PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

I. Graduates are able to develop, evaluate, and find solutions to challenges in manufacturing and industrial engineering.

II. Graduates will be qualified to find work in the manufacturing sector and become specialists in product and process design for environmentally responsible production.

III. Graduates become Production Engineering entrepreneurs via academic research and industry.

IV. To gain knowledge and experience in the fields of Materials, Management and Manufacturing respectively.

V. Communicate well, lead ethically, and behave responsibly with Lifelong learning which helps graduates adapt to changing technology.

PROGRAM OUTCOMES (POs)

<table>
<thead>
<tr>
<th>PO#</th>
<th>Graduate Attribute</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.</td>
</tr>
<tr>
<td>2</td>
<td>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.</td>
</tr>
<tr>
<td>3</td>
<td>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.</td>
</tr>
<tr>
<td>4</td>
<td>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.</td>
</tr>
<tr>
<td>5</td>
<td>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.</td>
</tr>
<tr>
<td>6</td>
<td>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.</td>
</tr>
<tr>
<td>7</td>
<td>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.</td>
</tr>
<tr>
<td>8</td>
<td>Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.</td>
</tr>
<tr>
<td>9</td>
<td>Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.</td>
</tr>
<tr>
<td>10</td>
<td>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.</td>
</tr>
</tbody>
</table>
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.

I. **PROGRAM SPECIFIC OUTCOMES (PSOs)**

1. Knowledge of the Production system includes being familiar with both fundamental and advanced techniques.

2. The knowledge necessary for the design, analysis, and development of production processes, automation systems, and quality control systems.

3. Knowledge on the application of materials, manufacturing processes, and production systems, as well as the creation of an ideal solution to accomplish continuous improvement in order to meet the requirements of industry and society, constitutes the foundation of continuous improvement.

<table>
<thead>
<tr>
<th>PEO</th>
<th>PO</th>
<th>PSO</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>II.</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>III.</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>IV.</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>V.</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

**PEO’s – PO’s & PSO’s MAPPING:**

<table>
<thead>
<tr>
<th>PEO</th>
<th>PO</th>
<th>PSO</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>II.</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>III.</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>IV.</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>V.</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>
## ANNA UNIVERSITY, CHENNAI
NON-AUTONOMOUS AFFILIATED COLLEGES
REGULATIONS 2021
CHOICE BASED CREDIT SYSTEM
B.E. PRODUCTION ENGINEERING

### CURRICULUM FOR SEMESTERS I TO VIII AND SYLLABI FOR SEMESTERS I TO IV

#### SEMESTER I

<table>
<thead>
<tr>
<th>SL. NO.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>PERIODS PER WEEK</th>
<th>TOTAL CONTACT PERIODS</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>IP3151</td>
<td>Induction Programme</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>HS3151</td>
<td>Professional English - I</td>
<td>HSMC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3.</td>
<td>MA3151</td>
<td>Matrices and Calculus</td>
<td>BSC</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>4.</td>
<td>PH3151</td>
<td>Engineering Physics</td>
<td>BSC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5.</td>
<td>CY3151</td>
<td>Engineering Chemistry</td>
<td>BSC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6.</td>
<td>GE3151</td>
<td>Problem Solving and Python Programming</td>
<td>ESC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7.</td>
<td>GE3152</td>
<td>டமிழ் மரபு / Heritage of Tamils</td>
<td>HSMC</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

#### PRACTICAL

| | GE3171 | Problem Solving and Python Programming Laboratory | ESC | 0 | 0 | 4 | 4 | 2 |        |
| | BS3171 | Physics and Chemistry Laboratory | BSC | 0 | 0 | 4 | 4 | 2 |        |
| | GE3172 | English Laboratory $\$ | EEC | 0 | 0 | 2 | 2 | 1 |        |

**TOTAL** 16 1 10 27 22

$\$Skill Based Course

#### SEMESTER II

<table>
<thead>
<tr>
<th>SL. NO.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>PERIODS PER WEEK</th>
<th>TOTAL CONTACT PERIODS</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>HS3251</td>
<td>Professional English - II</td>
<td>HSMC</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2.</td>
<td>MA3251</td>
<td>Statistics and Numerical Methods</td>
<td>BSC</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>3.</td>
<td>PH3251</td>
<td>Materials Science</td>
<td>BSC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4.</td>
<td>BE3251</td>
<td>Basic Electrical and Electronics Engineering</td>
<td>ESC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5.</td>
<td>GE3251</td>
<td>Engineering Graphics</td>
<td>ESC</td>
<td>2</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>6.</td>
<td>GE3252</td>
<td>நிகழ்த்து தமிழில் / Tamils and Technology</td>
<td>HSMC</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7.</td>
<td></td>
<td>NCC Credit Course Level 1*</td>
<td>-</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

#### PRACTICAL

| | GE3271 | Engineering Practices Laboratory | ESC | 0 | 0 | 4 | 4 | 2 |        |
| | BE3271 | Basic Electrical and Electronics Engineering Laboratory | ESC | 0 | 0 | 4 | 4 | 2 |        |
| | GE3272 | Communication Laboratory / Foreign Language $\$ | EEC | 0 | 0 | 4 | 4 | 2 |        |

**TOTAL** 14 1 16 31 23

$\$NCC Credit Course level 1 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA.

* Skill Based Course
### SEMESTER III

<table>
<thead>
<tr>
<th>SL. NO.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATE - GORY</th>
<th>PERIODS PER WEEK</th>
<th>TOTAL CONTACT PERIODS</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>THEORY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>MA3351</td>
<td>Transforms and Partial Differential Equations</td>
<td>BSC</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2.</td>
<td>ME3351</td>
<td>Engineering Mechanics</td>
<td>ESC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3.</td>
<td>PR3351</td>
<td>Thermodynamics and Thermal Engineering</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4.</td>
<td>PR3301</td>
<td>Machining Processes and Machine Tools</td>
<td>ESC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5.</td>
<td>PR3302</td>
<td>Engineering Materials</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6.</td>
<td>CE3391</td>
<td>Fluid Mechanics and Machinery</td>
<td>PCC</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>PRACTICAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>MF3361</td>
<td>Machining Technology Laboratory</td>
<td>PCC</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>8.</td>
<td>PR3311</td>
<td>Metallurgy and Materials Testing Laboratory</td>
<td>PCC</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>9.</td>
<td>GE3361</td>
<td>Professional Development*</td>
<td>EEC</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>18</td>
<td>2</td>
<td>10</td>
</tr>
</tbody>
</table>

*Skill Based Course

### SEMESTER IV

<table>
<thead>
<tr>
<th>SL. NO.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATE - GORY</th>
<th>PERIODS PER WEEK</th>
<th>TOTAL CONTACT PERIODS</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>THEORY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>PR3401</td>
<td>Metal Casting Technology</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2.</td>
<td>PR3451</td>
<td>Materials Joining Technology</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3.</td>
<td>ML3391</td>
<td>Mechanics of Solids</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4.</td>
<td>PR3402</td>
<td>Fluid Power Automation</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5.</td>
<td>MR3451</td>
<td>Kinematics and Dynamics of Machinery</td>
<td>PCC</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6.</td>
<td>GE3451</td>
<td>Environmental Sciences and Sustainability</td>
<td>BSC</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7.</td>
<td></td>
<td>NCC Credit Course Level 2*</td>
<td>-</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>PRACTICAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>PR3411</td>
<td>Foundry and Welding Laboratory</td>
<td>PCC</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>9.</td>
<td>PR3412</td>
<td>Dynamics of Machines Laboratory</td>
<td>PCC</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>10.</td>
<td>CE3481</td>
<td>Strength of Materials and Fluid Machinery Laboratory</td>
<td>ESC</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>18</td>
<td>0</td>
<td>12</td>
</tr>
</tbody>
</table>

* NCC Credit Course level 2 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA.
**SEMESTER V**

<table>
<thead>
<tr>
<th>SL. NO.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>PERIODS PER WEEK</th>
<th>TOTAL CONTACT PERIODS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>THEORY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>PR3501</td>
<td>Engineering Metrology</td>
<td>PCC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td>Professional Elective I</td>
<td>PEC</td>
<td>- - -</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td>Professional Elective II</td>
<td>PEC</td>
<td>- - -</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td>Professional Elective III</td>
<td>PEC</td>
<td>- - -</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td></td>
<td>Professional Elective IV</td>
<td>PEC</td>
<td>- - -</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td></td>
<td>Mandatory Course-I &amp;</td>
<td>MC</td>
<td>3 0 0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>PRACTICAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>PR3511</td>
<td>Summer internship</td>
<td>EEC</td>
<td>0 0 0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>8.</td>
<td>PR3512</td>
<td>Fluid Power Systems Laboratory</td>
<td>PCC</td>
<td>0 0 4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>9.</td>
<td>PR3513</td>
<td>Engineering Metrology Laboratory</td>
<td>PCC</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></td>
<td></td>
<td>20</td>
</tr>
</tbody>
</table>

