming constructs in python.
- To articulate where computing strategies support in providing python–based solutions to real world problems.
- To use Python data structures - lists, tuples, dictionaries.
- To do input/output with files in Python.

EXPERIMENTS:
1. Identification of Simple real life or Scientific or technical problems; Solve them and develop flow charts for the same.
2. Python programming using Simple statements and expressions
3. Scientific problems using Conditionals and Iterative loops.
5. Implementing Real-time/Technical applications Sets, Dictionaries.
6. Implementing programs using functions.
7. Implementing programs using Strings.
8. Implementing programs using your own modules and Python standard libraries.
10. Implementing Real-time/Technical applications using Exception handling.
11. Self exploring Pygame.
12. Developing a game activity using Pygame like bouncing ball, etc.

OUTCOMES:
Upon completion of the course, students will be able to:
- Develop algorithmic solutions to simple computational problems
- Developing and executing simple Python programs.
- Structure simple Python programs for solving problems.
- Decompose a Python program into functions.
- Represent compound data using Python data structures.
- Applying Python features in developing software applications.

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Program outcome and Program Specific Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
</tr>
<tr>
<td>CO6</td>
<td>3</td>
</tr>
<tr>
<td>Overall CO</td>
<td>3</td>
</tr>
</tbody>
</table>
OBJECTIVES

1. To impart hands on experience in verification of circuit laws and measurement of circuit parameters
2. To train the students in performing various tests on electrical motors.
3. It also gives practical exposure to the usage of CRO, power sources & function generators

List of Experiments

1. Verification of Kirchhoff’s Law.
2. Steady state response of AC and DC circuits (Mesh, Node Analysis)
3. Frequency response of RLC circuits.
5. Regulation of single phase transformer.
6. Performance characteristics of DC shunt generator.
7. Performance characteristics of single phase induction motor.
8. Characteristics of PN diode and Zener diode
9. Characteristics of Zener diode
10. Half wave and full wave Rectifiers
11. Application of Zener diode as shunt regulator.
12. Characteristics of BJT and JFET

OUTCOMES:

1. To become familiar with the basic circuit components and know how to connect them to make a real electrical circuit;
2. Ability to perform speed characteristic of different electrical machines
3. Ability to use logic gates and Flip flop

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Program outcome and Program Specific Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
<td>2</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
</tr>
<tr>
<td>Overall CO</td>
<td>2.6</td>
</tr>
</tbody>
</table>
SEMMESTER III

MA 5354  PROBABILITY AND STATISTICS  L T P C
3 1 0 4

OBJECTIVES

• To understand the basics of random variables with emphasis on the standard discrete and continuous distributions.
• To understand the basic probability concepts with respect to two dimensional random variables along with the relationship between the random variables and the significance of the Central Limit theorem.
• To apply the small/ large sample tests through Tests of hypothesis.
• To understand the concept of analysis of variance and use it to investigate factorial dependence.
• To monitor a process and detect a situation when the process is out of control.

UNIT I  RANDOM VARIABLES12
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 12
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 SIGNIFICANCE12
Type I and Type II errors – Tests for single mean, proportion, Difference of means (large and small samples) – Tests for single variance and equality of variances – Chi-square test for goodness of fit – Independence of attributes – Non-parametric tests: Test for Randomness and Rank – Sum test (Wilcoxon test).

UNIT IV  DESIGN OF EXPERIMENTS 12
Completely Randomized Design – Randomized Block Design – Latin Square Design – factorial design – Taguchi’s robust parameter design.

UNIT V  STATISTICAL QUALITY CONTROL 12
Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) Tolerance limits – Acceptance sampling.

TOTAL: 60 PERIODS

OUTCOMES

• To analyze the performance in terms of probabilities and distributions achieved by the determined solutions
• To be familiar with some of the commonly encountered two dimensional random variables and be equipped for a possible extension to multivariate analysis
• To apply the basic principles underlying statistical inference( estimation and hypothesis testing)
• To demonstrate the knowledge of applicable large sample theory of estimators and tests
• To obtain a better understanding of the importance of the methods in modern industrial processes.
TEXT BOOKS:

REFERENCES:
OBJECTIVES:
The objective of this course is
1. To know about how a solid (materials, structures) behaves when it is exposed to forces and deformations.
2. To apply the fundamental concepts of principle of superposition, equilibrium, compatibility, force deformation, and stress-strain relationships to the solid and structural mechanics problems
3. To analyze determinate and indeterminate bars, beams, to determine axial forces, torques, shear forces, and bending moments
4. To have physical insight into distribution of stresses and strains in structural members
5. To identify the biaxial stresses in acting in a body or an element.

UNIT I      STRESS - STRAIN, AXIAL LOADING         9
Stress and strain, elastic limit, Hooke's law, factor of safety, shear stress, shear strain, relationship between elastic constants. Stresses in stepped bars, uniformly varying sections, composite bars due to axial force. Lateral strain, Poisson's ratio, volumetric strain, changes in dimensions and volume. Thermal stresses and impact loading.

UNIT II    STRESSES IN BEAMS                       9
Beam – Definition, types of end supports, types of beam, types of loading. Shear force diagram and bending moment diagram for cantilever, simply supported and overhanging beams under point load, UDL, UVL and moments. Euler beam theory - Bending equation, section modulus, Bending stress in beams–Shear stress in beams.

UNIT III  DEFLECTION OF BEAMS AND COLUMNS         9

UNIT IV    TORSION AND SPRINGS                    9
Theory of torsion and assumptions - torsion equation, polar modulus, stresses in solid and hollow circular shafts, power transmitted by a shaft, shafts in series and parallel, deflection in shafts fixed at the both ends. Springs – types, Deflection expression for closed coiled helical spring – Stress in springs - design of springs.

UNIT V     BIAXIAL STRESS                         9
Principal stresses, normal and tangential stresses, maximum shear stress - analytical and graphical method. Stresses in combined loading. Thin walled cylinder under internal pressure – changes in dimensions – volume. spherical shells subjected to internal pressure – deformation in spherical shells – Lame’s theory.

TOTAL: 45 PERIODS
OUTCOMES:
At the end of the course, the students are expected to
i. Know about how a solid (materials, structures) behaves when it is exposed to forces and deformations.
ii. Apply the fundamental concepts of principle of superposition, equilibrium, compatibility, force-deformation, and stress-strain relationships to the solid and structural mechanics problems
iii. Analyze determinate and indeterminate bars, beams, to determine axial forces, torques, shear forces, and bending moments
iv. Have physical insight into distribution of stresses and strains in structural members
v. Identify the biaxial stresses in acting in a body or an element.

TEXT BOOKS:

REFERENCES:

<table>
<thead>
<tr>
<th>Course Outcome</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>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
<th>PSO4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<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>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<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>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</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>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</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>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall CO</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively
OBJECTIVES
To impart knowledge to the students in the following

- Basic organic chemistry reactions
- Fundamentals of polymer science
- Mechanism of free radical, ionic and copolymerization
- Mechanism and kinetics of step-wise polymerization
- Determination of solution properties of polymers

UNIT I  BASIC ORGANIC CHEMISTRY  10
Covalent bond: Hybridization Reaction mechanisms - Polarity of bonds-inductive mesomeric and electromeric effects, resonance, hyper conjugation, steric effects, classification of organic reactions, reaction intermediates: free radicals, carbocations and carbanions, properties and applications of Amines, Aniline, CS₂, furan, thiophene, pyrrole, pyridine, quinoline, isoquinoline, imidazoles, thiazoles

UNIT II  CHAIN POLYMERIZATION - I  10

UNIT III  CHAIN POLYMERIZATION - II  8
Coordination polymerization – Electrochemical polymerization- Metathetical- RAFT polymerization- Atom transfer polymerization - Group transfer Polymerization, Metallocene - photo polymerization, Industrial polymerization – Bulk, emulsion, suspension and solution polymerization techniques

UNIT- IV  STEP POLYMERIZATION  8
Polycondensation – Flory’s equal reactivity principle – Kinetics of Polycondensation - Carother’s equation – Linear polymers by Polycondensation – Interfacial polymerization – Crosslinked polymers by condensation – Gel point –Examples - Moulding powders - Industrial polymerization techniques

UNIT- V  SOLUTION PROPERTIES OF POLYMERS  9
Polymer Dissolution - Difference between simple solutions and polymer solutions – Molecular Weight - Average molecular weight – Molecular weight distribution – Polymer fractionation-Polydispersity – Molecular weight determination. Different methods – Gel Permeation Chromatography – Osmometry, Light Scattering – Basic Principles

TOTAL: 45 PERIODS
COURSE OUTCOMES
The students will be able to.

- Understand the basic mechanisms of organic chemistry
- Acquire knowledge on fundamentals of polymer chemistry
- Analyze the mechanism of addition polymerization in the synthesis of various polymers and polymerization techniques.
- Understand the mechanism of step-polymerization in the synthesis of moulding powders
- Able to calculate the molecular weight of polymers

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Program outcome and Program Specific Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
</tr>
<tr>
<td>Overall CO</td>
<td>3</td>
</tr>
</tbody>
</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

REFERENCES
OBJECTIVES:
i. To impart knowledge of basic principles of thermodynamics via real world engineering examples
ii. To analyse and evaluate cardinal air standard cycles
iii. To analyse and evaluate cardinal Steam power cycles
iv. Summarize the governing concepts of Refrigeration and Air conditioning
v. To introduce various modes of heat transfer, related to real time scenarios of thermodynamics applied in engineering practice

UNIT I BASIC THERMODYNAMICS

UNIT II AIR STANDARD CYCLES AND COMPRESSORS
Cycle, Carnot cycle, Otto, Diesel, Dual combustion and Brayton cycles. Air standard efficiency. Mean effective pressure. Comparison of cycles, Efficiency versus compression ratio, For the same compression ratio and the same heat input Compressors, Classifications of compressors, Single stage and multi stage, Effect of intercooler in multi stage compressor, Perfect and imperfect intercooler, work done by the compressor, Reciprocating, Rotary, Axial, Vane compressors.

UNIT III STEAM AND JET PROPULSION
Formation of steam and its thermodynamic properties, p-v, p-T, T-v, T-s, h-s diagrams. p-v-T surface Properties of steam, Dryness fraction, Quality of steam by steam tables and Mollier chart – Rankine cycle, Work done, Steam rate – Steam Nozzles, Types of nozzles, Friction in nozzles - Simple jet propulsion system – Thrust rocket motor – Specific impulse.

UNIT IV REFRIGERATION AND AIR-CONDITIONING
Principles of refrigeration, Vapour compression – Types of VCR system with respect to condition of vapour, Problems, Vapour absorption types, comparison - Co-efficient of performance (COP). Properties of refrigerants – Basic Principle, Summer, winter and Year round Air conditioning.

UNIT V HEAT AND MASS TRANSFER

TOTAL: 60 PERIODS

(Use of standard Steam tables with mollier chart and Refrigerant tables are permitted)
OUTCOMES:

i. Will demonstrate understanding of the nature of the thermodynamic processes for pure substances of ideal gases
ii. Will interpret First Law of Thermodynamics and its application to systems and control volumes
iii. Will solve any flow specific problem in an engineering approach based on basic concepts and logic sequences.
iv. Will compare and contrast between various types of refrigeration cycles
v. Will get exposed to the basics and modes of heat transfer

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Program outcome and Program Specific Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
</tr>
<tr>
<td>Overall CO</td>
<td>3</td>
</tr>
</tbody>
</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:

Of this course are

1. To learn about the basic properties of fluids.
2. To introduce the concept of incompressible and viscous flows.
3. To have a thorough knowledge on dimensional analysis and model studies.
4. To study the applications of conservation laws to flow through pipes and hydraulic machines.
5. To learn the basics of water turbines, their classification and working principles.

UNIT I  BASIC EQUATIONS

Definition of fluid, Newton’s law of viscosity, Units and dimensions-Properties of fluids, mass density, specific volume, specific gravity, viscosity, compressibility and surface tension, Control volume-application of continuity equation and momentum equation, Incompressible flow, Bernoulli’s equation and its applications.

UNIT II  INCOMPRESSIBLE VISCOUS FLOW

Exact flow solutions in channels and ducts, Couette and Poisuielle flow, laminar flow through circular conduits and circular annuli- concept of boundary layer – measures of boundary layer thickness – Darcy Weisbach equation, friction factor, Moody’s diagram.

UNIT III  DIMENSIONAL ANALYSIS AND MODEL STUDIES


UNIT IV  PUMPS

Euler’s equation – Theory of Roto dynamic 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 – Cavitation in pumps- Reciprocating pump–working principle.

UNIT V  TURBINES

Classification of water turbines, heads and efficiencies, velocity triangles- Axial, radial and mixed flow turbines- Pelton wheel, Francis turbine and Kaplan turbines, working principles – draft tube Specific speed, unit quantities, performance curves for turbines – governing of turbines.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, Students will be able to

**CO1:** Exhibit the basic understanding on fluid properties and fluid statics.

**CO2:** Demonstrate the understanding in fluid kinematics and governing equations.

**CO3:** Use the governing equations for fluid flow problems and understand the elementary plane flows.

**CO4:** Analyse laminar and turbulent flow problems.

**CO5:** Acquire knowledge on the various types of fluid machines.
TEXT BOOKS:
1. Ojha C.S.P, Berndtsson R and Chadramouli P. N., Oxford University Press, 2010

REFERENCES:

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Program outcome and Program Specific Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>2</td>
</tr>
<tr>
<td>CO2</td>
<td>2</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
</tr>
<tr>
<td>CO5</td>
<td>2</td>
</tr>
<tr>
<td>Overall CO</td>
<td>2.4</td>
</tr>
</tbody>
</table>

PROGRESS THROUGH KNOWLEDGE
OBJECTIVES
To make the students to acquire practical skills in the following:
- Identification of different plastics materials
- Synthesis of different plastics materials by various polymerization techniques
- Determination of density & molecular weight of polymers
- Determination of EEW of epoxy resin and acid value of polyester resin

LIST OF EXPERIMENTS
1. Synthesis of Polymers.
2. Bulk polymerization - Preparation of Polymethyl methacrylate.
3. Solution Polymerization - Preparation of polyacrylamide
4. Preparation of Phenol-Formaldehyde, UF and MF resins.
5. Density Determination
6. Identification of Polymers
8. Determination of K value of PVC
10. Determination of EEW
11. Study of Molecular weight distribution (GPC)
12. Study of Thermal Stability of polymers

TOTAL: 60 PERIODS

COURSE OUTCOMES:
- Capability to identify plastics materials
- Able to synthesize various types of polymers
- Able to measure viscosity of polymer solutions.
- Able to determine molecular weight and density of polymers.