&Mandatory Course-I is a Non-credit Course (Student shall select one course from the list given under MC-I)

**SEMESTER VI**

<table>
<thead>
<tr>
<th>SL. NO.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>PERIODS PER WEEK</th>
<th>TOTAL CONTACT PERIODS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>THEORY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>PR3601</td>
<td>Metal Forming Technology</td>
<td>PCC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td>Professional Elective V</td>
<td>PEC</td>
<td>- - -</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td>Professional Elective VI</td>
<td>PEC</td>
<td>- - -</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td>Professional Elective VII</td>
<td>PEC</td>
<td>- - -</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td></td>
<td>Open Elective – I *</td>
<td>OEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td></td>
<td>Mandatory Course-II &amp;</td>
<td>MC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>7.</td>
<td></td>
<td>NCC Credit Course Level 3 &amp;</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>PRACTICAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>PR3611</td>
<td>Metal Forming Lab and Special Machine Laboratory</td>
<td>PCC</td>
<td>0 0 4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>9.</td>
<td>PR3612</td>
<td>CAD and CAM Laboratory</td>
<td>PCC</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></td>
<td></td>
<td>19</td>
</tr>
</tbody>
</table>

*Open Elective – I shall be chosen from the emerging technologies*

&Mandatory Course-II is a Non-credit Course (Student shall select one course from the list given under MC-II)

& NCC Credit Course level 3 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA
### SEMESTER VII /VIII*

<table>
<thead>
<tr>
<th>SL. NO.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEG - GORY</th>
<th>PERIODS PER WEEK</th>
<th>TOTAL CONTACT PERIODS</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>MF3691</td>
<td>Mechatronics</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2.</td>
<td>ME3792</td>
<td>Computer Integrated Manufacturing</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3.</td>
<td>GE3791</td>
<td>Human Values and Ethics</td>
<td>HSMC</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4.</td>
<td>GE3752</td>
<td>Total Quality Management</td>
<td>HSMC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5.</td>
<td></td>
<td>Open Elective – II**</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6.</td>
<td></td>
<td>Open Elective – III***</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7.</td>
<td></td>
<td>Open Elective – IV***</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>PRACTICAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>MF3681</td>
<td>Mechatronics Laboratory</td>
<td>PCC</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td>20</td>
<td>0</td>
<td>4</td>
</tr>
</tbody>
</table>

*If students undergo internship in Semester VII, then the courses offered during semester VII will be offered during Semester VIII.

**Open Elective – II shall be chosen from the emerging technologies

***Open Elective III and IV (Shall be chosen from the list of open electives offered by other Programmes

### SEMESTER VIII /VII*

<table>
<thead>
<tr>
<th>SL. NO.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEG - GORY</th>
<th>PERIODS PER WEEK</th>
<th>TOTAL CONTACT PERIODS</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>PR3811</td>
<td>Project Work / Internship</td>
<td>EEC</td>
<td>0</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
<td>20</td>
</tr>
</tbody>
</table>

*If students undergo internship in Semester VII, then the courses offered during semester VII will be offered during semester VIII

TOTAL : 165 CREDITS
### MANDATORY COURSES I

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>PERIODS PER WEEK</th>
<th>TOTAL CONTACT PERIODS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>MX3081</td>
<td>Introduction to Women and Gender Studies</td>
<td>MC</td>
<td>3 0 0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>2.</td>
<td>MX3082</td>
<td>Elements of Literature</td>
<td>MC</td>
<td>3 0 0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>3.</td>
<td>MX3083</td>
<td>Film Appreciation</td>
<td>MC</td>
<td>3 0 0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>4.</td>
<td>MX3084</td>
<td>Disaster Management</td>
<td>MC</td>
<td>3 0 0</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

### MANDATORY COURSES II

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>PERIODS PER WEEK</th>
<th>TOTAL CONTACT PERIODS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>MX3085</td>
<td>Well Being with Traditional Practices (Yoga, Ayurveda and Siddha)</td>
<td>MC</td>
<td>3 0 0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>2.</td>
<td>MX3086</td>
<td>History of Science and Technology in India</td>
<td>MC</td>
<td>3 0 0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>3.</td>
<td>MX3087</td>
<td>Political and Economic Thought for a Humane Society</td>
<td>MC</td>
<td>3 0 0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>4.</td>
<td>MX3088</td>
<td>State, Nation Building and Politics in India</td>
<td>MC</td>
<td>3 0 0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>5.</td>
<td>MX3089</td>
<td>Industrial Safety</td>
<td>MC</td>
<td>3 0 0</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>
### Registration of Professional Elective Courses from Verticals:

Professional Elective Courses will be registered in Semesters V and VI. These courses are listed in groups called verticals that represent a particular area of specialisation / diversified group. Students are permitted to choose all the Professional Electives from a particular vertical or from different verticals. Further, only one Professional Elective course shall be chosen in a semester horizontally (row-wise). However, two courses are permitted from the same row, provided one course is enrolled in Semester V and another in Semester VI.

The registration of courses for B.E./B.Tech (Honours) or Minor degree shall be done from Semester V to VIII. The procedure for registration of courses explained above shall be followed for the courses of B.E./B.Tech (Honours) or Minor degree also. For more details on B.E./B.Tech (Honours) or Minor degree refer to the Regulations 2021, Clause 4.10.

Total number of courses per vertical may change as 6 or 7 or 8. If there is shortage of courses in a vertical then necessary courses may be chosen from another vertical of the same programme.

<table>
<thead>
<tr>
<th>Vertical 1</th>
<th>Vertical 2</th>
<th>Vertical 3</th>
<th>Vertical 4</th>
<th>Vertical 5</th>
<th>Vertical 6</th>
<th>Vertical 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROBOTICS AND AUTOMATION</td>
<td>OPERATIONS AND SUPPLY CHAIN MANAGEMENT</td>
<td>MATERIALS PROCESSING TECHNIQUES</td>
<td>TOOL ENGINEERING</td>
<td>LOGISTICS AND SUPPLY CHAIN MANAGEMENT</td>
<td>DIVERSIFIED COURSES GROUP 1</td>
<td>DIVERSIFIED COURSES GROUP 2</td>
</tr>
<tr>
<td>Electrical Drives and Actuators</td>
<td>Product Design and Value Engineering</td>
<td>Smart Materials for Manufacturing</td>
<td>Design of Press Tools</td>
<td>Warehousing Automation</td>
<td>Unconventional Machining Processes</td>
<td>Processing of Composites</td>
</tr>
<tr>
<td>Robotics</td>
<td>Business Process Re-Engineering</td>
<td>Micromachining and Fabrication</td>
<td>Design of Tooling for Thermoplastics</td>
<td>Robotics</td>
<td>Production of Automotive Components</td>
<td>Finite Element Analysis</td>
</tr>
<tr>
<td>Smart mobility and Intelligent Vehicles</td>
<td>Enterprise Resource Planning</td>
<td>Additive Manufacturing</td>
<td>Design of Tooling for Die Casting</td>
<td>Container Logistics</td>
<td>Robotic Technology</td>
<td>CNC Machining Technology</td>
</tr>
<tr>
<td>Drone Technologies</td>
<td>Supply Chain Risk Management</td>
<td>Surface Engineering</td>
<td>Design of Gauges</td>
<td>Data Science</td>
<td>Instrumentation and Control</td>
<td>Machine Design</td>
</tr>
<tr>
<td>Logistics Management</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## PROFESSIONAL ELECTIVE COURSES: VERTICALS

### VERTICAL 1: ROBOTICS AND AUTOMATION

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Category</th>
<th>Periods Per week</th>
<th>Total Contact Periods</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MR3491</td>
<td>Sensors and Instrumentation</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>MR3392</td>
<td>Electrical Drives and Actuators</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>MR3492</td>
<td>Embedded Systems and Programming</td>
<td>PEC</td>
<td>2 0 2</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>MR3691</td>
<td>Robotics</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>CMR338</td>
<td>Smart mobility and Intelligent Vehicles</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>CME345</td>
<td>Haptics and Immersive Technologies</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>CRA332</td>
<td>Drone Technologies</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

### VERTICAL 2 - OPERATIONS AND SUPPLY CHAIN MANAGEMENT

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Category</th>
<th>Periods Per week</th>
<th>Total Contact Periods</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CIE331</td>
<td>Project Management</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>CIE332</td>
<td>Product Design and Value Engineering</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>CIE333</td>
<td>Facility Design</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>CIE334</td>
<td>Business Process Re-Engineering</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>CIE335</td>
<td>Enterprise Resource Planning</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>CIE336</td>
<td>Cost Estimation and Control</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>CIE337</td>
<td>Supply Chain Risk Management</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>CIE338</td>
<td>Logistics Management</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>
### VERTICAL 3 – MATERIALS PROCESSING TECHNIQUES

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>PERIODS PER WEEK</th>
<th>TOTAL CONTACT PERIODS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>PR3001</td>
<td>Processing and Properties of Composites</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>PR3002</td>
<td>Smart Materials for Manufacturing</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>PR3003</td>
<td>MEMS and Nanotechnology</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>PR3004</td>
<td>Micromachining and Fabrication</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>CME339</td>
<td>Additive Manufacturing</td>
<td>PEC</td>
<td>2 0 2</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>PR3005</td>
<td>Material Testing and Characterization</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>7.</td>
<td>CME397</td>
<td>Surface Engineering</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

### VERTICAL 4 – TOOL ENGINEERING

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Course code</th>
<th>Course title</th>
<th>Category</th>
<th>Periods Per week</th>
<th>Total conta periods</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>CMF331</td>
<td>Design of Jigs and Fixtures</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>CMF332</td>
<td>Design of Press Tools</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>CMF333</td>
<td>Design of Cutting Tools</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>CMF334</td>
<td>Design of Tooling for Thermoplastics</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>CMF335</td>
<td>Design of Tooling for Die Casting</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>CMF336</td>
<td>Design of Tooling for Thermosets</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>7.</td>
<td>CMF337</td>
<td>Design of Gauges</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>
### VERTICAL 5: LOGISTICS AND SUPPLY CHAIN MANAGEMENT

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Course code</th>
<th>Course title</th>
<th>Category</th>
<th>Periods Per week</th>
<th>Total contact periods</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>CME373</td>
<td>Automation in Manufacturing</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>CME374</td>
<td>Warehousing Automation</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>CME375</td>
<td>Material Handling Equipment, Repair and Maintenance</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>CME378</td>
<td>Robotics</td>
<td>PEC</td>
<td>2 0 2</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>CME377</td>
<td>Container Logistics</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>CME376</td>
<td>Logistics in Manufacturing, Supply Chain and Distribution</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>7.</td>
<td>CME379</td>
<td>Data Science</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

### VERTICAL 6: DIVERSIFIED COURSES GROUP 1

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>PERIODS PER WEEK</th>
<th>TOTAL CONTACT PERIODS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>CPR331</td>
<td>Elements of Green Manufacturing</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>CMF339</td>
<td>Unconventional Machining Processes</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>CMF338</td>
<td>Non Destructive Testing and Evaluation</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>PR3006</td>
<td>Production of Automotive Components</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>PR3007</td>
<td>Robotic Technology</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>PR3008</td>
<td>Machine Vision</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>7.</td>
<td>PR3009</td>
<td>Instrumentation and Control</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

### VERTICAL 7: DIVERSIFIED COURSES GROUP 2

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>PERIODS PER WEEK</th>
<th>TOTAL CONTACT PERIODS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>PR3010</td>
<td>Surface Modifications and Analytical Techniques</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>PR3011</td>
<td>Processing of Composites</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>PR3012</td>
<td>Computer Aided Product Design</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>CPR332</td>
<td>Finite Element Analysis</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>MF3491</td>
<td>CNC Machining Technology</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>PR3013</td>
<td>Quality Control and Reliability Engineering</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>7.</td>
<td>CPR333</td>
<td>Machine Design</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>
OPEN ELECTIVES
(Students shall choose the open elective courses, such that the course contents are not similar to any other course contents/title under other course categories).

OPEN ELECTIVE I AND II
(EMERGING TECHNOLOGIES)
To be offered other than Faculty of Information and Communication Engineering

<table>
<thead>
<tr>
<th>SL. NO.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>PERIODS PER WEEK</th>
<th>TOTAL CONTACT Periods</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OCS351</td>
<td>Artificial Intelligence and Machine Learning Fundamentals</td>
<td>OEC</td>
<td>2 0 2</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>OCS352</td>
<td>IoT Concepts and Applications</td>
<td>OEC</td>
<td>2 0 2</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>OCS353</td>
<td>Data Science Fundamentals</td>
<td>OEC</td>
<td>2 0 2</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>OCS354</td>
<td>Augmented and Virtual Reality</td>
<td>OEC</td>
<td>2 0 2</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>OHS351</td>
<td>English for Competitive Examinations</td>
<td>OEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>OCE353</td>
<td>Lean Concepts, Tools And Practices</td>
<td>OEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>OMG352</td>
<td>NGOs and Sustainable Development</td>
<td>OEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>OMG353</td>
<td>Democracy and Good Governance</td>
<td>OEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>OME353</td>
<td>Renewable Energy Technologies</td>
<td>OEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>OMF351</td>
<td>Reverse Engineering</td>
<td>OEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>OAU351</td>
<td>Electric and Hybrid Vehicle</td>
<td>OEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>OAS352</td>
<td>Space Engineering</td>
<td>OEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>OIM351</td>
<td>Industrial Management</td>
<td>OEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>OIE354</td>
<td>Quality Engineering</td>
<td>OEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>OSF351</td>
<td>Fire Safety Engineering</td>
<td>OEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>OML351</td>
<td>Introduction to non-destructive testing</td>
<td>OEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>OMR351</td>
<td>Mechatronics</td>
<td>OEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
<td>Department</td>
<td>Credits</td>
<td>Hours</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------</td>
<td>--------------------------------------------------</td>
<td>------------</td>
<td>---------</td>
<td>-------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ORA351</td>
<td>Foundation of Robotics</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OAE352</td>
<td>Fundamentals of Aeronautical engineering</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OGI351</td>
<td>Remote Sensing Concepts</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OAI351</td>
<td>Urban Agriculture</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OEN351</td>
<td>Drinking Water Supply and Treatment</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OEE352</td>
<td>Electric Vehicle technology</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OEI353</td>
<td>Introduction to PLC Programming</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OCH351</td>
<td>Nano Technology</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OCH352</td>
<td>Functional Materials</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OBT352</td>
<td>Biomedical Instrumentation</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OFD352</td>
<td>Traditional Indian Foods</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OFD353</td>
<td>Introduction to food processing</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OPY352</td>
<td>IPR for Pharma Industry</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OTT351</td>
<td>Basics of Textile Finishing</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OTT352</td>
<td>Industrial Engineering for Garment Industry</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OTE353</td>
<td>Basics of Textile Manufacture</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OPE351</td>
<td>Introduction to Petroleum Refining and Petrochemicals</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OPE352</td>
<td>Energy Conservation and Management</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OPT351</td>
<td>Basics of Plastics Processing</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OEC351</td>
<td>Signals and Systems</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OEC352</td>
<td>Fundamentals of Electronic Devices and Circuits</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OBM351</td>
<td>Foundation Skills in integrated product Development</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OBM352</td>
<td>Assistive Technology</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OMA352</td>
<td>Operations Research</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OMA353</td>
<td>Algebra and Number Theory</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OMA354</td>
<td>Linear Algebra</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SL. NO.</td>
<td>COURSE CODE</td>
<td>COURSE TITLE</td>
<td>CATEGORY</td>
<td>PERIODS PER WEEK</td>
<td>TOTAL CONTACT PERIODS</td>
<td>CREDITS</td>
</tr>
<tr>
<td>--------</td>
<td>-------------</td>
<td>-------------------------------------------------------</td>
<td>----------</td>
<td>------------------</td>
<td>------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>1.</td>
<td>OHS352</td>
<td>Project Report Writing</td>
<td>OEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>OCE354</td>
<td>Basics of Integrated Water Resources Management</td>
<td>OEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>OMA355</td>
<td>Advanced Numerical Methods</td>
<td>OEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>OMA356</td>
<td>Random Processes</td>
<td>OEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>OMA357</td>
<td>Queuing and Reliability Modelling</td>
<td>OEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>OMG354</td>
<td>Production and Operations Management for Entrepreneurs</td>
<td>OEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>7.</td>
<td>OMG355</td>
<td>Multivariate Data Analysis</td>
<td>OEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>8.</td>
<td>OME352</td>
<td>Additive Manufacturing</td>
<td>OEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>9.</td>
<td>OME353</td>
<td>New Product Development</td>
<td>OEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>10.</td>
<td>OME355</td>
<td>Industrial Design &amp; Rapid Prototyping Techniques</td>
<td>OEC</td>
<td>2 0 2</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>11.</td>
<td>OMF352</td>
<td>Micro and Precision Engineering</td>
<td>OEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>12.</td>
<td>OAU352</td>
<td>Batteries and Management system</td>
<td>OEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>13.</td>
<td>OAU353</td>
<td>Sensors and Actuators</td>
<td>OEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>14.</td>
<td>OAS353</td>
<td>Space Vehicles</td>
<td>OEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>15.</td>
<td>OIM352</td>
<td>Management Science</td>
<td>OEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>16.</td>
<td>OIE353</td>
<td>Operations Management</td>
<td>OEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>17.</td>
<td>OSF352</td>
<td>Industrial Hygiene</td>
<td>OEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>18.</td>
<td>OSF353</td>
<td>Chemical Process Safety</td>
<td>OEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>19.</td>
<td>OML352</td>
<td>Electrical, Electronic and Magnetic materials</td>
<td>OEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>20.</td>
<td>OML353</td>
<td>Nanomaterials and applications</td>
<td>OEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>21.</td>
<td>OMR352</td>
<td>Hydraulics and Pneumatics</td>
<td>OEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>22.</td>
<td>OMR353</td>
<td>Sensors</td>
<td>OEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>23.</td>
<td>ORA352</td>
<td>Foundation of Automation</td>
<td>OEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>24.</td>
<td>ORA353</td>
<td>Concepts in Mobile Robotics</td>
<td>OEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>25.</td>
<td>OMV351</td>
<td>Marine Propulsion</td>
<td>OEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Course Code</td>
<td>Course Name</td>
<td>Department</td>
<td>Credits</td>
<td>1st Year Credits</td>
<td>2nd Year Credits</td>
</tr>
<tr>
<td>----</td>
<td>-------------</td>
<td>-------------------------------------------------</td>
<td>------------</td>
<td>---------</td>
<td>------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>26</td>
<td>OMV352</td>
<td>Marine Merchant Vehicles</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>27</td>
<td>OMV353</td>
<td>Elements of Marine Engineering</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>28</td>
<td>OAE353</td>
<td>Drone Technologies</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>29</td>
<td>OGI352</td>
<td>Geographical Information System</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>30</td>
<td>OA1352</td>
<td>Agriculture Entrepreneurship Development</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>31</td>
<td>OEN352</td>
<td>Biodiversity Conservation</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>32</td>
<td>OEE353</td>
<td>Introduction to control systems</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>33</td>
<td>OEL354</td>
<td>Introduction to Industrial Automation Systems</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>34</td>
<td>OCH353</td>
<td>Energy Technology</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>35</td>
<td>OCH354</td>
<td>Surface Science</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>36</td>
<td>OBT353</td>
<td>Environment and Agriculture</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>37</td>
<td>OFD354</td>
<td>Fundamentals of Food Engineering</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>38</td>
<td>OFD355</td>
<td>Food safety and Quality Regulations</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>39</td>
<td>OPE353</td>
<td>Nutraceuticals</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>40</td>
<td>OTT354</td>
<td>Basics of Dyeing and Printing</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>41</td>
<td>OTT355</td>
<td>Fibre Science</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>42</td>
<td>OTT356</td>
<td>Garment Manufacturing Technology</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>43</td>
<td>OPE353</td>
<td>Industrial safety</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>44</td>
<td>OPE354</td>
<td>Unit Operations in Petro Chemical Industries</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>45</td>
<td>OPT352</td>
<td>Plastic Materials for Engineers</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>46</td>
<td>OPT353</td>
<td>Properties and Testing of Plastics</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>47</td>
<td>OEC353</td>
<td>VLSI Design</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>48</td>
<td>OEC354</td>
<td>Industrial IoT and Industry 4.0</td>
<td>OEC</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>49</td>
<td>OBM353</td>
<td>Wearable devices</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>50</td>
<td>OBM354</td>
<td>Medical Informatics</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
## B.E. PRODUCTION ENGINEERING