REFERENCES
OBJECTIVES

- To understand the various physical characterization and mechanical properties of materials
- To examine the various testing methods of mechanical properties
- To evaluate the basics of internal combustion engine and its performance characteristics
- To measure the performance characteristics of pumps
- To evaluate the flash and fire points of various fuels which may be used as an alternative fuel in IC engine

LIST OF EXPERIMENTS

1. Tension test
2. Torsion test
3. Testing of springs
4. Impact test i) Izod ii) Charpy
5. Hardness test i) Vickers ii) Brinell iii) Rockwell iv) Shore
6. Deflection of beams
7. Performance test on a 4 stroke diesel engine
8. Mass moment of inertia of connecting rods
9. Valve timing of a 4 stroke engine
10. Port timing of a 2 stroke engine
11. Determination of kinematic and dynamic viscosity of given oil blend
12. Determination of flash point and fire point of given fuel sample

TOTAL: 60 PERIODS

OUTCOMES:

Student able to perceive,

- Understand the various physical characterization and mechanical properties of materials
- Examine the various testing methods of mechanical properties
- Evaluate the basics of internal combustion engine and its performance characteristics
- Measure the performance characteristics of pumps
- Evaluate the flash and fire points of various fuels which may be used as an alternative fuel in IC engine

<table>
<thead>
<tr>
<th>Course Outcome</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>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
<th>PSO4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>2</td>
<td>2</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>2</td>
<td>2</td>
<td>1</td>
<td></td>
<td>3</td>
<td>2</td>
<td>2</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>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td></td>
<td>3</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall CO</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></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.

UNIT I  ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY  14

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 – bio geographical 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  8

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  10

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and overutilization of surface and ground water, 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 45 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

OUTCOMES:

Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course:

- **CO1:** Public awareness of environment at infant stage.
- **CO2:** Ignorance and incomplete knowledge has lead to misconceptions.
- **CO3:** Development and improvement in standard of living has lead to serious Environmental disasters.
- **CO4:** Can understand the various acts about prevention and control of pollution.
- **CO5:** Acquire knowledge about human population and human values.

TEXT BOOKS:


REFERENCES:

OBJECTIVES
To impart knowledge to the students in the following:

- On different states of polymer systems in bulk
- Comparative evaluation of properties of polymers with conventional materials
- Concepts of tribology and their significance in polymer systems
- Relationship between structure and electrical properties in polymers
- Specialty properties of polymers and their applications

UNIT I  STATES OF AGGREGATIONS IN POLYMERS
Glassy and rubbery states - Segmental mobility and glass transition Temperature - Thermodynamics and significance - Factors affecting transitions - Multiple transitions–Semi crystalline state - Requirements for crystallization - Crystallization from polymer solutions and melts-Crystal nucleation and growth- Effect of crystallization on polymer properties - Degree of crystallinity - Relationship between Tg and Tm - Non-Newtonian behaviour of polymer melts

UNIT II  DEFORMATION & FAILURE IN POLYMERS
Stress – strain properties of polymers - Comparison with conventional materials - Short term mechanical properties - Flexural strength - Impact strength - Fatigue endurance - Ductile and Brittle failure - Ductile-Brittle transitions - Long term mechanical properties - Creep and Stress relaxation - Boltzmann Superposition principle - Effect of temperature on properties of polymers - viscoelastic properties - Time-Temperature superposition- crazing and cracks and their role in fracture – Fracture and microstructure

UNIT III  TRIBOLOGICAL PROPERTIES OF POLYMERS

UNIT IV  ELECTRICAL AND OPTICAL PROPERTIES OF POLYMERS
Volume and surface resistivity - Polar and Non-polar polymers - Polarization - Dielectric properties of polymers - Factors affecting dielectric properties - Dielectric relaxation spectroscopy in polymers - Dielectric breakdown- Anti static and conducting polymers - Optical applications of polymers - Reflection - Refraction - Light scattering - Light transfer and Absorption - Rheoptical properties - Photoelastic effects and analysis in polymers - Birefringence and orientation in polymers

UNIT V  ENVIRONMENTAL AND SPECIALITY PROPERTIES
Barrier properties: Sorption, Diffusion and Permeation - Chemical resistance, Thermal stability and photo degradation in Polymers - Flammability Characteristics - magneto-rheological behaviour in polymer systems - Properties and applications of polyelectrolytes - properties and applications of hydrogels - Piezoelectric properties of polymers - Shape memory polymer systems - Ablative plastics and their applications

TOTAL: 45 PERIODS
COURSE OUTCOMES:
Students will be able to:
- Classify polymers based on their amorphous and crystalline states
- Understand the effects of viscoelasticity on the performance properties of polymers
- Relate the tribological properties with the performance and failure of polymers in friction related applications
- Choose a dielectric material for a given set of operating conditions
- Identify polymer based novel applications

REFERENCES:

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Program outcome and Program Specific Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
</tr>
<tr>
<td>Overall CO</td>
<td>3</td>
</tr>
</tbody>
</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.
OBJECTIVES

To impart knowledge to the students in the following:

- Fundamental concepts of heat transfer and their applications
- Thermodynamic property relations and their application to fluid flow
- Mass transfer Concepts in the design of Distillation columns, Cooling tower and Dryers
- Particle size reduction and also working principles of different equipments that are used for various mechanical operations

UNIT-I  HEAT TRANSFER


UNIT-II  BASIC THERMODYNAMICS

Thermodynamic Systems and variable - work, heat, internal energy, thermodynamic equilibrium, reversible and irreversible processes - Equation of state - First law - closed and open systems. Steady flow energy equation. Second law, - Concept of Entropy, isentropic efficiency, Maxwell's relation and fluid properties - application to flow processes

UNIT-III  MASS TRANSFER


UNIT-IV  AGITATION AND DRYING


UNIT-V  SEPARATION PROCESSES


TOTAL: 45 PERIODS
COURSE OUTCOMES:

• Students introduced to various types of unit operation in chemical industries.
• Students get an understanding on the basics of heat and mass transfer mechanism
• Students will apply the principles of heat and mass transfer in rubber and plastics processing
• Students will be able to comprehend the agitation of liquids, absorption and adsorption and machinery used for the process.
• To get the overview of equipment used to perform various mechanical operations and problems associated during implementation and applications

REFERENCES:


<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Program outcome and Program Specific Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>2</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
</tr>
<tr>
<td>Overall CO</td>
<td>3</td>
</tr>
</tbody>
</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively
OBJECTIVES

- To understand the concept of flexible polymer chains and difference between rubbers, plastics and fibres in terms of Tg
- To appreciate the influence of chemical structure on various properties of rubbers
- To acquire basic knowledge of Natural rubber—production, properties & uses
- To become familiar with manufacture, properties and uses of synthetic and high Performance rubbers
- To become familiar with the concept, manufacture and properties of TPE's

UNIT - I  INTRODUCTION

Rubber Elasticity – Requirements for rubber elasticity- flexible chain and Tg- Effect of chemical structure on the properties of rubbers - Natural Rubber Latex, tapping, processing, properties and applications – Conversion of Latex into dry rubber – Properties of dry rubber – Classification based on technical specifications – mastication of NR

UNIT - II  DIENE RUBBERS

Modifications of Natural Rubber–Applications –epoxidised natural rubber - Synthetic polyisoprene- SBR-solution SBR-recent advances in solution SBR – BR-Polyalkenamers and polynorbornene-Nitrile Rubber NBR-PVC blends, Butyl Rubber, halobutyl rubber, Polychloprene Rubbers

UNIT - III  SPECIAL PURPOSE ELASTOMERS

Ethylene Propylene Rubber and Ethylene – Vinyl acetate copolymers – Elastomers based on modified polyethylene – Acrylate rubbers Polysulphide rubbers- polyether rubbers – selection criteria for the special purpose rubbers for various applications

UNIT - IV  HIGH PERFORMANCE ELASTOMERS

HNBR- Fluoroelastomers-VDF based fluoro rubbers-perfluoro rubbers- base resistant rubbers- silicone elastomers- Preparation, structure, properties and applications – liquid silicone rubbers – silicones in medical applications

UNIT - V  POLYURETHANES AND THERMOPLASTIC ELASTOMERS


TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to:

- Differentiate between rubbers, plastics and fibres in terms of Tg
- Relates chemical structure to performance and processing properties of rubbers
- Get knowledge about preparation, properties and uses of various rubbers
- Understands the importance of TPEs, their preparation and properties and uses
- Suggest rubbers for specific end uses
TEXT BOOK:

REFERENCES

<table>
<thead>
<tr>
<th>Course Outcome</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>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
<th>PSO4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>--</td>
<td>--</td>
<td>-</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1</td>
<td>3</td>
<td>--</td>
<td>--</td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1</td>
<td>3</td>
<td>--</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1</td>
<td>3</td>
<td>--</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>1</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1</td>
<td>1</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1</td>
<td>3</td>
<td>--</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1</td>
<td>1</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Overall CO</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>--</td>
<td>--</td>
<td>1</td>
<td>1</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1</td>
<td>3</td>
<td>--</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.
OBJECTIVES
To impart knowledge to the students in the following:

- Classification of polymers
- Preparation, properties and uses of PE and PP
- Styrenics and acrylics preparation, properties and uses
- PVC technology
- Additives for plastics

UNIT- I  INTRODUCTION TO PLASTICS
Plastics – Classification – Structure – Property relationship (effect on thermal, mechanical, optical, chemical, Barrier & electrical properties)

UNIT - II  OLEFINIC PLASTICS
Manufacturing methods – structure / property relationships, processing & applications of PE, PP & Copolymers of PE & PP– Metallocene polymers

UNIT - III  STYRENICS & ACRYLICS
Styrenics: Manufacturing methods – Structure - property relationship, processing & applications of PS, SAN, ABS, HIPS & EPS.
Acrylics: Manufacturing Methods – Structure - property relationship processing & applications of PAN, PMMA & their copolymers

UNIT - IV  PVC AND FLOURO PLASTICS
Manufacturing, Structure - property relationship, additives for PVC - Processing applications of pPVC, uPVC, PVC pastes, co polymers of PVC, blends & alloys of PVC, Testing of PVC resin, PVC compounds & Products, flourine containing polymers

UNIT – V  ADDITIVES FOR PLASTICS

TOTAL: 60 PERIODS

OUTCOMES:
Students will be able to

- Understand classification of polymers
- Know the properties and applications of PE and PP
- Understand the properties and applications of PS, PVC and acrylics
- Select an appropriate polymer for the required application
- Demonstrate the necessity for new material development to replace the existing one.
REFERENCES


<table>
<thead>
<tr>
<th>Course Outcome</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>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
<th>PSO4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall CO</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively
OBJECTIVES
To make the students to:
- Understand the concepts of drawing
- Construct the machine elements
- Assemble the drawing by computer drafting
- Use dimensions with standard dimensioning rules.
- Allocate geometrical tolerances and to develop part drawing.

Introduction to machine drawing & production drawing - classification of drawing - Standardization – Orthographic and isometric projections- Conversion of orthographic to isometric drawing and vice versa- sectional views. Reviews of the concepts of limits, tolerance, fits, surface roughness, and symbols terminology used in Production drawing.

COMPUTER AIDED PRODUCTION DRAFTING
Detailed part drawing and assembly drawings (with suitable tolerances, machine symbols, specification of fit).
1. Screw jack
2. Connecting rod Assembly
3. Plummer block
4. Machine vice
5. Stop valve
6. Universal coupling and knuckle joint
7. Hydraulic & Pneumatic Assembly
8. Injection moulding toggle type clamping
9. Polymerization Plant Layout - I
10. Polymerization Plant Layout - II

OUTCOMES
Students will be able to:
- Describe and identify the parts, to choose the functions and operations of a CAD system and draw up specifications.
- Know the different techniques of graphical representation for simple parts and assemblies
- Apply the correct current technical drawing rules.

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Program outcome and Program Specific Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
</tr>
<tr>
<td>CO3</td>
<td>2</td>
</tr>
<tr>
<td>Overall CO</td>
<td>3</td>
</tr>
</tbody>
</table>
1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

**TEXT BOOK**

**REFERENCES**
OBJECTIVES
- To make the familiarize with simple quality control test for the given rubber latex.
- To perform simple tests for identification of elastomers.
- To carry out tests related to properties of rubber and its additives.

LIST OF EXPERIMENTS
1. Determination of Total Solids Content, Dry Rubber Content., KOH number of natural rubber Latex
2. Estimation of total alkalinity of the latex
3. Determination of volatile matter, dirt, ash content in Rubber from Natural sources
4. Estimation of Cu, Fe and Mn in rubber by colorimetry
5. Rubber identification pyrolysis and spot test by specific reagents
6. Soxhlet extraction – determination of total extractables
7. Rapid reflux extract
8. Chemical analysis of synthetic rubber components and vulcanisates
9. Determination of structure of carbon black
   (i) DBP absorption, (ii) IAN (iii) Surface area Calculation
10. Estimation of total and free sulphur in rubber products
11. Estimation of process oils
    (i) Aniline point, (ii) Flash point (iii) Viscosity (iv) Density
13. Knowledge about Spectroscopy – UV – Vis and FTIR
14. TGA / DSC analysis of Rubber Compounds.
15. TLC Analysis

TOTAL: 60 PERIODS

OUTCOMES
- Identification of rubber
- Analyze the physical properties of NR latex.
- Chemical analysis of synthetic rubber
- Able to carry out the specifications test and interpretation of data’s of various rubbers

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively
OBJECTIVES:
- Sketch the Evolution of Management.
- Extract the functions and principles of management.
- Learn the application of the principles in an organization.
- Study the various HR related activities.
- Analyze the position of self and company goals towards business.

UNIT I  INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS  9
Definition of Management – Science or Art – Manager Vs Entrepreneur- types of managers-
managerial roles and skills – Evolution of Management –Scientific, human relations , system and
contingency approaches– Types of Business organization- Sole proprietorship, partnership,
company-public and private sector enterprises- Organization culture and Environment – Current
trends and issues in Management.

UNIT II  PLANNING  9
Nature and purpose of planning – Planning process – Types of planning – Objectives – Setting
objectives – Policies – Planning premises – Strategic Management – Planning Tools and
Techniques – Decision making steps and process.