<table>
<thead>
<tr>
<th>S.No</th>
<th>Subject Area</th>
<th>Credits per Semester</th>
<th>Total Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>I</td>
<td>II</td>
</tr>
<tr>
<td>1</td>
<td>HSMC</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>BSC</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>ESC</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>4</td>
<td>PCC</td>
<td></td>
<td>14</td>
</tr>
<tr>
<td>5</td>
<td>PEC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>OEC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>EEC</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>Non-Credit / (Mandatory)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>22</td>
<td>23</td>
</tr>
</tbody>
</table>
ENROLLMENT FOR B.E. / B. TECH. (HONOURS) / MINOR DEGREE (OPTIONAL)

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honours) or Minor Degree.

For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only.

For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes, Moreover, for minor degree the student can register for courses from any one of the following verticals also.

Complete details are available in clause 4.10 of Regulations 2021.

**VERTICALS FOR MINOR DEGREE**
(In addition to all the verticals of other programmes)

<table>
<thead>
<tr>
<th>Vertical I</th>
<th>Vertical II</th>
<th>Vertical III</th>
<th>Vertical IV</th>
<th>Vertical V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial Management</td>
<td>Foundations of Entrepreneurship</td>
<td>Principles of Public Administration</td>
<td>Statistics for Management</td>
<td>Sustainable Infrastructure Development</td>
</tr>
<tr>
<td>Fundamentals of Investment</td>
<td>Team Building and Leadership Management for Business</td>
<td>Constitution of India</td>
<td>Data Mining for Business Intelligence</td>
<td>Sustainable Agriculture and Environmental Management</td>
</tr>
<tr>
<td>Banking, Financial Services and Insurance</td>
<td>Creativity and Innovation in Entrepreneurship</td>
<td>Public Personnel Administration</td>
<td>Human Resource Analytics</td>
<td>Sustainable Bio Materials</td>
</tr>
<tr>
<td>Introduction to Blockchain and its Applications</td>
<td>Principles of Marketing Management for Business</td>
<td>Administrative Theories</td>
<td>Marketing and Social Media Web Analytics</td>
<td>Materials for Energy Sustainability</td>
</tr>
<tr>
<td>Fintech Personal Finance and Payments</td>
<td>Human Resource Management for Entrepreneurship</td>
<td>Indian Administrative System</td>
<td>Operation and Supply Chain Analytics</td>
<td>Green Technology</td>
</tr>
<tr>
<td>Introduction to Fintech</td>
<td>Financing New Business Ventures</td>
<td>Public Policy Administration</td>
<td>Financial Analytics</td>
<td>Environmental Quality Monitoring and Analysis</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Integrated Energy Planning for Sustainable Development</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Energy Efficiency for Sustainable Development</td>
</tr>
</tbody>
</table>
(Choice of courses for Minor degree is to be made from any one vertical of other programmes or from anyone of the following verticals)

**VERTICAL 1: FINTECH AND BLOCK CHAIN**

<table>
<thead>
<tr>
<th>SL. NO.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>PERIODS PER WEEK</th>
<th>TOTAL CONTACT PERIODS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>CMG331</td>
<td>Financial Management</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>CMG332</td>
<td>Fundamentals of Investment</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>CMG333</td>
<td>Banking, Financial Services and Insurance</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>CMG334</td>
<td>Introduction to Blockchain and its Applications</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>CMG335</td>
<td>Fintech Personal Finance and Payments</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>CMG336</td>
<td>Introduction to Fintech</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

**VERTICAL 2: ENTREPRENEURSHIP**

<table>
<thead>
<tr>
<th>SL. NO.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>PERIODS PER WEEK</th>
<th>TOTAL CONTACT PERIODS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>CMG337</td>
<td>Foundations of Entrepreneurship</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>CMG338</td>
<td>Team Building and Leadership Management for Business</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>CMG339</td>
<td>Creativity and Innovation in Entrepreneurship</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>CMG340</td>
<td>Principles of Marketing Management for Business</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>CMG341</td>
<td>Human Resource Management for Entrepreneurship</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>CMG342</td>
<td>Financing New Business Ventures</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>
### VERTICAL 3: PUBLIC ADMINISTRATION

<table>
<thead>
<tr>
<th>SL. NO.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>PERIODS PER WEEK</th>
<th>TOTAL CONTACT PERIODS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CMG343</td>
<td>Principles of Public Administration</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>CMG344</td>
<td>Constitution of India</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>CMG345</td>
<td>Public Personnel Administration</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>CMG346</td>
<td>Administrative Theories</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>CMG347</td>
<td>Indian Administrative System</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>CMG348</td>
<td>Public Policy Administration</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

### VERTICAL 4: BUSINESS DATA ANALYTICS

<table>
<thead>
<tr>
<th>SL. NO.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>PERIODS PER WEEK</th>
<th>TOTAL CONTACT PERIODS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CMG349</td>
<td>Statistics for Management</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>CMG350</td>
<td>Datamining for Business Intelligence</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>CMG351</td>
<td>Human Resource Analytics</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>CMG352</td>
<td>Marketing and Social Media Web Analytics</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>CMG353</td>
<td>Operation and Supply Chain Analytics</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>CMG354</td>
<td>Financial Analytics</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>SL. NO.</td>
<td>COURSE CODE</td>
<td>COURSE TITLE</td>
<td>CATEGORY</td>
<td>PERIODS PER WEEK</td>
<td>TOTAL CONTACT PERIODS</td>
<td>CREDITS</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
<td>------------------------------------------</td>
<td>----------</td>
<td>------------------</td>
<td>------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>1.</td>
<td>CES331</td>
<td>Sustainable infrastructure Development</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>CES332</td>
<td>Sustainable Agriculture and Environmental Management</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>CES333</td>
<td>Sustainable Bio Materials</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>CES334</td>
<td>Materials for Energy Sustainability</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>CES335</td>
<td>Green Technology</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>CES336</td>
<td>Environmental Quality Monitoring and Analysis</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>7.</td>
<td>CES337</td>
<td>Integrated Energy Planning for Sustainable Development</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>8.</td>
<td>CES338</td>
<td>Energy Efficiency for Sustainable Development</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>
This is a mandatory 2 week programme to be conducted as soon as the students enter the institution. Normal classes start only after the induction program is over.

The induction programme has been introduced by AICTE with the following objective:

“Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond. The graduating student must have knowledge and skills in the area of his/her study. However, he/she must also have broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he/she would understand and fulfill his/her responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying values are needed.”

“One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character.”

Hence, the purpose of this programme is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

(i) Physical Activity

This would involve a daily routine of physical activity with games and sports, yoga, gardening, etc.

(ii) Creative Arts

Every student would choose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it everyday for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, grow into engineering design later.

(iii) Universal Human Values

This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do's and dont's, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing. Discussions would be conducted in small groups of about 20 students with a faculty
mentor each. It would be effective that the faculty mentor assigned is also the faculty advisor for the student for the full duration of the UG programme.

(iv) Literary Activity

Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

(v) Proficiency Modules

This would address some lacunas that students might have, for example, English, computer familiarity etc.

(vi) Lectures by Eminent People

Motivational lectures by eminent people from all walks of life should be arranged to give the students exposure to people who are socially active or in public life.

(vii) Visits to Local Area

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the underprivileged.

(viii) Familiarization to Dept./Branch & Innovations

They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

(ix) Department Specific Activities

About a week can be spent in introducing activities (games, quizzes, social interactions, small experiments, design thinking etc.) that are relevant to the particular branch of Engineering/Technology/Architecture that can serve as a motivation and kindle interest in building things (become a maker) in that particular field. This can be conducted in the form of a workshop. For example, CSE and IT students may be introduced to activities that kindle computational thinking, and get them to build simple games. ECE students may be introduced to building simple circuits as an extension of their knowledge in Science, and so on. Students may be asked to build stuff using their knowledge of science.

**Induction Programme is totally an activity based programme and therefore there shall be no tests / assessments during this programme.**

References:

Guide to Induction program from AICTE
OBJECTIVES:

- To improve the communicative competence of learners
- To learn to use basic grammatic structures in suitable contexts
- To acquire lexical competence and use them appropriately in a sentence and understand their meaning in a text
- To help learners use language effectively in professional contexts
- To develop learners’ ability to read and write complex texts, summaries, articles, blogs, definitions, essays and user manuals.

UNIT I INTRODUCTION TO EFFECTIVE COMMUNICATION

What is effective communication? (Explain using activities) Why is communication critical for excellence during study, research and work? What are the seven C’s of effective communication? What are key language skills? What is effective listening? What does it involve? What is effective speaking? What does it mean to be an excellent reader? What should you be able to do? What is effective writing? How does one develop language and communication skills? What does the course focus on? How are communication and language skills going to be enhanced during this course? What do you as a learner need to do to enhance your English language and communication skills to get the best out of this course?

UNIT 1 INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION

Reading - Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails. Writing - Writing emails / letters introducing oneself. Grammar - Present Tense (simple and progressive); Question types: Why/ Yes or No/ and Tags. Vocabulary - Synonyms; One word substitution; Abbreviations & Acronyms (as used in technical contexts).

UNIT II NARRATION AND SUMMATION

Reading - Reading biographies, travelogues, newspaper reports, Excerpts from literature, and travel & technical blogs. Writing - Guided writing -- Paragraph writing Short Report on an event (field trip etc.) Grammar – Past tense (simple); Subject-Verb Agreement; and Prepositions. Vocabulary - Word forms (prefixes& suffixes); Synonyms and Antonyms. Phrasal verbs.

UNIT III DESCRIPTION OF A PROCESS / PRODUCT

Reading – Reading advertisements, gadget reviews; user manuals. Writing - Writing definitions; instructions; and Product /Process description. Grammar - Imperatives; Adjectives; Degrees of comparison; Present & Past Perfect Tenses. Vocabulary - Compound Nouns, Homonyms; and Homophones, discourse markers (connectives & sequence words).

UNIT IV CLASSIFICATION AND RECOMMENDATIONS

Reading – Newspaper articles; Journal reports –and Non Verbal Communication (tables, pie charts etc.). Writing – Note-making / Note-taking (*Study skills to be taught, not tested); Writing recommendations; Transferring information from non verbal (chart, graph etc, to verbal mode) Grammar – Articles; Pronouns - Possessive & Relative pronouns. Vocabulary - Collocations; Fixed / Semi fixed expressions.

UNIT V EXPRESSION

Reading – Reading editorials; and Opinion Blogs; Writing – Essay Writing (Descriptive or narrative). Grammar – Future Tenses, Punctuation; Negation (Statements & Questions); and Simple, Compound & Complex Sentences. Vocabulary - Cause & Effect Expressions – Content vs Function words.

TOTAL : 45 PERIODS
LEARNING OUTCOMES:
At the end of the course, learners will be able
- To use appropriate words in a professional context
- To gain understanding of basic grammatic structures and use them in right context.
- To read and infer the denotative and connotative meanings of technical texts
- To write definitions, descriptions, narrations and essays on various topics

TEXT BOOKS:
1. English for Engineers & Technologists Orient Blackswan Private Ltd. Department of English, Anna University, (2020 edition)
   Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

REFERENCE BOOKS:

ASSESSMENT PATTERN
Two internal assessments and an end semester examination to test students’ reading and writing skills along with their grammatical and lexical competence.

MA3151  MATRICES AND CALCULUS  L  T  P  C
3  1  0  4

COURSE 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  9 + 3
UNIT - II DIFFERENTIAL CALCULUS 9 + 3

UNIT - III FUNCTIONS OF SEVERAL VARIABLES 9 + 3

UNIT - IV INTEGRAL CALCULUS 9 + 3
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 - Applications : Hydrostatic force and pressure, moments and centres of mass.

UNIT - V MULTIPLE INTEGRALS 9 + 3

TOTAL: 60 PERIODS

COURSE 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 in 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.

TEXT BOOKS:
3. James Stewart, "Calculus : Early Transcendentals", Cengage Learning, 8th Edition, New Delhi, 2015. [For Units II & IV - Sections 1.1, 2.2, 2.3, 2.5, 2.7 (Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1 (Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].

REFERENCES:
COURSE OBJECTIVES

- To make the students effectively to achieve an understanding of mechanics.
- To enable the students to gain knowledge of electromagnetic waves and its applications.
- To introduce the basics of oscillations, optics and lasers.
- Equipping the students to be successfully understand the importance of quantum physics.
- To motivate the students towards the applications of quantum mechanics.

UNIT I  MECHANICS

UNIT II  ELECTROMAGNETIC WAVES
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 –Compton effect - The Schrodinger equation (Time dependent and time independent forms) - meaning of wave function - Normalization –Free particle - particle in a infinite potential well: 1D,2D and 3D Boxes- Normalization, probabilities and the correspondence principle.