UNIT III  ORGANISING  9
Nature and purpose – Formal and informal organization – Organization chart – Organization
structure – Types – Line and staff authority – Departmentalization – delegation of authority –
Centralization and decentralization – Job Design - Human Resource Management – HR Planning,
Recruitment, selection, Training and Development, Performance Management , Career planning
and management.

UNIT IV  DIRECTING  9
Foundations of individual and group behaviour– Motivation – Motivation theories – Motivational
techniques – Job satisfaction – Job enrichment – Leadership – types and theories of leadership –
Communication – Process of communication – Barrier in communication – Effective
communication – Communication and IT.

UNIT V  CONTROLLING  9
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.

TOTAL: 45 PERIODS
OUTCOMES:
CO1: Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling.
CO2: Have same basic knowledge on international aspect of management.
CO3: Ability to understand management concept of organizing.
CO4: Ability to understand management concept of directing.
CO5: Ability to understand management concept of controlling.

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Program outcome and Program Specific Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
<td>2</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
</tr>
<tr>
<td>CO4</td>
<td>2</td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
</tr>
<tr>
<td>Overall CO</td>
<td>2.6</td>
</tr>
</tbody>
</table>

TEXT BOOKS:

REFERENCES:
RP5501 RUBBER COMPOUNDING L T P C
3 0 0 3

OBJECTIVES

- To introduce the technical classification of rubber mixes
- To impart role of chemical structure of fine chemicals on rubber compounding
- To introduce to the science of filler, short fibre, flexibilisers on formulations
- To study the quality related concepts
- To understand the compound design requirement of various rubber products

UNIT I SCIENCE OF COMPOUNDING
9
Technical approach to compound development, standard practices, compounding for general and specific application, design of rubber compounds, processability, properties, performance and cost

UNIT II COMPONENTS
9
Compounding additives, cross linkers, age resistors, reinforcingers, process enablers, extenders, flexibilisers, thermal aging resistors, special functional additives, homogenisers. Safe handling of various rubber chemicals - environmental regulations.

UNIT III COMPOUNDING FOR GENERAL PURPOSE RUBBERS
9
Hardness specified NR, SBR, compounds for age resistance, compression set resistance, flexural fatigue, abrasion resistance, vibration mounts and isolation pads, bridge bearing, conveyor belting.

UNIT IV COMPOUNDING FOR SPECIFIC END USES
9
Principles and materials for EPDM, CR, halobutyls, nitriles, silicones, fluorocarbons, chlorosulphonated polyethylenes, acrylates, polyurethanes, hydrogenated nitriles.

UNIT V QC ASPECTS
9
Application of QC, statistics on compounding, DOE, traceability, role of specific gravity on end use, sustainability, control and disposal of off spec compounds, matching of hardness.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to apply the concept of science in various addition, design a formulation for a specific requirement
- Apply basic statistics on compounding and the properties
- Appreciation for the choice of general purpose rubbers in a set of given conditions
- Theoretical background on the role of rubber chemistry and fine chemicals in solvent, thermal, oxidative environments
- Understand the costing aspects of compounds- volume, specific gravity and mass balance

TEXTBOOKS

REFERENCES

1. Bayer Handbook on Rubber Technology,
2. Vanderbilt Handook,
3. NOCIL manual,
4. Rubber Technology, Maurice Morton.

<table>
<thead>
<tr>
<th>Course Outcome</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>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
<th>PSO4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Overall CO</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively
OBJECTIVES

- To impart the knowledge on various rubber processing machinery construction and its operations
- To understand the various rubber product manufacturing process
- To introduce the basic concept on plant layout and plant services for rubber product manufacturing

UNIT-I COMPOUNDING AND MIXING OPERATIONS 10


UNIT-II FORMING OPERATIONS 10


UNIT-III MOULDING AND OTHER VULCANISING TECHNIQUES 10

Compression, transfer and injection molding process – Blanks & pre-heating techniques, preparation of surfaces for bonding, common problems in molding. Vulcanization –Batch vulcanization- Autoclaves, Hot air chambers - curing of hand built up products - tank, pipe lining, roller covering. Continuous vulcanization - L.C.M. (Liquid Curing Media), Microwave curing, Roto cure, Hot air oven, common problems in curing.

UNIT-IV MANUFACTURE OF RUBBER PRODUCTS 10

Belting, Hoses, Cables, Rubber Footwear, Sportsgoods, molded products -Rubber to Metal bonded products- Bridge Bearings, Engine mountings, Finishing of rubber components.

UNIT-V PLANT DESIGN FOR RUBBER COMPONENT MANUFACTURING 5

Plant layout design, Plant services, Power transmission, Hydraulics, Heating and cooling systems - automation, Safety systems, man power requirements, Storage and Flow pattern of materials, Energy conservation- Case study.

TOTAL : 45 PERIODS

OUTCOMES

Student should be able to:

- Acquire knowledge on various rubber processing machinery and its operation
- Familiarize with various rubber product manufacturing process
- Design a plant layout and familiarize with plant services for rubber product manufacturing
REFERENCES


<table>
<thead>
<tr>
<th>Course Outcome</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>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
<th>PSO4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Overall CO</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.
OBJECTIVES
To impart knowledge in:
• Fundamentals and types of composites
• Properties and applications of various thermoset resins.
• Various reinforcements and additives used in composite manufacture.

UNIT- I INTRODUCTION
Historical Development- Concept of Composite- Basic Definitions and Classifications of Composites - MMC, CMC and PMC- Advantages and Limitations of Composites Materials

UNIT- II MATRIX MATERIALS - THERMOSETS-I
PF, UF and MF Resins – Preparation properties and uses – Moulding powders – Additives
Epoxy-Preparation properties and uses UnsaturatedPolyester, Vinyl Ester

UNIT-III MATRIX MATERIALS - THERMOSETS-II
Cyanate Ester, Furan resins, Polyimides and BMI’s - preparation, properties and applications
phthalonitrile resins, Benzoxazine resin – Preparation properties and applications

UNIT IV FIBROUS REINFORCEMENTS
Reinforcements-Classification-Role and Selection of fibers - Glass fibre -classification, Manufacture and properties, Carbon fibre -classification, Manufacture and properties, Aromatic polyamides ,PE fibres, Boron Fibres, Natural Fibres

UNIT – V ADDITIVES FOR COMPOSITES
Cross linkers, Coupling agents, Fillers -particulate, Whiskers, Nano fillers - carbons based, silica based, cellulose based, self reinforcing composites

TOTAL: 45 PERIODS

OUTCOMES:
• Students acquire fundamental knowledge on composites and its classification
• Students acquire knowledge about various matrix materials used
• Students acquire sound information on fibrous reinforcements
• Students understand the importance of additives in composite manufacture
REFERENCES

5. Debatta Ratna, "Handbook of Thermoset Resins", Smithers – A Smithers Group Company, Shawbury, Shrewsbury, Shropshire, SY4 4NR, United Kingdom

<table>
<thead>
<tr>
<th>Course Outcome</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>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
<th>PSO4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Overall CO</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively
OBJECTIVES

• To study the flow behaviour of plastics
• To understand various primary processing techniques
• To understand various secondary processing techniques

UNIT I  RHEOLOGY AND MELT PROCESSING OF PLASTICS  9

Flow behavior – Flow analysis for Power law fluid - Viscosity and polymer processing, Melt flow index, capillary rheometer - thermal behaviour, crystallization, orientation.

UNIT II  EXTRUSION PROCESS & BLOW MOULDING  12

Extruderc components and their functions – Geometry & various types of extruderscrews - Barrierscrews, flow analysis with extruder, two-stage, ventedextruders;– Plastics compounding and its machinery. Extrusion of pipes, profiles, films and sheets – Co extrusion - Blowmolding - Extrusion blowmolding - Injection Blowmolding - Stretch Blowmolding – Wall thickness and parison programming - Advanced blow moulding techniques - troubleshooting

UNIT III  INJECTION MOULDING OF PLASTICS  12


UNIT IV  MOULDING OF THERMOSETS  6

Thermosetting compounds—properties and uses; compression molding - preform and preheating - curing - process control; transfer molding - intergal and auxiliary mould - process control - mould; thermoset injection moulding

UNIT V  THERMOFORMING, CALENDARING AND ROTATIONAL MOULDING  6


TOTAL: 45 PERIODS

OUTCOMES

• Familiarize with various types of additives used for plastics and its mixing machinery.
• Acquaint of various parameters to operate injection molding machine.
• Realize the application of different types of injection molds.
• Gain knowledge of principle and process of extrusion, calendaring and blow molding operations.
• Aware of thermoforming, rotational molding and finishing, machining and welding of plastics.
REFERENCES:

<table>
<thead>
<tr>
<th>Course Outcome</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>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
<th>PSO4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall CO</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium), and Substantial (High) respectively.
OBJECTIVES

To make the student to familiarize with

• Mixing studies of various rubbers
• Processing and curing studies of various rubbers.
• Preparation of samples for different testing of rubbers and its hands on experience.

The students will prepare using the rubber & rubber materials as appropriate using the process machinery as suggested in the following titles

Ex No:1 Mixing behaviour of NR on two roll mill
Ex No :2 Mixing study of carbon black filled NR
Ex No: 3 Mixing study of carbon black filled SBR
Ex No: 4 Mixing study of carbon black filled SBR & NR blend
Ex No: 5 Mixing study of carbon black filled EPDM
Ex No: 6 Mixing study of carbon black filled NBR
Ex No: 7 Extrusion characteristics of a filled rubber mix- NR
Ex No: 8 Extrusion characteristics of a filled rubber mix- SBR
Ex No: 9 Extrusion characteristics of a filled rubber mix- NBR
Ex No: 10 Extrusion characteristics of a filled rubber mix- EPDM
Ex No: 11 Curing Process of Rubber Compound- NR filled
Ex No: 12 Curing Process of Rubber Compound- SBR filled
Ex No 13 Curing Process of Rubber Compound- NBR filled
Ex no: 14 Curing Process of Rubber Compound- EPDM filled

OUTCOMES:

• Operate and mix rubber compound using 2-roll mixing mill.
• Optimize the cure parameters of various rubber compounds.
• Mold rubber compounds using molds such as tensile, flex, buttons.
• Demonstration of the skill acquired to operate and analyze the problems in various rubbers processing equipment.
• Capability to carry out testing of rubber compounds and observe the behavior of the material under the test conditions.
• To perform the cure characteristics and mechanical testing of rubbers.

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Program outcome and Program Specific Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>1</td>
</tr>
<tr>
<td>CO2</td>
<td>2</td>
</tr>
<tr>
<td>CO3</td>
<td>1</td>
</tr>
<tr>
<td>CO4</td>
<td>2</td>
</tr>
<tr>
<td>CO5</td>
<td>1</td>
</tr>
<tr>
<td>Overall CO</td>
<td>1</td>
</tr>
</tbody>
</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively
OBJECTIVES

- Provide the hands on experience in various rubber and plastics testing instruments,
- Know the sample preparation Techniques
- Test the Compound and vulcanizate properties.

RUBBER TESTING EXPERIMENTS

RUBBER COMPOUND TESTING

1. Determination of Mooney Viscosity of Raw and Compounded rubber
2. Determination of Scorch and Cure parameters of Compounded rubber

RUBBER VULCANIZATE TESTING

1. Hardness, Resilience,
2. Tensile properties, Tear strength,
3. Fatigue (crack initiation and propagation)
4. Abrasion resistance, Compression Set Resistance
5. Hot air aging Resistance, Swelling Resistance

PLASTICS TESTING EXPERIMENTS

1. Tensile Testing of Plastics
2. Flexural Testing of Plastics, Compressive Testing of Plastics
3. Impact Testing of Plastics, Falling Dart Impact testing for films
4. Arc Testing of Plastics
5. Melt flow index, Bulk Density
6. HDT & VSP
7. COF, 11. ESCR

TOTAL: 60 PERIODS

COURSE OUTCOMES:

- To prepare and characterize the product for testing
- Understand the importance of standards and specifications.
- Familiarization about various test methods on Rubber and Plastics used in industry.
- Access and analyze the properties and performance of the rubber and plastics products in service condition.

TEXT BOOKS:

REFERENCES:

<table>
<thead>
<tr>
<th>Course Outcome</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>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
<th>PSO4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall CO</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively
OBJECTIVES
To impart knowledge
- on fundamentals of product design
- on plastics product design
- on composite product design
- on latest tooling concepts

UNIT I INTRODUCTION TO PLASTICS PRODUCT DESIGN 9
Product design, steps for product design, factors affecting product design - size, shape and function - form and function - Aesthetics, Ergonomics - shrinkage, Flash lines. Undercuts - External & Internal - Wall thickness - variances in wall thickness - Emphasize on designing with engineering plastics. Taper / draft - Fits & Tolerances.

UNIT II PLASTICS PRODUCT DESIGN I 9

UNIT III PLASTICS PRODUCT DESIGN II 9
Design of integral hinges, hinges and snap fits for boxes and assembly of moulded parts. Moulded threads—thread pieces—threaded holes. Inserts-Materials-Selection of metal for inserts-minimum wall thickness of material round inserts-relieving moulding stresses around inserts-location of inserts in the part- moulded in inserts-pressed in inserts

UNIT IV TOOLING ASPECTS 9
Quality and economy-tooling aspects on product design-process variables and product design-product design appraisal. Product design limitations-shrinkage and tolerance-minimum wall thickness mechanical properties-creep properties-end use requirements with case studies. Prototype development – rapid prototyping techniques – stereolithography.

UNIT V COMPOSITES PRODUCT DESIGN 9

TOTAL: 45 PERIODS

OUTCOMES
1. Students will acquire the knowledge and principles of basic plastics product design.
2. To enable the students to understand the concepts of plastics and composite product design.
3. To learn the design for threaded moulds and insert moulded products.
4. To acquire knowledge on tooling aspects.
TEXTBOOKS

REFERENCES
3. Plastics Product Design Engineering Hand Book- By Dubois, H.

<table>
<thead>
<tr>
<th>Course</th>
<th>Program outcome and Program Specific Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
</tr>
<tr>
<td>Overall</td>
<td>3</td>
</tr>
</tbody>
</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively
OBJECTIVES

- To study the design fundamentals for structural and product designs.
- To enhance the knowledge on designing of rubber components.
- To appreciate the role of rubber in noise and vibration control.
- To relate viscoelasticity of rubber in load bearing and space filling applications.