UNIT V  APPLIED QUANTUM MECHANICS
The harmonic oscillator(qualitative)- Barrier penetration and quantum tunneling(qualitative)- Tunneling microscope - Resonant diode - Finite potential wells (qualitative)- Bloch’s theorem for particles in a periodic potential –Basics of Kronig-Penney model and origin of energy bands.

TOTAL : 45 PERIODS
COURSE OUTCOMES
After completion of this course, the students should be able to
- Understand the importance of mechanics.
- Express their knowledge in electromagnetic waves.
- Demonstrate a strong foundational knowledge in oscillations, optics and lasers.
- Understand the importance of quantum physics.
- Comprehend and apply quantum mechanical principles towards the formation of energy bands.

TEXT BOOKS:
2. E.M.Purcell and D.J.Morin, Electricity and Magnetism, Cambridge Univ.Press, 2013.

REFERENCES:

CY3151 ENGINEERING CHEMISTRY

COURSE OBJECTIVES:
- To inculcate sound understanding of water quality parameters and water treatment techniques.
- To impart knowledge on the basic principles and preparatory methods of nanomaterials.
- To introduce the basic concepts and applications of phase rule and composites.
- To facilitate the understanding of different types of fuels, their preparation, properties and combustion characteristics.
- To familiarize the students with the operating principles, working processes and applications of energy conversion and storage devices.

UNIT I WATER AND ITS TREATMENT
UNIT II  NANOCHEMISTRY
Basics: Distinction between molecules, nanomaterials and bulk materials; Size-dependent properties (optical, electrical, mechanical and magnetic); Types of nanomaterials: Definition, properties and uses of – nanoparticle, nanocluster, nanorod, nanowire and nanotube. Preparation of nanomaterials: sol-gel, solvothermal, laser ablation, chemical vapour deposition, electrochemical deposition and electro spinning. Applications of nanomaterials in medicine, agriculture, energy, electronics and catalysis.

UNIT III  PHASE RULE AND COMPOSITES
Phase rule: Introduction, definition of terms with examples. One component system - water system; Reduced phase rule; Construction of a simple eutectic phase diagram - Thermal analysis; Two component system: lead-silver system - Pattinson process. Composites: Introduction: Definition & Need for composites; Constitution: Matrix materials (Polymer matrix, metal matrix and ceramic matrix) and Reinforcement (fiber, particulates, flakes and whiskers). Properties and applications of: Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites. Hybrid composites - definition and examples.

UNIT IV  FUELS AND COMBUSTION

UNIT V  ENERGY SOURCES AND STORAGE DEVICES
Stability of nucleus: mass defect (problems), binding energy; Nuclear energy: light water nuclear power plant, breeder reactor. Solar energy conversion: Principle, working and applications of solar cells; Recent developments in solar cell materials. Wind energy; Geothermal energy; Batteries: Types of batteries, Primary battery - dry cell, Secondary battery - lead acid battery and lithium-ion-battery; Electric vehicles – working principles; Fuel cells: H₂-O₂ fuel cell, microbial fuel cell; Supercapacitors: Storage principle, types and examples.

TOTAL: 45 PERIODS

COURSE OUTCOMES
At the end of the course, the students will be able:

- To infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.
- To identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.
- To apply the knowledge of phase rule and composites for material selection requirements.
- To recommend suitable fuels for engineering processes and applications.
- To recognize different forms of energy resources and apply them for suitable applications in energy sectors.

TEXT BOOKS:
REFERENCES:

GE3151 PROBLEM SOLVING AND PYTHON PROGRAMMING L T P C
3 0 0 3

COURSE OBJECTIVES:
• To understand the basics of algorithmic problem solving.
• To learn to solve problems using Python conditionals and loops.
• To define Python functions and use function calls to solve problems.
• To use Python data structures - lists, tuples, dictionaries to represent complex data.
• To do input/output with files in Python.

UNIT I COMPUTATIONAL THINKING AND PROBLEM SOLVING

UNIT II DATA TYPES, EXPRESSIONS, STATEMENTS
Python interpreter and interactive mode, debugging; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROL FLOW, FUNCTIONS, STRINGS
Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV LISTS, TUPLES, DICTIONARIES
Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation.
UNIT V FILES, MODULES, PACKAGES

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file, Voter’s age validation, Marks range validation (0-100).

TOTAL : 45 PERIODS

COURSE OUTCOMES:
Upon completion of the course, students will be able to
CO1: Develop algorithmic solutions to simple computational problems.
CO2: Develop and execute simple Python programs.
CO3: Write simple Python programs using conditionals and looping for solving problems.
CO4: Decompose a Python program into functions.
CO5: Represent compound data using Python lists, tuples, dictionaries etc.
CO6: Read and write data from/to files in Python programs.

TEXT BOOKS:

REFERENCES:
5. https://www.python.org/
TEXT-CUM-REFERENCE BOOKS

1. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
2. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
3. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
4. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
5. Keeladi - ‘Sangam City Civilization on the banks of river Vaigai’ (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
6. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
7. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
UNIT I  LANGUAGE AND LITERATURE  3

UNIT II  HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE  3

UNIT III  FOLK AND MARTIAL ARTS  3
Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT IV  THINAI CONCEPT OF TAMILS  3
Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

UNIT V  CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE  3
Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS
1. மொழிபெயர் மற்றும் மிக்கவைகள் – தமிழ் பல்கலைக் கழகம் – தமிழ். பிராமணம் (தமிழில்: மொழிபெயர் மற்றும் மிக்கவைகள் – தமிழில் பல்கலைக் கழகம்).
2. கல்விகைத் தொகுப்பு – புதுக்கோட்டை ஒழு கல்வியியல் (எழுதிய பிராமணம்).
3. வேளாண்மை - தமிழக நகரிகம் - செயற்கை தமிழ் தற்கொலை (தமிழில் தற்கொலை).
4. வரலைகள் – அறிவியல் தத்தொல்லியல் (தமிழில் தற்கொலை).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - ‘Sangam City Civilization on the banks of river Vaigai’ (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
COURSE OBJECTIVES:
- To understand the problem solving approaches.
- To learn the basic programming constructs in Python.
- To practice various computing strategies for Python-based solutions to real world problems.
- To use Python data structures - lists, tuples, dictionaries.
- To do input/output with files in Python.

EXPERIMENTS:
Note: The examples suggested in each experiment are only indicative. The lab instructor is expected to design other problems on similar lines. The Examination shall not be restricted to the sample experiments listed here.
1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)
2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).
3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)
4. Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building –operations of list & tuples)
5. Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)
6. Implementing programs using Functions. (Factorial, largest number in a list, area of shape)
7. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)
8. Implementing programs using written modules and Python Standard Libraries (pandas, numpy, Matplotlib, scipy)
9. Implementing real-time/technical applications using File handling. (copy from one file to another, word count, longest word)
10. Implementing real-time/technical applications using Exception handling. (divide by zero error, voter’s age validity, student mark range validation)
12. Developing a game activity using Pygame like bouncing ball, car race etc.

COURSE OUTCOMES:
On completion of the course, students will be able to:
CO1: Develop algorithmic solutions to simple computational problems
CO2: Develop and execute simple Python programs.
CO3: Implement programs in Python using conditionals and loops for solving problems.
CO4: Deploy functions to decompose a Python program.
CO5: Process compound data using Python data structures.
CO6: Utilize Python packages in developing software applications.

TOTAL: 60 PERIODS
TEXT BOOKS:

REFERENCES:
5. https://www.python.org/

BS3171 PHYSICS AND CHEMISTRY LABORATORY

PHYSICS LABORATORY: (Any Seven Experiments)

COURSE OBJECTIVES:
- To learn the proper use of various kinds of physics laboratory equipment.
- To learn how data can be collected, presented and interpreted in a clear and concise manner.
- To learn problem solving skills related to physics principles and interpretation of experimental data.
- To determine error in experimental measurements and techniques used to minimize such error.
- To make the student as an active participant in each part of all lab exercises.

1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of regular and irregular objects.
2. Simple harmonic oscillations of cantilever.
3. Non-uniform bending - Determination of Young’s modulus
4. Uniform bending – Determination of Young’s modulus
5. Laser- Determination of the wave length of the laser using grating
6. Air wedge - Determination of thickness of a thin sheet/wire
7. a) Optical fibre - Determination of Numerical Aperture and acceptance angle
   b) Compact disc- Determination of width of the groove using laser.
8. Acoustic grating- Determination of velocity of ultrasonic waves in liquids.
9. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids
11. Photoelectric effect
12. Michelson Interferometer.
13. Melede’s string experiment
14. Experiment with lattice dynamics kit.

TOTAL: 30 PERIODS
COURSE OUTCOMES:
Upon completion of the course, the students should be able to
- Understand the functioning of various physics laboratory equipment.
- Use graphical models to analyze laboratory data.
- Use mathematical models as a medium for quantitative reasoning and describing physical reality.
- Access, process and analyze scientific information.
- Solve problems individually and collaboratively.

CHEMISTRY LABORATORY: (Any seven experiments to be conducted)

COURSE 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, pHmetry, potentiometry and conductometry in the determination of impurities in aqueous solutions.
- To demonstrate the analysis of metals and alloys.
- To demonstrate the synthesis of nanoparticles

1. Preparation of Na₂CO₃ as a primary standard and estimation of acidity of a water sample using the primary standard
2. Determination of types and amount of alkalinity in water sample.
   - Split the first experiment into two
3. Determination of total, temporary & permanent hardness of water by EDTA method.
4. Determination of DO content of water sample by Winkler’s method.
5. Determination of chloride content of water sample by Argentometric method.
6. Estimation of copper content of the given solution by Iodometry.
7. Estimation of TDS of a water sample by gravimetry.
8. Determination of strength of given hydrochloric acid using pH meter.
9. Determination of strength of acids in a mixture of acids using conductivity meter.
10. Conductometric titration of barium chloride against sodium sulphate (precipitation titration)
11. Estimation of iron content of the given solution using potentiometer.
13. Preparation of nanoparticles (TiO₂/ZnO/CuO) by Sol-Gel method.
14. Estimation of Nickel in steel
15. Proximate analysis of Coal

TOTAL : 30 PERIODS

COURSE 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 analyse and determine the composition of alloys.
- To learn simple method of synthesis of nanoparticles
- To quantitatively analyse the impurities in solution by electroanalytical techniques

TEXT BOOK :
OBJECTIVES:
- To improve the communicative competence of learners
- To help learners use language effectively in academic/work contexts
- To develop various listening strategies to comprehend various types of audio materials like lectures, discussions, videos etc.
- To build on students' English language skills by engaging them in listening, speaking and grammar learning activities that are relevant to authentic contexts.
- To use language efficiently in expressing their opinions via various media.

UNIT I INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION 6
Listening for general information-specific details- conversation; Introduction to classmates - Audio / video (formal & informal); Telephone conversation; Listening to voicemail & messages; Listening and filling a form. Speaking - making telephone calls-Self Introduction; Introducing a friend; - politeness strategies- making polite requests, making polite offers, replying to polite requests and offers- understanding basic instructions( filling out a bank application for example).

UNIT II NARRATION AND SUMMATION 6
Listening - Listening to podcasts, anecdotes / stories / event narration; documentaries and interviews with celebrities. Speaking - Narrating personal experiences / events-Talking about current and temporary situations & permanent and regular situations* - describing experiences and feelings- engaging in small talk-describing requirements and abilities.

UNIT III DESCRIPTION OF A PROCESS / PRODUCT 6
Listening - Listen to product and process descriptions; a classroom lecture; and advertisements about products. Speaking – Picture description- describing locations in workplaces- Giving instruction to use the product- explaining uses and purposes- Presenting a product- describing shapes and sizes and weights- talking about quantities(large & small)-talking about precautions.

UNIT IV CLASSIFICATION AND RECOMMENDATIONS 6
Listening – Listening to TED Talks; Listening to lectures - and educational videos. Speaking – Small Talk; discussing and making plans-talking about tasks-talking about progress- talking about positions and directions of movement-talking about travel preparations-talking about transportation-

UNIT V EXPRESSION 6
Listening – Listening to debates/ discussions: different viewpoints on an issue; and panel discussions. Speaking –making predictions- talking about a given topic-giving opinions-understanding a website-describing processes

TOTAL : 30 PERIODS

LEARNING OUTCOMES:
At the end of the course, learners will be able
- To listen and comprehend complex academic texts
- To speak fluently and accurately in formal and informal communicative contexts
- To express their opinions effectively in both oral and written medium of communication

ASSESSMENT PATTERN
- One online / app based assessment to test listening /speaking
- End Semester ONLY listening and speaking will be conducted online.
- Proficiency certification is given on successful completion of listening and speaking internal test and end semester exam.
OBJECTIVES:

- To engage learners in meaningful language activities to improve their reading and writing skills.
- To learn various reading strategies and apply in comprehending documents in professional context.
- To help learners understand the purpose, audience, contexts of different types of writing.
- To develop analytical thinking skills for problem solving in communicative contexts.
- To demonstrate an understanding of job applications and interviews for internship and placements.

UNIT I  MAKING COMPARISONS  6
Reading - Reading advertisements, user manuals, brochures; Writing – Professional emails, Email etiquette - Compare and Contrast Essay; Grammar – Mixed Tenses, Prepositional phrases

UNIT II  EXPRESSING CAUSAL RELATIONS IN SPEAKING AND WRITING  6
Reading - Reading longer technical texts – Cause and Effect Essays, and Letters / emails of complaint, Writing - Writing responses to complaints. Grammar - Active Passive Voice transformations, Infinitive and Gerunds

UNIT III  PROBLEM SOLVING  6
Reading - Case Studies, excerpts from literary texts, news reports etc. Writing – Letter to the Editor, Checklists, Problem solution essay / Argumentative Essay. Grammar – Error correction; If conditional sentences

UNIT IV  REPORTING OF EVENTS AND RESEARCH  6

UNIT V  THE ABILITY TO PUT IDEAS OR INFORMATION COGENTLY  6
Reading – Company profiles, Statement of Purpose, (SOP), an excerpt of interview with professionals; Writing – Job / Internship application – Cover letter & Resume; Grammar – Numerical adjectives, Relative Clauses.

TOTAL : 30 PERIODS

OUTCOMES:

At the end of the course, learners will be able

- To compare and contrast products and ideas in technical texts.
- To identify cause and effects in events, industrial processes through technical texts.
- To analyse problems in order to arrive at feasible solutions and communicate them orally and in the written format.
- To report events and the processes of technical and industrial nature.
- To present their opinions in a planned and logical manner, and draft effective resumes in context of job search.
TEXT BOOKS:
3. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

REFERENCE BOOKS:

ASSESSMENT PATTERN
Two internal assessments and an end semester examination to test students’ reading and writing skills along with their grammatical and lexical competence.

MA3251 STATISTICS AND NUMERICAL METHODS

COURSE OBJECTIVES:
- This course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

UNIT I TESTING OF HYPOTHESIS
Sampling distributions - Tests for single mean, proportion and 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.

UNIT II DESIGN OF EXPERIMENTS
One way and two way classifications - Completely randomized design – Randomized block design – Latin square design - $2^k$ factorial design.
UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9+3

UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION 9+3
Lagrange’s and Newton’s divided difference interpolations – Newton’s forward and backward difference interpolation – Approximation of derivates using interpolation polynomials – Numerical single and double integrations using Trapezoidal and Simpson’s 1/3 rules.

UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 9+3

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

- Apply the concept of testing of hypothesis for small and large samples in real life problems.
- Apply the basic concepts of classifications of design of experiments in the field of agriculture.
- Appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.
- Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
- Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.

TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVES:

- To make the students understand the basics of crystallography and its importance in studying materials properties.
- To understand the electrical properties of materials including free electron theory, applications of quantum mechanics and magnetic materials.
- To instil knowledge on physics of semiconductors, determination of charge carriers and device applications.
- To establish a sound grasp of knowledge on different optical properties of materials, optical displays and applications.
- To inculcate an idea of significance of nano structures, quantum confinement and ensuing nano device applications.

UNIT I  CRYSTALLOGRAPHY  9

UNIT II  ELECTRICAL AND MAGNETIC PROPERTIES OF MATERIALS  9

UNIT III  SEMICONDUCTORS AND TRANSPORT PHYSICS  9

UNIT IV  OPTICAL PROPERTIES OF MATERIALS  9

UNIT V  NANOELECTRONIC DEVICES  9

TOTAL: 45 PERIODS
COURSE OUTCOMES:
At the end of the course, the students should be able to
- know basics of crystallography and its importance for varied materials properties
- gain knowledge on the electrical and magnetic properties of materials and their applications
- understand clearly of semiconductor physics and functioning of semiconductor devices
- understand the optical properties of materials and working principles of various optical devices
- appreciate the importance of functional nanoelectronic devices.