UNIT I   DEFORMATION, LOADING AND RESPONSE    9
Spring rates- creep- stress relaxation- rubber in compression- simple geometries- blocks-
geometry and materials on spring characteristics- metal bonded rubber assemblies- design
for spring rates.

UNIT II  DESIGN FOR COMBINED DEFORMATION    9
Rubber product in simple shear- axial shear- rotary shear- sleeves- bush for torsion loads-
shear spring rates- compression and shear in combination- material selection.

UNIT III  RUBBER DESIGN FOR DAMPING AND DYNAMIC CONDITION      9
Dynamic mechanical properties and media- hysteresis- heat generation- vibration control-
damping- engine mounts, bearings and earthquake resistant bearings- compound design.

UNIT IV  SEALS AND SEALABILITY OF RUBBER AND PRODUCT DESIGN  9
Rubber in fluid sealing - type of seals- static seals, gaskets, couplings, hose- profile-
beltings- conveyor and power transmission- failure mechanism and remedial measures.

UNIT V  MOULD DESIGN FOR RUBBER PRODUCTS    9
Molds for rubber products- compression molds- transfer molds- injection molds- rubber
products for specialty applications- nuclear- aerospace- naval fields.

TOTAL: 45 PERIODS

OUTCOMES

- Demonstrate the role of rubber elasticity in product application
- To understand rubber application in load bearing, sealing and vibration control
- The student gets some idea about design aspects of materials and product geometry.
- Compare the role of rubber hardness and form factor in fatigue life and strength of
  products.
REFERENCES

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Program outcome and Program Specific Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
</tr>
<tr>
<td>Overall CO</td>
<td>3</td>
</tr>
</tbody>
</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.
OBJECTIVES

- To understand the basic and advanced composite processing techniques
- To identify, describe and evaluate the properties of fibre reinforcements, polymer matrix materials and commercial composites.
- To analyze the elastic properties and simulate the mechanical performance of composite laminates
- To understand and predict the failure behavior of fibre-reinforced composites
- To perform various tests on composites

UNIT I  MECHANICS OF COMPOSITES  9


UNIT II  DESIGN OF COMPOSITES  9


UNIT III  FABRICATION  12


UNIT IV  TESTING OF COMPOSITES  9


UNIT V  COMPOSITES FOR SPECIFIC APPLICATIONS  6

Aircraft radomes - Composite leaf-spring – composite pressure vessel – tubes for space stations truss structure – Boat hull – automotive shaft – Chemical transportation pipe - solid rocket motors- windmill blades – Orthopedic applications – Application in Dentistry.

TOTAL: 45 PERIODS
OUTCOMES:
Students will be able to
- Acquire the knowledge of various techniques involved in manufacturing of composites
- Apply basic principles of mechanics to composite materials
- Select raw materials for a lamina, chose the proper stacking sequence of laminas, and design a laminated composite structure to best suit specific applications
- Predict the failure of laminate based on various failure theories.
- Apply knowledge of composite mechanical performance and manufacturing methods to a composites in design/main project

REFERENCES:

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Program outcome and Program Specific Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
</tr>
<tr>
<td>Overall CO</td>
<td>3</td>
</tr>
</tbody>
</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively
OBJECTIVE

- To provide hands on experience in designing and drawing of moulds and dies for plastics and rubber products.
- To impart the knowledge in designing of extrusion dies.
- To train the students to analyze the flow behavior of plastics materials for specific products by mould flow analysis software’s.

LIST OF EXPERIMENTS
I DESIGN AND DRAWING OF MOULDS

1. Hand Mould
2. Semi – Injection Mould
3. Automatic Mould – with working area calculations
4. Multi Cavity – Multiday Light Mould
5. Split Cavity – Finger Cam Mechanism
6. Split Cavity – Dog Leg Cam Mechanism
7. Split Cavity – Cam tract Actuation
8. Side Core – Hydraulic Actuation
9. Collapsible core – Mechanism
10. Gear Core – Mechanism
11. Compression Mould
12. Transfer Mould

II DESIGN AND DRAWING OF EXTRUSION DIES

1) Hot and Cold Extrusions
2) Extrusion of Tubes and profiles

II. ANALYSIS OF INJECTION MOULDING OF SIMPLE PRODUCTS USING MOULD FLOW ANALYSIS SOFTWARES


TOTAL: 60 PERIODS

OUTCOMES

Upon completion of this course, the students can able to
- understand mould and die design and drawing.
- design a mould for complex plastics product with allowances
- design a gate system, ejection system, and cooling system for particular mould
- analyze the flow behaviour of plastics in every stages of forming such as filling, packing, cooling, warping etc.
<table>
<thead>
<tr>
<th>Course Outcome</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>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
<th>PSO4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Overall CO</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

RP5612 PLASTICS PROCESSING LAB L T P C 0 0 4 2

OBJECTIVE
- To provide hands on experience in various plastics processing equipments.

LIST OF EXPERIMENTS
1. Compounding and Mixing of plastic and their characteristics.
2. Semi and Fully Automatic Injection Molding-Piston Type.
3. Injection moulding
4. Extrusion of plastics-Single screw and Twin screw extruder
5. Compression moulding
6. Composites-Hand lay-up technique Gelation
7. Study of Injection and Compression molds.
8. Study of machining of plastics
9. Study of Adhesive materials
10. Determination of gel point

TOTAL: 60 PERIODS

COURSE OUTCOMES
- Apply practical skills in handling various plastic processing equipments
- Able to identify the different processing defects
- Able to troubleshoot the processing problems.

TEXT BOOKS
REFERENCES
2. Innovation in Polymer Processing - By Stevenson., 1996

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Program outcome and Program Specific Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO  1  PO  2  PO  3  PO  4  PO  5  PO  6  PO  7  PO  8  PO  9  PO1  0  PO1  1  PO1  2  PSO  1  PSO  2  PSO  3  PSO  4</td>
</tr>
<tr>
<td>CO1</td>
<td>3  3  3  2  2</td>
</tr>
<tr>
<td>CO2</td>
<td>3  3  3  2  2</td>
</tr>
<tr>
<td>CO3</td>
<td>3  3  3  2  2</td>
</tr>
<tr>
<td>Overall CO</td>
<td>3  3  3  2  2</td>
</tr>
</tbody>
</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

RP 5701 TECHNOLOGY OF TYRES AND TUBES

OBJECTIVES
- To impart the relationship between rubberiness and tyre functions
- To impart the knowledge on geometry, components and their materials.
- To impart the indispensability of pneumatic tyre in handling, performance
- To impart tyre manufacturing, process flow and inspection.
- To impart the role of material science on the emerging tyre requirements.

UNIT I TYRE FUNCTIONS
Functions of pneumatic tyres, tyre geometry, tyre sizes, nomenclature, role of inflation pressure, deflection, generic designs, comparison of diagonal and radial construction.

UNIT II TYRE MECHANICS
Tyre load, ply rating, tubeless construction, tyre components- primary and secondary, role of dimensions on carcass and bead stress, tyre forces, spring rates and moments.

UNIT III TYRE DESIGN
Tyre composites- textile and steel cord- materials and methods, adhesion techniques, measurement, fatigue and endurance, role of cord angle in diagonal and radial, shear relationship.

UNIT IV TYRE PERFORMANCE
Tyre performance- role of components and construction, cornering, traction, tyre handling, rolling resistance, tread design, abrasion resistance, wet grip.

UNIT V TYRE MANUFACTURE AND TESTING
Tyre and tube manufacturing, Tyre testing and failure analysis, disposal of end of life cycle, tyre retreading, regulations, smart tyres, run flat tyres, TPMS

TOTAL: 45 PERIODS
OUTCOMES
Students will have acquired knowledge in the following:
- Basics of tyre terminology and construction
- Various forces experienced by the tyre
- Various components of making a tyre and their functions
- Important performance properties of tyre and their optimization
- Key Technologies involved in tyre manufacture and tyre recycling

REFERENCES

<table>
<thead>
<tr>
<th>Course Outcome</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>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
<th>PSO4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Overall CO</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.
In the VII Semester a comprehension test will be conducted with at least one written test in the middle of the Semester with Objective type of questions and a terminal viva-voce test in order to evaluate the comprehension of the students in all the subjects covered in the earlier semesters.

**TOTAL: 60 PERIODS**

**OUTCOMES**
CO1 Comprehend the courses studied  
CO2 Make the students technically stronger  
CO3 Prepare the students to face the interview

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Program outcome and Program Specific Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1  PO2  PO3  PO4  PO5  PO6  PO7  PO8  PO9  PO10  PO11  PO12  PSO1  PSO2  PSO3  PSO4</td>
</tr>
<tr>
<td>CO1</td>
<td>3     3     3</td>
</tr>
<tr>
<td>CO2</td>
<td>3     3     3</td>
</tr>
<tr>
<td>CO3</td>
<td>3     3     3</td>
</tr>
<tr>
<td>Overall CO</td>
<td>3     3     3</td>
</tr>
</tbody>
</table>
The students are expected to carryout one design project in the following fields of Rubber/Plastics Technology:

1. Computer aided Drafting and Design
2. Product Development and Analysis
3. Development of Machines for Rubber Processing
5. Mould / Die Design
6. Process Control / Modification
7. Plant Layout

TOTAL: 90 PERIODS

OUTCOMES

CO1: Perform extensive literature survey on proposed research area
CO2: Identify the research gap and formulate the objectives
CO3: Evaluate the results and prepare the final report

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Program outcome and Program Specific Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>1</td>
</tr>
<tr>
<td>CO2</td>
<td>1</td>
</tr>
<tr>
<td>CO3</td>
<td>1</td>
</tr>
<tr>
<td>Overall CO</td>
<td>1</td>
</tr>
</tbody>
</table>
All the students have to undergo industrial training of **FOUR weeks** duration in recognized establishments, at the end of which they have to submit a report. The internal assessment will be based on the report and presentation and the examination marks, on viva voce examination.

**OUTCOMES**

CO 1 Get hands-on experience on various machineries

CO 2 Apply the knowledge gained from theory courses

CO 3 Apply the experience gained from various laboratory courses

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Program outcome and Program Specific Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
</tr>
<tr>
<td>Overall CO</td>
<td>3</td>
</tr>
</tbody>
</table>
Each student will be assigned a project involving some design and fabrication work as well as theoretical and experimental studies on problems related to Rubber and Plastics Technology. Continuous internal assessment marks for the project will be given during project review meeting. The student has to prepare and present a detailed project report at the end of the semester and give a presentation about the work done. End semester examination mark will be based on viva voce examination.

TOTAL: 240 PERIODS

OUTCOMES

CO 1 Able to identify research gap

CO 2 Able to propose the objectives

CO 3 Able to design and develop process and products

CO 4 Able to apply the knowledge gained from various theory and Lab courses

CO 5 Triggers the confidence to become entrepreneurs

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Program outcome and Program Specific Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>1</td>
</tr>
<tr>
<td>CO2</td>
<td>1</td>
</tr>
<tr>
<td>CO3</td>
<td>1</td>
</tr>
<tr>
<td>CO4</td>
<td>1</td>
</tr>
<tr>
<td>CO5</td>
<td>1</td>
</tr>
<tr>
<td>Overall CO</td>
<td>1</td>
</tr>
</tbody>
</table>
LIST OF ELECTIVES

MA5353  NUMERICAL METHODS  L T P C
3 1 0 4

OBJECTIVE

- To introduce the importance of numerical concepts in solving the problems.

UNIT I  SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS  12


UNIT II  INTERPOLATION AND APPROXIMATION  12

Interpolation with unequal intervals – Lagrange interpolation – Newton’s divided difference interpolation – Cubic Splines – Interpolation with equal intervals – Newton’s forward and backward difference formulae – Linear curve fitting – Least square method.

UNIT III  NUMERICAL DIFFERENTIATION AND INTEGRATION  12


UNIT IV  INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS  12


UNIT V  BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS  12

Finite difference methods for solving two-point linear boundary value problems. Finite difference techniques for the solution of two dimensional Laplace’s and Poisson’s equations on rectangular domain – One dimensional heat-flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.

TOTAL:60 PERIODS

TEXT BOOKS:


REFERENCES:

OBJECTIVE
This course aims to provide necessary knowledge and attitude to understand and appreciate the process of starting and developing a new venture.

UNIT I QUALITY OF ENTREPRENEURS 8

UNIT II PLANNING AND DEVELOPMENT 8

UNIT III FINANCIAL MANAGEMENT 10

UNIT IV ORGANIZATIONAL MANAGEMENT 9
Building Team – creating growth oriented organizational culture. Employee motivation, retention strategies. Organizational structure with clear roles, responsibilities, authorities and accountabilities. Attracting talent with ESOP and other incentives and benefits. Training development to enhance the quality of operators, supervisors and managers of the tannery.

UNIT V BUSINESS DEVELOPMENT STRATEGIES 10

TOTAL : 45 PERIODS
OUTCOMES:
At the end of this course, the students are expected to

CO1. Have knowledge on entrepreneurial tasks such as, generating idea, planning business
CO2. Have knowledge on financial management
CO3. Understand the organizational management and business development strategies.

REFERENCES:

Course Articulation Matrix:

<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>Statement</th>
<th>PO 1</th>
<th>PO 2</th>
<th>PO 3</th>
<th>PO 4</th>
<th>PO 5</th>
<th>PO 6</th>
<th>PO 7</th>
<th>PO 8</th>
<th>PO 9</th>
<th>PO 10</th>
<th>PO 11</th>
<th>PO 12</th>
<th>PS O1</th>
<th>PS O2</th>
<th>PS O3</th>
<th>PS O4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Have knowledge on entrepreneurial tasks such as, generating idea, planning business</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
<td>Have knowledge on financial management</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CO3</td>
<td>Understand the organizational management and business development strategies.</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>ENTREPRENEURSHIP DEVELOPMENT</td>
<td></td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.
UNIT I  
INTRODUCTION  

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II  
GENERAL METHODS OF PREPARATION  

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III  
NANOMATERIALS  

Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, 92 Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO_2, MgO, ZrO_2, NiO, nanoalumina, CaO, AgTiO_2, Ferrites, Nanoclays-functionalization and applications-Quantum wires, Quantum dotspreparation, properties and applications

UNIT IV  
CHARACTERIZATION TECHNIQUES  

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nano-indentation

UNIT V  
APPLICATIONS  


TEXT BOOKS:  


REFERENCES:  

COURSE OBJECTIVES: The main learning objective of this course is to prepare the students for:

1. Explaining basic concepts of management; approaches to management; contributors to management studies; various forms of business organization and trade unions function in professional organizations.
2. Applying various functions of management in professional organization.
3. Applying organizational theory in professional organization.
4. Applying the principles of productivity and operations management in professional organization.
5. Applying modern concepts and marketing in management in professional organization.

UNIT I  INTRODUCTION TO MANAGEMENT  9
Definition and functions of Management - Approaches to the study of Management – Mintzberg’s Ten Managerial Roles – Principles of Taylor; Fayol; Weber; Parker – Forms of Organization: Sole Proprietorship; Partnership; Company (Private and Public); Cooperative – Public Sector Vs Corporate Organization – Business Environment: Economic; Social; Political; Legal – Trade Union: Definition; Functions; Pros and cons.

UNIT II  FUNCTIONS OF MANAGEMENT  9
Planning: Characteristics; Nature; Importance; Steps; Limitation – Organizing: Features; Process; Principles; Types – Departmentalization: Functional – Divisional (Product; Customer; Geographic) – Staffing: Systems Approach; Recruiting and Selection Process – Directing (Leading): Traits; Style; Managerial Grid (Blake-Mounton, Reddin) – Communication: Purpose; Model; Barriers – Controlling: Types; Audit (External, Internal, Merits) – Decision Making: Elements; Characteristics; Process; Classification – Controlling techniques.

UNIT III  ORGANIZATION THEORY  9
Human Resource Development (HRD): Goals – Organizational Conflict: Positive Aspects; Individual; Role; Interpersonal; Intra Group; Inter Group; Conflict Management – Need and Motivation Theories: Maslow’s Hierarchy of Needs Theory; Herzberg’s Motivation-Hygiene Theory; McClelland’s Needs Theory of Motivation – Change Management: Concept of Change; Lewin’s Process of Change Model; Sources of Resistance; Overcoming Resistance; Guidelines to managing Conflict.

UNIT IV  PRODUCTIVITY AND OPERATIONS MANAGEMENT  9
Productivity: Concept; Measurements; Affecting Factors; Methods to Improve – Operations Management Tools: (Simple problems in) Transportation Model (Balanced); Assignment Model (Hungarian); Network Model (Shortest path); Critical Path Method; Decision Trees.

UNIT V  MODERN CONCEPTS AND MARKETING MANAGEMENT  9
Concept, features, merits and demerits of: SWOT Analysis; Business Process Re-engineering (BPR); Supply Chain Management (SCM) – Marketing: Concept; Functions; Importance; Segmentation; Mix; Problems of Marketing in Small Enterprise; Competitive Analysis and Advantage – E-marketing.

Total  (L: 45) = 45 PERIODS

COURSE OUTCOMES: Upon completion of this course, the students will be able to:
1. Explain basic concepts of management; approaches to management; contributors to management studies; various forms of business organization and trade union function in professional organizations.
2. Apply various functions of management in professional organization.
3. Apply organizational theory in professional organization.
4. Apply the principles of productivity and operations management in professional organization.
5. Apply modern concepts and marketing in management in professional organization.

TEXT BOOKS:


REFERENCES:


GE5451 TOTAL QUALITY MANAGEMENT

UNIT- I INTRODUCTION


UNIT- II TQM – OLD TOOLS


UNIT- III TQM – MANAGEMENT TOOLS


UNIT- IV TQM – PRINCIPLES


UNIT- V TQM TECHNIQUES

Text Book:

Reference

GE5551  STATISTICS FOR PRODUCTION MANAGEMENT  L P T C
3 0 0 3

OBJECTIVES:
- To train the students so that students will be able to design experimental designs and
  use these concepts for research design.
- To introduce the concept of probability so that they can be used for industrial
  applications.
- To stress upon the importance of the sampling theory and its usefulness in industrial
  quality control.
- To make students familiarize with the concepts of estimation theory and its
  applications.
- To help students the usefulness of test of significance and its applications in industry
  and research.

UNIT I   PROBABILITY THEORY  12
Random variables – Discrete and continuous random variable- Probability mass and density
functions- Joint density and mass functions-Moment about mean and origin- Moment
generating and characteristic functions – Binomial, Poisson, Normal distributions and their
applications- to manufacturing problems.

UNIT II  SAMPLING THEORY  12
Sampling with and without replacement- Random sample- Sampling distributions of means,
proportions, difference of means and proportions-Student ‘t’ distribution- Chi square
distribution- Fisher’s distribution and their applications to production problems.

UNIT III  ESTIMATION THEORY  6
Point and interval estimation- Confidence limits for mean, proportions, difference of means,
proportions- Confidence limits using student ‘t’ distribution, Chi square and F distribution-
applications.

UNIT IV TESTING OF HYPOTHESIS  10
Procedure for testing hypothesis and significance- Level of Significance of large samples for
means, proportions, difference of means and difference of proportions- Tests based on
student t distribution, chi square distribution and F distribution – Applications to
manufacturing.

UNIT V ANOVA  5
One factor experiments – Mathematical model for one factor experiments- Two factor
experiments-Mathematical model for two factor experiments- Applications to production
problems.

TOTAL: 45 PERIODS

OUTCOMES
At the end of the course, students will be able to:
CO1: Design of experiments for research and industry.
CO2: Apply the concept of probability so that they can be used for industrial applications.
CO3: Use sampling theory and its usefulness in industrial quality control.
CO4: Apply the concepts of estimation theory to industrial problems.
CO5: Apply the test of significance and its applications to industry and research.

<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>
<th>PO13</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>
<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>
<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 BOOKS


REFERENCES


RP5001 ADHESIVES AND PAINTS

<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>

Objective

- To understand the concept of adhesion as a joining operation and how it compares with fastening and welding
- To appreciate the physical chemistry of adhesives and paints, mechanisms of setting and development of strength in the joints and coatings
- To understand the principles of formulating various adhesives and paints
- To understand the importance of and methods of surface preparations for adhesion and painting of substrates

UNIT I FUNDAMENTALS OF ADHESION

Adhesives – Fundamentals – types of substrates – mechanisms of setting, adhesive strength – thermodynamics of adhesives – concepts of surface energy, contact angle etc – types of joints – joint selection
UNIT II  NON REACTIVE ADHESIVES  

UNIT III  REACTIVE ADHESIVES  
Phenolics, epoxies, acrylics, anaerobics, cyanoacrylates – uses of adhesives in civil Engineering, automobile, aerospace, electrical & electronic industries.

UNIT IV SURFACE COATINGS  
Components of Paints – Preparations formulations, pigment dispersion, drying & film formation mechanisms, types of paints – based on emulsion, oil, alkyds, epoxies, PF, UF etc, Urethanes, Silicones – Primers like chlorinated rubber – applications, powder coatings.

UNIT V SURFACE PREPARATION AND TESTING  
Surface preparation for adhesion & painting, powder coatings, factors affecting coating properties, barrier properties – rheology & its importance, paint & adhesion performance testing.

TOTAL: 45 PERIODS

Course Outcome
The students will be able to
- understand the concept of adhesion as a joining operation
- appreciate the physical chemistry of adhesives and paints, mechanisms of setting and development of strength in the joints and coatings
- understand the principles of formulating various adhesives and paints
- understand the importance of and methods of surface preparations

REFERENCES

<table>
<thead>
<tr>
<th>Course Outcome</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>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
<th>PSO4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall CO</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively
OBJECTIVES
- To familiarize students with the latest plastics processing technologies.
- To study about the troubleshoots and process parameters to overcome the troubleshoots.

UNIT I ADVANCED INJECTION MOULDING PROCESS - I

UNIT II ADVANCED INJECTION MOULDING PROCESS – II
Multi-layer Moulding, Counter flow moulding, Liquid Injection Moulding processes. Thin walled moulding, Structural foam moulding - Low pressure and high pressure processes - Merits & demerits.

UNIT III ADVANCED BLOW MOULDING - I

UNIT IV ADVANCED BLOW MOULDING – II

UNIT V ADVANCED EXTRUSION PROCESSES

TOTAL: 45 PERIODS

OUTCOMES
At the end of the course the students will be able
- To learn the advanced processing techniques and Product manufacture
- To know about troubleshoots and its remedy in processing

REFERENCES

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Program outcome and Program Specific Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>PO1: 2 PO2: 3 PO3: 3 PO4: 3 PO5: 3 PO6: 3 PO7: 3 PO8: 2 PO9: 3 PO10: 2 PO11: 3</td>
</tr>
<tr>
<td>CO2</td>
<td>PO1: 2 PO2: 3 PO3: 3 PO4: 3 PO5: 3 PO6: 3 PO7: 3 PO8: 2 PO9: 3 PO10: 2 PO11: 3</td>
</tr>
<tr>
<td>Overall CO</td>
<td>PO1: 2 PO2: 3 PO3: 3 PO4: 3 PO5: 3 PO6: 3 PO7: 3 PO8: 2 PO9: 3 PO10: 2 PO11: 3</td>
</tr>
</tbody>
</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively
OBJECTIVES
To impart knowledge to the students in the following:

• Biopolymers fundamentals
• Properties and applications of PLA, PHA, Starch
• Proteins, hemicellulose, cellulose and its derivatives
• Biopolymers in packaging applications
• Biopolymers in the field of agriculture

UNIT- I  GREEN CHEMISTRY FOR POLYMERS


UNIT - II  RESOURCES FOR BIOPOLYMERS

Polysaccharide based polymers – Gelatinization – Starch based blends - Biodegradation of Starch based Polymers - Production of Lactic acid and Polylactide - Properties and applications of Polylactides – Introduction to Polyhydroxyalkanoates and their derivatives – Applications – Chitin & Chitosan and its derivatives as biopolymers

UNIT-III  PROTEINS, HEMICELLULOSE AND CELLULOSE BASED BIOPOLYMERS

Plant and animal based Proteins – Solution casting of proteins – Processing of proteins as plastics – Preparation and properties of hemicellulose – Cellulose based Composites – Surface and Chemical modifications of Cellulose fibers

UNIT- IV  PACKAGING APPLICATIONS OF BIOPOLYMERS


UNIT- V  BIOPOLYMER APPLICATIONS IN AGRICULTURE

Biopolymer Films – Biodegradable mulching – Advantages and Disadvantages - Chemical sensors – Biosensors - Functionalized Biopolymer Coatings and Films – Applications of biopolymers in horticulture

TOTAL: 45 PERIODS

COURSE OUTCOMES
Students will be able to:

• Appreciate the importance of sustainable materials
• Understand the properties and applications of PLA, PHA and Starch derivatives
• Know the properties and applications of Cellulose, proteins and hemicellulose
• Recognize the importance of biopolymers in the field of Food packaging.
• Identify the importance of biopolymers in the field of Agriculture.
REFERENCES


4.

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Program outcome and Program Specific Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1  PO2  PO3  PO4  PO5  PO6  PO7  PO8  PO9  PO10  PO11  PSO1  PSO2  PSO3  PSO4</td>
</tr>
<tr>
<td>CO1</td>
<td>3     3     3     3     3     3     3     1     2     3     3     2</td>
</tr>
<tr>
<td>CO2</td>
<td>3     3     3     3     1     3     3     1     2     3     3     2</td>
</tr>
<tr>
<td>CO3</td>
<td>3     3     3     3     1     3     3     1     2     3     3     2</td>
</tr>
<tr>
<td>CO4</td>
<td>3     3     3     3     1     3     3     1     2     3     3     2</td>
</tr>
<tr>
<td>CO5</td>
<td>3     3     3     3     1     3     3     1     2     3     3     2</td>
</tr>
<tr>
<td>Overall CO</td>
<td>3     3     3     3     1     3     3     1     2     3     3     2</td>
</tr>
</tbody>
</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively
OBJECTIVES
To expose the students to:
- The design and theory of common machine elements
- Practice the students in solving design problems involving various machine elements.
- Familiarize with design of components subjected to various stresses and moments like direct stress, bending stress, twisting moment and combined stresses.

UNIT I  INTRODUCTION AND FUNDAMENTALS OF DESIGN
Introduction to the design concept and its role in the design of mechanical elements. Stages in Design, General consideration and factors influencing the design of machine elements and design process. Design criteria- Factor of safety -Selection of Materials -Standards and Codes – Economical and reliable design—Basic Design equations for various loading and various sectional elements-Design against static loading – modes of failure - Principal stresses, Theories of Failure – stress concentration- Eccentric loading.

UNIT II  DESIGN FOR VARIABLE LOADING

UNIT III  DESIGN OF JOINTS, SHAFTS AND COUPLINGS

UNIT IV  DESIGN OF TRANSMISSION ELEMENTS
Design of Spur, Helical, Bevel and Worm gear drives – Design of belt drives – flat and V belts

UNIT V  DESIGN OF SPRINGS AND BEARINGS

TOTAL: 45 PERIODS

OUTCOMES
Students will be able to:
- Understand the importance of economical and reliable design.
- Differentiate the constant loading design and variable loading design
- Know the design procedure for various mechanical elements design.
- Understand the design procedure for various power transmission elements.
- Identify the importance of material selection in design and its influence

TEXT BOOK
REFERENCES

<table>
<thead>
<tr>
<th>Course Outcome</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>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
<th>PSO4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Overall CO</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively
OBJECTIVES

• To impart knowledge on properties and applications of Engineering plastics
• To make them understand the structure property relationship and applications of high
temperature polymers.
• To highlight the applications of specialty polymers.

UNIT- I ENGINEERING PLASTICS 10

Polyamides, (nylons), modified polyamides, polyesters – PET, PBT, Polyacetals, PC and its
blends – Preparation, properties & applications,

UNIT- II HIGH TEMPERATURE PLASTICS 10

Fluorine containing Plastics – Preparation, properties & uses of PTFE, PCTFE, PVDF, other
high performance plastics like PPO, PPS, polysulphones, PEEK, Polymides,
Polybenzimidazoles, aromatic polyamides – Kevlar, Nomex – Preparation, properties &
aplications.

UNIT-III SPECIALTY POLYMERS - I 9

Polymers for electronic applications, conducting polymers – Photoresists, polymers in
optoelectronics polymers with piezoelectric, pyroelectric& ferroelectric properties, Polymers
in telecommunications and power transmission

UNIT – IV SPECIALTY POLYMERS -II 9

Synthetic polymer membranes, ionic polymers, hydrogels and smart polymers, dendritic
polymers, shape memory polymers, LCP’s, IPN’s

UNIT V POLYMERS FOR BIO MEDICAL APPLICATIONS 7

Bio- compatible and bio degradable polymers, Controlled drug release, tissue engineering,
orthopaedic application, dentistry.

TOTAL: 45 PERIODS

OUTCOMES

• Students understand the importance Engineering plastics.
• Students acquire fundamental knowledge about properties and uses of high
temperature plastics.
• Students acquire sound information on specialty polymers.
REFERENCES

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Program outcome and Program Specific Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
</tr>
<tr>
<td>Overall CO</td>
<td>3</td>
</tr>
</tbody>
</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.
UNIT- I   INTRODUCTION

Review of various approximate methods – Raleigh Ritz’s, Galerkin and finite difference methods- Governing equation and convergence criteria of finite element method.

UNIT - II  DISCRETE ELEMENTS

Bar elements, uniform sections, mechanical and thermal loading, varying section, truss analysis, Beam element- problems for various loadings and boundary conditions – longitudinal and lateral vibration – use of local and natural coordinates

UNIT- III  CONTINUUM ELEMENTS

Plane stress, plane strain and axisymmetric problems, Derivation of element matrices for constant and linear strain triangular elements and axisymmetric elements

UNIT- IV   ISOPARAMETRIC ELEMENTS & FIELD PROBLEM

Definitions, shape function for 4,8 nodal quadrilateral elements, stiffness matrix and consistent load vector, Gaussian integration Heat transfer problems, steady state fin problems

UNIT- V    NON LINEAR ANALYSIS

Elastomers- Elastic material model correlation-Terminology-Types of FEA models-Model building- Non linear material behavior- Boundary conditions-Applications-case studies

TOTAL: 45 PERIODS

Outcome

- Develop depth knowledge on techniques of FEA and tools for analysis of polymer products
- Get idea of implementation of computer on solving FEA based problems.
- Discretize and solve one-dimensional solid mechanics and heat transfer problems in FEA.
- Analyze a non-linear behavior of polymer through FEA and control it’s parameters
REFERENCES


<table>
<thead>
<tr>
<th>Course Outcome</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>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
<th>PSO4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>3</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Overall CO</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>-</td>
<td>1</td>
</tr>
</tbody>
</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.
OBJECTIVES

- To impart knowledge on concepts in fracture mechanics
- To understand the various stages in fracture.
- To impart the knowledge on dynamic effect in various fractures.

UNIT-I  FATIGUE OF STRUCTURES  10
S.N. curves - Endurance limits - Notches and stress concentrations - Neuber's stress concentration factors - Plastic stress concentration factors - Notched S.N. curves. Low cycle and high cycle fatigue - Coffin - Manson’s relation - Transition life - cyclic strain hardening and softening - Analysis of load histories - Cycle counting techniques

UNIT- II  FRACTURE MECHANICS  12

UNIT- III  FRACTURE INITIATION  9

UNIT- IV  SLOW CRACK GROWTH AND STABILITY  7
Time dependent fracture- Environmental crack and Zone growth-Other controlling mechanisms- fatigue- Visco elastic behavior- Ductile tearing.

UNIT- V  IMPACT TESTING AND DYNAMIC EFFECTS  7
Dynamic effects in impact testing- Applications to small scale yielding- Applications to contained yielding- Rate effects- General dynamic analysis

TOTAL: 45 PERIODS

OUTCOMES:
Students will be able to:

- Understand the various concepts in fracture mechanics
- Acquire the knowledge on various stages in fracture with specific fracture analysis for various polymeric materials.
- Familiarize the importance of dynamic effects in fracture.
REFERENCES:


<table>
<thead>
<tr>
<th>Course Outcome</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>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
<th>PSO4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</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>
<td>3</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</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>3</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</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>3</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall CO</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively
OBJECTIVES

- To impart knowledge on natural rubber latex processing
- To understand the various latex product manufacturing process
- To impart the knowledge on synthetic latex and its applications

UNIT- I  LATEX CHARACTERISTICS AND CONCENTRATION METHODS 9

Definition of Latex, classification, Latex particle size and distribution, stability and destabilization of latices, Comparison between latices and polymer solution; Natural rubber latex —origin, tapping, bulking and preservation, composition of field latex, properties, preservation, methods of concentrating latex - creaming, centrifuging, & evaporation,— Specification and testing- (National and ISO) for latex grades (ASTM D 1076 )

UNIT- II  LATEX COMPOUNDING  9

Latex compounding-Ingredients, Preparation of Dispersions, Emulsion, Slurries; Machineries- Ball mill, Pearl mill; Preparation of latex compound and maturation; Prevulcanized latex, MG Latex, -Preparation, properties and application; Evaluation of the latex compound- Chloroform number, swelling index test; Design for latex products formulation.

UNIT- III  LATEX DIPPING PROCESS  9

Principle and types of dipping process, Dipping plant design, formers, sequence of operation, post processing; Manufacture of Condoms, Gloves, Catheters, Balloons-formulations, process, specification, testing and troubleshooting.

UNIT- IV  LATEX FOAM, SHEETING AND SPRAYING  9

Principle and Manufacture of Foam-Dunlop and Talalay process, Compound design-Process details, Foam properties, testing and defects, foam applications; Latex sheeting; latex binders and carpet backing- Basics and process.

UNIT- V  EXTRUSION AND PRODUCTS BASED ON SYNTHETIC LATEX  9

Principle and Manufacture of latex elastic threads; latex tubing; latex casting process specification and testing, defects. Synthetic latex- Types, properties, and application- surface coatings, adhesives, paper industries.

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to:

- Understand the Natural rubber latex processing
- Acquire the knowledge on various Latex product manufacturing
- Familiarize the importance of synthetic latex and its applications
REFERENCES:


<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Program outcome and Program Specific Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
</tr>
<tr>
<td>Overall CO</td>
<td>3</td>
</tr>
</tbody>
</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.
OBJECTIVES

To impart knowledge on:

- Various mould making techniques
- Conventional and special Machining operations
- Various mould materials
- Material selection and
- Quality control concepts in mould making.

UNIT I  PRODUCTION PROCESSES FOR MOULD MAKING  9


UNIT II  MOULD ENGINEERING AND MATERIALS  9


UNIT III  UNCONVENTIONAL MACHINING PROCESSES  9


UNIT IV  ADVANCED MOULD MAKING TECHNIQUES  9


UNIT V  QUALITY CONTROL IN MOULD MANUFACTURE  9


TOTAL: 45 PERIODS
REFERENCES

OUTCOMES
To make the student to familiarize with

- Design mold manufacturing steps along with material selection, surface treatment
- Understand inspection, quality control of molds.
- Understand basics of CNC machine
- Theory of metal cutting and lathe operations

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Program outcome and Program Specific Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1  PO2  PO3  PO4  PO5  PO6  PO7  PO8  PO9  PO10  PO11  PO12  PSO1  PSO2  PSO3  PSO4</td>
</tr>
<tr>
<td>CO1</td>
<td>3     3     3     3     3     1     3     1</td>
</tr>
<tr>
<td>CO2</td>
<td>3     3     3     3     3     1     3     1</td>
</tr>
<tr>
<td>CO3</td>
<td>3     3     3     3     3     1     3     1</td>
</tr>
<tr>
<td>CO4</td>
<td>3     3     3     3     3     1     3     1</td>
</tr>
<tr>
<td>Overall CO</td>
<td>3     3     3     3     3     1     3     1</td>
</tr>
</tbody>
</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively
Objectives
To impart knowledge on
- On needs and functions of packaging materials
- Various methods of packaging to improve the shelf life of the products
- Testing of packaging materials

UNIT-I  INTRODUCTION TO PACKAGING  9
Definition, functions of packaging, types and selection of package, packaging hazards, interaction of package and contents, materials and machine interface, environmental and recycling considerations-Life cycle assessment; Package design-Fundamentals, factors influencing design, stages in package development.

UNIT - II  DIFFUSION AND PERMEABILITY  9
Diffusion-Types of diffusion, Fick's law of diffusion and applications; Diffusion coefficients of gas, liquid and vapour in polymers and packaging films, techniques to measure diffusion coefficient in polymer interface; Polymer permeability, gaseous transport in polymers, permeability measurement.

UNIT-III  PACKAGING TECHNIQUES  9
Flexible and Rigid Packaging-Extrusion- Blown film, cast film, multi-layer film and sheet, lamination; Injection moulding; Blow moulding;Thermoforming; Surface treatment for printing and printing processes.

UNIT-IV  SPECIALITY PACKAGING  9
Aerosol packaging, shrink and stretch wrapping, blister packaging, antistatic packaging, aseptic packaging, active packaging, modified atmospheric packaging, ovenable package, cosmetic package, hardware packaging, food packaging, textile packaging, health care packaging, export packaging.

UNIT-V  TESTING OF PACKAGING MATERIALS  9
Package Testing- Mechanical properties – Tensile and tear properties, Impact properties, Burst strength, Stiffness, Crease or flex resistance; Co-efficient of friction, Blocking Orientation and Shrinkage; Optical Properties – Clarity, Haze and gloss; Barrier Properties – Oxygen transmission, Water vapour transmission rate migration; Chemical resistance tests

OUTCOMES:
Upon completing this course, the students will be able to
- Apply and examine the knowledge of properties for selection of packaging materials
- Select between different techniques of packaging
- Will familiarize in testing of plastic packaging
-
REFERENCES:

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Program outcome and Program Specific Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
</tr>
<tr>
<td>Overall CO</td>
<td>3</td>
</tr>
</tbody>
</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively
OBJECTIVES

To Impart knowledge to the students in the following:

- Segregation and sorting of plastics
- Polymer degradation mechanism
- Recycling of plastics
- Understand the importance of quaternary recycling
- Rubber recycling

UNIT-I  INTRODUCTION TO RECYCLING

Need for recycling – Source of plastic waste – Life cycle analysis – Legislations related to polymer recycling - depolymerization - Ceiling temperature and its importance – Degradation – Biodegradation, Primary, Secondary, Tertiary recycling and Quaternary recycling

UNIT- II  SORTING TECHNIQUES


UNIT-III  RECYCLING OF MATERIALS- I


UNIT – IV  RECYCLING MATERIALS- II


UNIT-V  RUBBER RECYCLING


TOTAL: 45 PERIODS
OUTCOMES:
Students will be able to:
• Appreciate the importance of sorting techniques
• Understand the different degradation mechanisms
• Identify right techniques to recycle thermoplastics
• Know the importance of closed loop recycling.
• Recognize methods to recycle scrap rubber

REFERENCES:

<table>
<thead>
<tr>
<th>Course Outcome</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>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
<th>PSO4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Overall CO</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.
UNIT-I PRINCIPLES OF PU CHEMISTRY AND SPECIAL APPLICATIONS 12
Reactions of isocyanate group-building blocks for PUs—polyls, isocyanates, chain extenders—
Preparation methods like prepolymer process, one shot process—preparation of aqueous
two phase systems—Special areas like ionomers, LCP based on PUs, hydrogels, promoters—
Uses in medical areas, bio technology, optical lenses etc. Structure-property relationships in
hard and soft segments—Morphology of domains—Effect of cross links on PU properties,
structure-property relationships in ionomers

UNIT-II RAW MATERIALS AND AN OVERVIEW OF PROCESSING OF PU 6
Polyols, isocyanates—Their preparation and characteristics, conversion products of the raw
materials—Additives—Industrial hygiene—Principles of PU processing

UNIT-III PU FOAMS 9
Flexible foams—Their production—Equipment and process, properties and uses—Rigid foams—
Production and properties—Relationship between production methods and properties, uses—
Integral skin foams—RIM

UNIT-IV SOLID PU MATERIALS 9
Casting of PUs, TPUs—Chemistry, manufacturing, processing, compounding and uses,
millable PUs—preparation, properties and uses

UNIT-V PU COATINGS AND ADHESIVES 9
Solvent based coatings, air dried coatings, solvent free paints and coatings, applications of
PU based coatings—two components and one component adhesives based on PUs, solvent
based adhesives, dispersion adhesives, hot melts, PU binders.

TOTAL: 45 PERIODS

COURSE OUTCOME:
The students will be able to
• understand the formation of polyurethanes—castable products, TPEs, and the
  necessary raw materials
• understand the structure-property relationships in PUs
• gain knowledge about various production methods for PU products

REFERENCES:

<table>
<thead>
<tr>
<th>Course Outcome</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>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
<th>PSO4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Overall</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and
Substantial (High) respectively
UNIT- I  INTRODUCTION TO PRODUCT DEVELOPMENT  9

UNIT- II  PROCESS PLANNING  9

UNIT- III   ESTIMATING, COSTING AND ELEMENTS OF COST  9

UNIT- IV  ANALYSIS OF OVERHEAD EXPENSES  9

UNIT- V  AN OVERVIEW ON INTELLECTUAL PROPERTY RIGHTS  9

TOTAL:  45 PERIODS

REFERENCES
Course Outcome:

The students will be able to

- understand the basic factors which go into product design in general
- understand the role of process planning towards product development
- gain knowledge about arriving at costing of a product covering various fixed and variable costs
- get some understanding about IPRs

<table>
<thead>
<tr>
<th>Course Outcome</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>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
<th>PSO4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>--</td>
<td>--</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>---</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>--</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>--</td>
<td>--</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>---</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>--</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>CO3</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>--</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>--</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>--</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>CO4</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Overall CO</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>--</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>--</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.
OBJECTIVES

- To enlighten the students on knowledge of standards and specifications of rubber and plastics testing.
- To learn the specimen preparation, conditioning and testing requirements.
- To impart the knowledge on various testing machines and procedures as per the standards.
- To understand the various tests performed for rubber and plastics compound and products

UNIT I  TESTS ON RUBBER COMPOUNDS

UNIT II  TESTS ON RUBBER VULCANISATES

UNIT IV  PLASTICS TESTING - I

UNIT V  PLASTICS TESTING- II

UNIT V  TESTS ON PRODUCTS

TOTAL: 45 PERIODS

OUTCOMES:

- The students can able to
  - Familiarize about various test methods on Rubber and Plastics used in industry
  - Use different standards
  - Assess and analyze the properties and performance of the product in service condition
  - Work with various testing machineries
  - Predict the life of the compound or product.
REFERENCES:


<table>
<thead>
<tr>
<th>Course Outcome</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>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
<th>PSO4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>CO3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>CO4</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>CO5</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Overall CO</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.
Objectives

To impart knowledge on

- Selection of materials for various automobile components
- Structure - property relationship of polymers
- Materials for Rubber springs, fluid sealing and flexible couplings and hoses

UNIT- I INTRODUCTION

Identification of plastics / rubber components in automobiles – Function – Selection criteria.

UNIT- II STRUCTURE-PROPERTY RELATIONSHIPS IN RUBBERS

Resilience, creep, hysteresis and damping, stability, set and stress relaxation, behaviour in dynamic applications.

UNIT- III VIBRATION AND RUBBER SPRING


UNIT- IV FLUID SEALINGS AND FLEXIBLE COUPLINGS AND HOSES


UNIT- V COMPOUNDING AND MANUFACTURE

Types of couplings – Specification and selection – Torque vs deflection relationship – Brake fluid / hydraulic hoses, materials and manufacture

TOTAL: 45 PERIODS

OUTCOMES

On successful completion of this course the students will be able to

- Select right rubber for various automobile components
- Understand structure - property relationship of rubbers
- Choose materials for spring, fluid sealing and flexible couplings and hoses

REFERENCES

The scope of the subject will include studies on the following components:
- Cylinder head gasket : ACM, Silicon
- Oil Pan gasket : ACM
- Blow-by Circuit hose : NBR / PVC, CM, FKM/EVA, FKM/VMQ
- Vacuum Hose : CR, CM, AEM
- Oil Circuit and blow-by seals : AEM, FPM, HNBR
- Oil hose : AEM
- Oil filter base gasket : NBR, AEM and ACM
- Dipstick guide : HNBR
- Dipstick seal : NBR, FPM
- Drain plug seal : NBR, ACM
- Air filter intake duct : TPV-(EPDM+PP)
- Throttle valve intake duct : TPV-(EPDM+PP), EPDM, NBR/PVC, CM, ECO
- Throttle valve seals : NBR
- Air intake manifold seals : NBR
- Cooling Hose : EPDM
- Cooling Seals : EPDM

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Program outcome and Program Specific Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
</tr>
<tr>
<td>Overall CO</td>
<td>3</td>
</tr>
</tbody>
</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively
UNIT- I  THEORY OF POLYMER BLENDS 9


UNIT- II  MELT PROCESSING OF POLYMER BLENDS 9

Factors influencing Morphology – Influence of Processing methods on Morphology Chemistry of compatibilization –Compatibilizers - Reactive compatibilization – Commercially important Blends: Structure – Property relationships

UNIT- III  MORPHOLOGY OF POLYMER BLENDS 9

Continuous & discontinuous phases – Microscopic Phase visualization methods – Optical Microscopy, TEM, SEM and AFM – Dispersed phase size and Dispersion Uniformity – Glass transition in Polymers blends and copolymers – Applications of thermal analysis in crystalline polymer blends – Interpenetrating Polymer networks

UNIT- IV  PROPERTIES OF POLYMER BLENDS 9

Thermo-mechanical Performance of amorphous – Amorphous and Amorphous- Crystalline blends – Permeability of miscible blends – Barrier materials through control of Blend morphology – Reinforced polymer blend

UNIT- V  ELASTOMER BLENDS 9


TOTAL: 45 PERIODS
REFERENCES


<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Program outcome and Program Specific Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
</tr>
<tr>
<td>Overall CO</td>
<td>3</td>
</tr>
</tbody>
</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively
OBJECTIVES

To make the student to understand the following:

- Various mechanism and its kinematic analysis.
- Various frictional force in mechanical devices.
- Various profile of gear and its mechanisms.
- Balancing in mechanical systems and various vibrations

UNITI MECHANISMS


UNITII FRICTION

Types of friction–Friction in screw and nut–Screw jack–Pivot, collar and thrust bearings–Plate and cone clutch–belt (flat & V) and dropped drives–Creep belts–Open and crossed belt drives–Ratio of tensions–Effect of centrifugal and initial tensions–Condition for maximum power transmission.

UNITIII GEARING AND CAMS

Gear–Types and profile–Nomenclature of spur & helical gears–Laws of gearing–interference–Requirement of minimum number of teeth–gears–Cams different types of followers–Cam–Types of cams and followers–Cam design for different follower motions.

UNITIV BALANCING

Static and dynamic balancing–Single and several masses in different planes–Primary and secondary balancing of reciprocating masses–Balancing of single and multicylinder engines–Governors and gyroscopic effects.

UNITV VIBRATION


TOTAL: 45 PERIODS

OUTCOMES:

- Analyze the practice of forming different mechanism using link
- Be familiar with friction force and its importance in mechanical devices
- Understanding the analysis of gear and cam power transmission
- Scrutinize the effect of unbalance and balancing techniques
- Acquire the knowledge of different vibration and to analyze the transmission of vibration
REFERENCES:

<table>
<thead>
<tr>
<th>Course Outcome</th>
<th>Program outcome and Program Specific Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>2</td>
</tr>
<tr>
<td>CO2</td>
<td>2</td>
</tr>
<tr>
<td>CO3</td>
<td>2</td>
</tr>
<tr>
<td>CO4</td>
<td>2</td>
</tr>
<tr>
<td>CO5</td>
<td>2</td>
</tr>
<tr>
<td>Overall CO</td>
<td>2</td>
</tr>
</tbody>
</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively
OBJECTIVES

To impart knowledge to students in the following:
- Microstructural characterization techniques
- Spectroscopic Characterization
- Rheological Characterization
- Thermal Characterization
- Chromatographic Characterization

UNIT- I  CHEMICAL AND MICROSTRUCTURAL CHARACTERIZATION  6
Identification of Olefins, Dienes, and other vinyl Polymers by Chemical Methods – preliminary examination – Polymer identification through functional group reactions – Microstructural characterization using X-ray diffraction, SEM, TEM and AFM

UNIT- II  SPECTROSCOPIC CHARACTERIZATION OF POLYMERS  12

UNIT- III  RHEOLOGICAL CHARACTERIZATION  9

UNIT- IV  THERMAL ANALYSIS  12

UNIT- V  CHROMATOGRAPHIC CHARACTERIZATION  6
Molecular weight distribution using GPC, HPLC – Biological Separations - Analysis of antioxidant, process oil and additives in Polymer Compounds – Analysis of Decomposition products using GC – Pyrolysis, Gas Chromatography

TOTAL: 45 PERIODS
OUTCOMES:
Students will be able to
• Understand basic principles and applications of SEM, TEM, AFM and XRD studies
• Know the importance of spectroscopic techniques in polymer characterization
• Understand the importance of rheological characterization
• Appreciate the importance of thermal studies in polymer characterization
• Understand basic principles and applications of Pyrolysis GC, HPLC and GPC

REFERENCES:

<table>
<thead>
<tr>
<th>Course Outcome</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>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
<th>PSO4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Overall CO</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively
OBJECTIVES:
- Teach history and philosophy of Indian Constitution.
- Describe the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- Summarize powers and functions of Indian government.
- Explain emergency rule.
- Explain structure and functions of local administration.

UNIT I  INTRODUCTION  9
History of Making of the Indian Constitution-Drafting Committee- (Composition & Working) - Philosophy of the Indian Constitution-Preamble-Salient Features

UNIT II  CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES  9

UNIT III  ORGANS OF GOVERNANCE  9
Parliament-Composition-Qualifications and Disqualifications-Powers and Functions-Executive President-Governor-Council of Ministers-Judiciary, Appointment and Transfer of Judges, Qualifications Powers and Functions

UNIT IV  EMERGENCY PROVISIONS  9

UNIT V  LOCAL ADMINISTRATION  9
District's Administration head- Role and Importance-Municipalities- Introduction- Mayor and role of Elected Representative-CEO of Municipal Corporation-Pachayati raj- Introduction-PRI- ZilaPachayat-Elected officials and their roles- CEO ZilaPachayat- Position and role-Block level-Organizational Hierarchy (Different departments)-Village level- Role of Elected and Appointed officials-Importance of grass root democracy

TOTAL: 45 PERIODS

OUTCOMES:
CO1: Able to understand history and philosophy of Indian Constitution.
CO2: Able to understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
CO3: Able to understand powers and functions of Indian government.
CO4: Able to understand emergency rule.
CO5: Able to understand structure and functions of local administration.

<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>

TEXTBOOKS:
4. The Constitution of India (Bare Act), Government Publication, 1950
OBJECTIVES:
- Develop knowledge of self-development
- Explain the importance of Human values
- Develop the overall personality through value education
- Overcome the self-destructive habits with value education
- Interpret social empowerment with value education

UNIT I INTRODUCTION TO VALUE EDUCATION
Values and self-development – Social values and individual attitudes, Work ethics, Indian vision of humanism, Moral and non-moral valuation, Standards and principles, Value judgements

UNIT II IMPORTANCE OF VALUES
Importance of cultivation of values, Sense of duty, Devotion, Self-reliance, Confidence, Concentration, Truthfulness, Cleanliness. Honesty, Humanity, Power of faith, National Unity, Patriotism, Love for nature, Discipline

UNIT III INFLUENCE OF VALUE EDUCATION
Personality and Behaviour development - Soul and Scientific attitude, Positive Thinking, Integrity and discipline, Punctuality, Love and Kindness, Avoid fault Thinking, Free from anger, Dignity of labour, Universal brotherhood and religious tolerance, True friendship, Happiness Vs suffering, love for truth.

UNIT IV REINCARNATION THROUGH VALUE EDUCATION

UNIT V VALUE EDUCATION IN SOCIAL EMPOWERMENT
Equality, Non violence, Humility, Role of Women, All religions and same message, Mind your Mind, Self-control, Honesty, Studying effectively

TOTAL: 45 PERIODS

OUTCOMES:
CO1 – Gain knowledge of self-development
CO2 – Learn the importance of Human values
CO3 – Develop the overall personality through value education
CO4 – Overcome the self-destructive habits with value education
CO5 – Interpret social empowerment with value education

<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>

REFERENCES:
OBJECTIVES:
- Understand the methodology of pedagogy.
- Compare pedagogical practices used by teachers in formal and informal classrooms in developing countries.
- Infer how can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy.
- Illustrate the factors necessary for professional development.
- Identify the Research gaps in pedagogy.

UNIT I   INTRODUCTION AND METHODOLOGY: 9
Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions - Overview of methodology and Searching.

UNIT II   THEMATIC OVERVIEW 9
Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education.

UNIT III   EVIDENCE ON THE EFFECTIVENESS OF PEDAGOGICAL PRACTICES 9
Methodology for the in depth stage: quality assessment of included studies - How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches - Teachers’ attitudes and beliefs and Pedagogic strategies.

UNIT IV   PROFESSIONAL DEVELOPMENT 9
Professional development: alignment with classroom practices and follow up support - Peer support - Support from the head teacher and the community - Curriculum and assessment - Barriers to learning: limited resources and large class sizes.

UNIT V   RESEARCH GAPS AND FUTURE DIRECTIONS 9
Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment - Dissemination and research impact.

TOTAL: 45 PERIODS

OUTCOMES:
- Understand the methodology of pedagogy.
- Understand Pedagogical practices used by teachers in formal and informal classrooms in developing countries.
- Find how can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy.
- Know the factors necessary for professional development.
- Identify the Research gaps in pedagogy.

<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>
<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>
</tr>
</tbody>
</table>
AD5094 STRESS MANAGEMENT BY YOGA

OBJECTIVES:
- Develop healthy mind in a healthy body thus improving social health also improve efficiency
- Invent Do's and Don’ts in life through Yam
- Categorize Do’s and Don’t’s in life through Niyam
- Develop a healthy mind and body through Yog Asans
- Invent breathing techniques through Pranayam

UNIT I INTRODUCTION TO YOGA
Definitions of Eight parts of yog.( Ashtanga )

UNIT II YAM
Do’s and Don’ts in life.
Shaucha, santosh, tapa, swadhyay, iswarpranidhan

UNIT III NIYAM
Do’s and Don’ts in life.
Ahinsa, satya, astheya, bramhacharya and aparigraha

UNIT IV ASAN
Various yog poses and their benefits for mind & body

UNIT V PRANAYAM
Regularization of breathing techniques and its effects-Types of pranayam

OUTCOMES:
CO1 – Develop healthy mind in a healthy body thus improving social health also improve efficiency
CO2 – Learn Do's and Don’t's in life through Yam
CO3 – Learn Do's and Don’t's in life through Niyam
CO4 – Develop a healthy mind and body through Yog Asans
CO5 – Learn breathing techniques through Pranayam

<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:
1. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata
2. "Yogic Asanas for Group Tarining-Part-I" : Janardan Swami Yogabhya Mandal, Nagpur
OBJECTIVES:
- Develop basic personality skills holistically
- Develop deep personality skills holistically to achieve happy goals
- Rewrite the responsibilities
- Reframe a person with stable mind, pleasing personality and determination
- Discover wisdom in students

UNIT I  NEETISATAKAM-HOLISTIC DEVELOPMENT OF PERSONALITY – I
Verses- 19,20,21,22 (wisdom) - Verses- 29,31,32 (pride & heroism) – Verses- 26,28,63,65 (virtue)

UNIT II  NEETISATAKAM-HOLISTIC DEVELOPMENT OF PERSONALITY - II
Verses- 52,53,59 (don’ts) - Verses- 71,73,75,78 (do’s)

UNIT III  APPROACH TO DAY TO DAY WORK AND DUTIES
Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48 - Chapter 3-Verses 13, 21, 27, 35
Chapter 6-Verses 5,13,17,23, 35 - Chapter 18-Verses 45, 46, 48

UNIT IV  STATEMENTS OF BASIC KNOWLEDGE – I
Statements of basic knowledge - Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68
Chapter 12 -Verses 13, 14, 15, 16,17, 18

UNIT V  PERSONALITY OF ROLE MODEL - SHRIMAD BHAGWADGEETA
Chapter 2-Verses 17, Chapter 3-Verses 36,37,42 -  Chapter 4-Verses 18, 38,39 Chapter18 –
Verses 37,38,63

TOTAL: 45PERIODS

OUTCOMES:
CO1: To develop basic personality skills holistically
CO2: To develop deep personality skills holistically to achieve happy goals
CO3: To rewrite the responsibilities
CO4: To reframe a person with stable mind, pleasing personality and determination
CO5: To awaken wisdom in students

<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>

REFERENCES:
1. Gopinath,Rashtriya Sanskrit Sansthanam P, Bharthrihari’s ThreeSatakam , Nitisringar-vairagya, New Delhi,2010
2. Swami Swarupananda , Srimad Bhagavad Gita, AdvaitaAshram,Publication Department, Kolkata,2016
COURSE OBJECTIVES
The course will introduce the students to
- get a knowledge about Indian Culture
- Know Indian Languages and Literature religion and philosophy and the fine arts in India
- Explore the Science and Scientists of Ancient, Medieval and Modern India
- Understand education systems in India

UNIT I INTRODUCTION TO CULTURE 9
Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India.

UNIT II INDIAN LANGUAGES AND LITERATURE 9
Indian Languages and Literature – I: Languages and Literature of South India, – Indian Languages and Literature – II: Northern Indian Languages & Literature

UNIT III RELIGION AND PHILOSOPHY 9
Major religions practiced in India and Understanding their Philosophy – religious movements in Modern India (Selected movements only)

UNIT IV FINE ARTS IN INDIA (ART, TECHNOLOGY & ENGINEERING) 9
Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India

UNIT V EDUCATION SYSTEM IN INDIA 9
Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India

TOTAL: 45 PERIODS

COURSE OUTCOMES
After successful completion of the course the students will be able to
- Understand philosophy of Indian culture.
- Distinguish the Indian languages and literature.
- Learn the philosophy of ancient, medieval and modern India.
- Acquire the information about the fine arts in India.
- Know the contribution of scientists of different eras.
- Understand education systems in India

REFERENCES:
5. Satya Prakash, "Founders of Sciences in Ancient India", Vijay Kumar Publisher, 1989
Course Objectives: The main learning objective of this course is to make the students an appreciation for:

1. Introduction to Sanga Tamil Literature.
2. ‘Agathinai’ and ‘Purathinai’ in Sanga Tamil Literature.
3. ‘Attruppadai’ in Sanga Tamil Literature.
4. ‘Puranaanuru’ in Sanga Tamil Literature.
5. ‘Pathitrupaththu’ in Sanga Tamil Literature.

UNIT I SANGA TAMIL LITERATURE AN INTRODUCTION 9

UNIT II ‘AGATHINAI’ AND ‘PURATHINAI’ 9

UNIT III ‘ATTRUPPADAI’. 9

UNIT IV ‘PURANAANURU’ 9
Puranaanuru on Good Administration, Ruler and Subjects–Emotion and its Effect in Puranaanuru.

UNIT V ‘PATHITRUPATHTHU’ 9
Pathitrupaththu in ‘Ettuthogai’–Pathitrupaththu’s Parables–Tamil dynasty: Valor, Administration, Charity in Pathitrupaththu–Message to Society from Pathitrupaththu.

Total (L:45) = 45 PERIODS

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

1. Appreciate and apply the messages in Sanga Tamil Literature in their life.
2. Differentiate ‘Agathinai’ and ‘Purathinai’ in their personal and societal life.
3. Appreciate and apply the messages in ‘Attruppadai’ in their personal and societal life.
4. Appreciate and apply the messages in ‘Puranaanuru’ in their personal and societal life.
5. Appreciate and apply the messages in ‘Pathitrupaththu’ in their personal and societal life.
REFERENCES:


<table>
<thead>
<tr>
<th>CO</th>
<th>P</th>
<th>PS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.9</td>
<td>0.6</td>
</tr>
<tr>
<td>2</td>
<td>0.9</td>
<td>0.6</td>
</tr>
<tr>
<td>3</td>
<td>0.9</td>
<td>0.6</td>
</tr>
<tr>
<td>4</td>
<td>0.9</td>
<td>0.6</td>
</tr>
<tr>
<td>5</td>
<td>0.9</td>
<td>0.6</td>
</tr>
</tbody>
</table>
COURSE DESCRIPTION
This course offers an introduction to language and communication. The primary goal of this course is to familiarize students with key ideas related to communication using language as well as non verbal means. Ideas related to the use of language and the underlying power structures are also examined. The course also examines the role of media in communication and in the dissemination of ideas as well as opinions.

Objectives
✓ To familiarize students with the concept of communication using linguistic and non linguistic resources.
✓ To help students ask critical questions regarding facts and opinions.
✓ To provide students with the material to discuss issues such as language and power structures.
✓ To help students think critically about false propaganda and fake news.

Learning Outcomes
➢ Students will be able to use linguistic and non linguistic resources of language in an integrated manner for communication.
➢ Students will be able to analyse communication in terms of facts and opinions.
➢ Students will be able to discuss, analyse and argue about issues related to language and power.

UNIT I  LINGUISTIC AND NON-LINGUISTIC RESOURCE OF COMMUNICATION:  9
a) Writing and Speech
b) Distinction between language structure and language use, form and function, acceptability and grammaticality
c) Gestures and Body language, pictures and symbols, cultural appropriacy
d) Communicative Competency, context and situation, combination of linguistic and non-linguistic elements of communication

UNIT II  STRUCTURE OF WRITING/CONVERSATION:  9
a) Language skills and the communication cycle; speaking and listening, writing and reading
b) Initiating and closing conversations, intervention, turn taking
c) Writing for target reader, rhetorical devices and strategies
d) Coherence and Cohesion in speech and writing

UNIT III  POWER STRUCTURE AND LANGUAGE USE:  9
a) Gender and language use
b) Politeness expressions and their use
c) Ethical dimensions of language use
d) Language rights as part of human rights

UNIT IV  MEDIA COMMUNICATION:  9
a) Print media, electronic media, social media
b) Power of media
c) Manufacturing of opinion, fake news and hidden agendas

UNIT V  PERSUASIVE COMMUNICATION AND MISCOMMUNICATION:  9
a) Fundamentals of persuasive communication
b) Persuasive strategies
c) Communication barriers

TOTAL : 45 PERIODS
TEXT BOOKS:
OBJECTIVES:

- Teach definition and classification of values.
- Explain Purusartha.
- Describe Sarvodaya idea.
- Summarize sustenance of life.
- Conclude views of hierarchy of values.

UNIT I  DEFINITION AND CLASSIFICATION OF VALUES  9
Extrinsic values- Universal and Situational values- Physical- Environmental-Sensuous- Economic-Social-Aesthetic-Moral and Religious values

UNIT II  CONCEPTS RELATED TO VALUES  9
Purusartha-Virtue- Right- duty- justice- Equality- Love and Good

UNIT III  IDEOLOGY OF SARVODAYA  9
Egoism- Altruism and universalism- The Ideal of Sarvodaya and Vasudhaiva Kutumbakam

UNIT IV  SUSTENANCE OF LIFE  9
The Problem of Sustenance of value in the process of Social, Political and Technological Changes

UNIT V  VIEWS ON HIERARCHY OF VALUES  9
The Problem of hierarchy of values and their choice, The views of Pt. Madan Mohan Malviya and Mahatma Gandhi

TOTAL: 45 PERIODS

OUTCOMES:

CO1: Able to understand definition and classification of values.
CO2: Able to understand purusartha.
CO3: Able to understand sarvodaya idea.
CO4: Able to understand sustenance of life.
CO5: Able to understand views of hierarchy of values.

<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>CO 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>CO 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>CO 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>CO 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>
<tr>
<td>CO 5</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>

TEXTBOOKS:

2. Little, William, : An Introduction of Ethics (Allied Publisher, Indian Reprint 1955)
OBJECTIVES:
- Illustrate human relations at work its relationship with self.
- Explain the importance of interacting with people at work to develop teamwork.
- Infer the importance of physical health in maintaining human relations at work.
- Describe the importance of staying psychologically healthy.
- Identify the essential qualities for progressing in career.

UNIT I UNDERSTANDING AND MANAGING YOURSELF 9
Human Relations and You: Self-Esteem and Self-Confidence; Self-Motivation and Goal Setting; Emotional Intelligence, Attitudes, and Happiness; Values and Ethics and Problem Solving and Creativity.

UNIT II DEALING EFFECTIVELY WITH PEOPLE 9
Communication in the Workplace; Specialized Tactics for Getting Along with Others in the Workplace; Managing Conflict; Becoming an Effective Leader; Motivating Others and Developing Teamwork; Diversity and Cross-Cultural Competence.

UNIT III STAYING PHYSICALLY HEALTHY 9
Yoga, Pranayam and Exercise: Aerobic and anaerobic.

UNIT IV STAYING PSYCHOLOGICALLY HEALTHY 9
Managing Stress and Personal Problems, Meditation.

UNIT V DEVELOPING CAREER THRUST 9

TOTAL: 45 PERIODS

OUTCOMES:
Students will be able to
CO1: Understand the importance of self-management.
CO2: Know how to deal with people to develop teamwork.
CO3: Know the importance of staying healthy.
CO4: Know how to manage stress and personal problems.
CO5: Develop the personal qualities essential for career growth.

<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>
<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>
</tr>
</tbody>
</table>

TEXT BOOK:

REFERENCES:
COURSE DESCRIPTION
Psychological Processes course is designed for students to be aware of the basic principles of psychology for the better understanding of people’s psyche and behaviour around them. This course enables learners to use the optimal use of different forms of thinking skills and thereby results in effective communication in diverse situations. Every unit of the syllabus highlights the psychological process of people, the most powerful and constructive use of perceptions.

OBJECTIVES
The major objectives of this course is
- To develop students’ awareness on psychology, learning behavior and usage of perception effectively.
- To learn to use the various kinds of thinking in a formal context.
- To critically evaluate content and comprehend the message on the bases of perception, personality and intelligence.

UNIT 1: INTRODUCTION

UNIT 2: SENSORY & PERCEPTUAL PROCESSES
Some general properties of Senses: Visual system – the eye, colour vision – Auditory system – Hearing, listening, Sounds - Other senses - Selective attention; physiological correlates of attention; Internal influences on perception learning – set - motivation & emotion - cognitive styles; External influences on perception figure and ground separation – movement – organization – illusion; Internal- external interactions: Constancy - Depth Perception- Binocular & Monocular Perception; Perceptual defense & Perceptual vigilance; Sensory deprivation -Sensory bombardment; ESP - Social Perception.

UNIT 3: COGNITION & AFFECT

UNIT 4: THINKING, PROBLEM-SOLVING & DECISION MAKING

UNIT 5: PERSONALITY & INTELLIGENCE
Psychological phenomena & Attributes of humans - cognition, motivation, and behavior - thoughts, feelings, perceptions, and actions – personality dimensions, traits, patterns - Specialized knowledge, performance accomplishments, automaticity or ease of functioning, skilled performance under challenge - generative flexibility, and speed of learning or behavior change.
References
COURSE DESCRIPTION
This course introduces students to multidisciplinary studies in Education, Technology and Society. Students will get an understanding of the relationship between education, technology and society. They will also learn about the long-lasting impact of good education in a technologically advanced society.

COURSE OBJECTIVES:
The course aims
- To help learners understand the basics of different types of technology utilised in the field of education
- To make them realize the impact of education in society
- To make them evolve as responsible citizen in a technologically advanced society

LEARNING OUTCOMES
By the end of the course, learners will be able to
- Understand the various apps of technology apps and use them to access, generate and present information effectively.
- Apply technology based resources and other media formats equitably, ethically and legally.
- Integrate their technical education for betterment of society as well as their personal life.

UNIT I INDIAN EDUCATION SYSTEM
Gurukul to ICT education – Teacher as facilitator – Macaulay’s Minutes – English medium vs Regional medium – Importance of Education in Modern India - Challenges in Education

UNIT II LEARNING THEORIES

UNIT III TECHNOLOGICAL ADVANCEMENTS
Web tools – Social media in education – elearning – MOOCs – Mobile assisted learning – Learning Apps – Blended learning - Self-directed learning

UNIT IV EDUCATIONAL TECHNOLOGY
Technological implications on Education – Teaching, Learning & Testing with Technology - Advantages and drawbacks – Critical analysis on the use of technology

UNIT V ETHICAL IMPLICATIONS
Plagiarism – Online Copyright issues – Ethical and value implications of education and technology on individual and society.

TOTAL: 45 PERIODS

TEACHING METHODS
Teaching modes include guest lectures, discussion groups, presentations, visual media, and a practicum style of learning.

EVALUATION
As this is course is not a content based course, it focuses more on the ethical use of technology in education and society, and so, evaluation can be based on assignments and discussions. So there is no need for an end semester examination. Internals marks can be taken for the total marks.
INTERNAL (100 % WEIGHTAGE)
(a) Written Test (40 marks)

(b) Assignment: Write a real time report of the technology use in any school / college
(15 marks)
(c) Presentation: Students choose any one of the technological tools and present its
relevance to education and society (15 marks)
(d) Group discussion: Students discuss in groups on case studies relating to various
challenges in education and technology use in society (20 marks)
(e) Blog entry: Making weekly blog posts in Class Blog on the topics related to the course
posted by the instructor and commenting on others’ posts. (10 marks)

REFERENCES
1) Education and Social order by Bertrand Russel
2) Theories of learning by Bower and Hilgard
3) Technology and Society by Jan L Harrington
OBJECTIVES

- To create a new understanding by teaching philosophy through a comparison of Indian and Western traditions.
- To foster critical thinking and imagination by dealing with inter-related concepts in literature and science.
- To bridge the gap between the sciences and humanities through introspective analyses.
- To nurture an understanding of the self and elucidates ways to progress towards a higher understanding of one’s self and others.

UNIT I KNOWLEDGE


UNIT II ORIGIN


UNIT III WORD


UNIT IV KNOWLEDGE AS POWER/OPPRESSION


UNIT V SELF KNOWLEDGE/BRHMAN


TOTAL : 45 PERIODS
OUTCOMES:
On completion of the course, the students will be able to:
1. Think sceptically, ask questions and to arrive at deductions.
2. Connect and relate different branches of thought.
3. Comprehends the relation between language, thought and action.
4. Arrive at a better understanding of self and others and forms a new outlook.

REFERENCES:
7. Bacon, Francis: Power as Knowledge
UNIT I       INTRODUCTION
Natureandfields.

UNIT II      PSYCHOLOGY IN INDUSTRIES AND ORGANIZATIONS
Jobanalysis; fatigueandaccidents; consumerbehavior.

UNIT III     PSYCHOLOGY AND MENTAL HEALTH
Abnormality, symptoms and causes psychological disorders

UNIT IV      PSYCHOLOGY AND COUNSELING
Need of Counseling, Counselor and the Counselee, Counseling Process, Areas of Counseling.

UNIT V       PSYCHOLOGY AND SOCIAL BEHAVIOUR
Group, group dynamics, teambuilding, Prejudice and stereotypes; Effective Communication, conflict and negotiation.

TOTAL: 45 PERIODS

TEXTBOOKS