TEXT BOOKS:

REFERENCES:

BE3251 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING L T P C
3 0 0 3

COURSE OBJECTIVES:
- To introduce the basics of electric circuits and analysis
- To impart knowledge in the basics of working principles and application of electrical machines
- To introduce analog devices and their characteristics
- To educate on the fundamental concepts of digital electronics
- To introduce the functional elements and working of measuring instruments

UNIT I ELECTRICAL CIRCUITS
DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm’s Law - Kirchhoff’s Laws –Independent and Dependent Sources – Simple problems- Nodal Analysis, Mesh analysis with Independent sources only (Steady state)
Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor – Steady state analysis of RLC circuits (Simple problems only)
UNIT II  ELECTRICAL MACHINES  9

UNIT III  ANALOG ELECTRONICS  9

UNIT IV  DIGITAL ELECTRONICS  9
Review of number systems, binary codes, error detection and correction codes, Combinational logic - representation of logic functions-SOP and POS forms, K-map representations - minimization using K maps (Simple Problems only)

UNIT V  MEASUREMENTS AND INSTRUMENTATION  9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
After completing this course, the students will be able to
1. Compute the electric circuit parameters for simple problems
2. Explain the working principle and applications of electrical machines
3. Analyze the characteristics of analog electronic devices
4. Explain the basic concepts of digital electronics
5. Explain the operating principles of measuring instruments

TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Drawing engineering curves.
2. Drawing freehand sketch of simple objects.
3. Drawing orthographic projection of solids and section of solids.
4. Drawing development of solids
5. Drawing isometric and perspective projections 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  6+12
Basic Geometrical constructions, Curves used in engineering practices: Conics — Construction of ellipse, parabola and hyperbola by eccentricity method — Construction of cycloid — construction of involutes of square and circle — Drawing of tangents and normal to the above curves.

UNIT II  PROJECTION OF POINTS, LINES AND PLANE SURFACE  6+12
Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III  PROJECTION OF SOLIDS AND FREEHAND SKETCHING  6+12
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes and parallel to the other by rotating object method. Visualization concepts and Free Hand sketching: Visualization principles — Representation of Three Dimensional objects — Layout of views- Freehand sketching of multiple views from pictorial views of objects.
Practicing three dimensional modeling of simple objects by CAD Software (Not for examination)

UNIT IV   PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES  6+12
Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other — obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids — Prisms, pyramids cylinders and cones.
Practicing three dimensional modeling of simple objects by CAD Software (Not for examination)

UNIT V   ISOMETRIC AND PERSPECTIVE PROJECTIONS  6+12
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 - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.
Practicing three dimensional modeling of isometric projection of simple objects by CAD Software (Not for examination)

TOTAL: (L=30; P=60) 90 PERIODS

COURSE OUTCOMES:
On successful completion of this course, the student will be able to

- Use BIS conventions and specifications for engineering drawing.
- Construct the conic curves, involutes and cycloid.
- Solve practical problems involving projection of lines.
- Draw the orthographic, isometric and perspective projections of simple solids.
- Draw the development 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. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day
மேலும் மனைவி பட்டம் எகிப்தினாள் மானுடம்: 3
தமிழ் கல்வியறிஞர் தேசிய தமிழி - பட்டம் எகிப்தினாள் - தமிழ்நாட்டு பட்டம் மானுடம் - பட்டம் எகிப்தினாள் மினாளி குண்டிகைகள்.

மேலும் மேலும் மனைவி பட்டம் எகிப்தினாள்: 3
தமிழ் கல்வியறிஞர் வெளியே பண்டையாளின் பண்டையாள் - தமிழ் கல்வியறிஞர் தமிழ்நாட்டு பட்டம் மானுடம் - திருப்பாலக்கேக்கு வெளியே பண்டையாளின் வெளியே பண்டையாள் - தமிழ் கல்வியறிஞர் பட்டம் மானுடம் - நூலயகர் தமிழ்நாட்டு பட்டம் மானுடம் - தமிழ் கல்வியறிஞர் பட்டம் மானுடம் - தமிழ் கல்வியறிஞர் பட்டம் மானுடம் - தமிழ் கல்வியறிஞர் பட்டம் மானுடம்.

மேலும் IV இருண்டலாள் மதுமர் பண்டையாளின் தேசிய தமிழின்: 3
அரசன், புரி, தனிக்கு மக்கு - இருளாசாவின் இலப்புத் தமிழின் (அல் இலப்புத் தமிழின்) - கால்வெளி பண்டையாள் - தமிழ்நாடு கல்வெளியும் பண்டையாளின் விளக்கத் தமிழின் - இருண்டலாள் மதுமர் பண்டையாளின் கல்வீத் தமிழின் - பேண்டின் - அம்மக் மதுமர் பண்டையாளின் கல்வீத் தமிழின் - பேண்டின் கல்வீத் தமிழின் அரசன் - சுமார்சன் குழப்பம்.

மேலும் V ஐந்தியர் தமிழ் கல்வியறிஞர்: 3
ஐந்தியர் தமிழ் கல்வியறிஞர் - கல்வியறிஞர் ஌ந்தியர் - தமிழ் கல்வி வழி பிளாய்ப் பிளாய்ப் - தமிழ் வழி பிளாய்ப் பிளாய்ப் - தமிழ் வழி பிளாய்ப் பிளாய்ப் - தமிழ் பழுது தமிழ் - தமிழ் பழுது தமிழ் - தமிழ் கல்வியறிஞர் - (அல் இலப்புத் தமிழின்) 

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS
1. தமிழக வரலொறு – மக்களும் பண பொடும் – மக்களும் பிளமள (தவளியீடு: தமிழ்நொடு பொடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).

2. கணினித் தமிழ் – முமனவர் இலசுந்தரம். (விகடன் பிரசுரம்).

3. கீழடி-மவமக நதிக்கமரயில் எங்ககொல நகரநொகரிகம் (ததொல்லியல் துமற் தவளியீடு).

4. தபொருமந – ஆற்றங்கமர நொகரிகம். (ததொல்லியல் துமற் தவளியீடு).

5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)

6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).

7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).

8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)

9. Keeladi - ‘Sangam City Civilization on the banks of river Vaigai’ (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)

11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)


GE3252 TAMILS AND TECHNOLOGY L T P C 1 0 0 1

UNIT I WEAVING AND CERAMIC TECHNOLOGY 3
Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY 3
Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

UNIT III MANUFACTURING TECHNOLOGY 3

UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY 3
UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING


TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS

2. கணினி தமிழ் – முமனவர் இல.சுந்தரம். (விகடன் பிரசுரம்).
3. சிறுமியர் - கல்விக் கடிகாரார் தமிழக குழு தொகுகாட்சி (தமிழில் தொல்லியல் துமற்தவளி).
4. பயிற்சிகள் – அறிவியலாக குழுக்கள். (தமிழில் தொல்லியல் துமற்தவளி)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - ‘Sangam City Civilization on the banks of river Vaigai’ (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>NX3251</td>
<td><strong>NCC CREDIT COURSE LEVEL 1</strong> <em>(ARMY WING)</em> NCC CREDIT COURSE LEVEL - I</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>NCC GENERAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>NCC 1  Aims, Objectives &amp; Organization of NCC</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>NCC 2  Incentives</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>NCC 3  Duties of NCC Cadet</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>NCC 4  NCC Camps: Types &amp; Conduct</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><strong>NATIONAL INTEGRATION AND AWARENESS</strong></td>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>NI 1  National Integration: Importance &amp; Necessity</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>NI 2  Factors Affecting National Integration</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>NI 3  Unity in Diversity &amp; Role of NCC in Nation Building</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>NI 4  Threats to National Security</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td><strong>PERSONALITY DEVELOPMENT</strong></td>
<td></td>
<td></td>
<td></td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>PD 1  Self-Awareness, Empathy, Critical &amp; Creative Thinking, Decision Making</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>PD 2  Communication Skills</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>PD 3  Group Discussion: Stress &amp; Emotions</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><strong>LEADERSHIP</strong></td>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>L 1  Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>L 2  Case Studies: Shivaji, Jhasi Ki Rani</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><strong>SOCIAL SERVICE AND COMMUNITY DEVELOPMENT</strong></td>
<td></td>
<td></td>
<td></td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>SS 1  Basics, Rural Development Programmes, NGOs, Contribution of Youth</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>SS 4  Protection of Children and Women Safety</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>SS 5  Road / Rail Travel Safety</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>SS 6  New Initiatives</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>SS 7  Cyber and Mobile Security Awareness</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL: 30 PERIODS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
NCC CREDIT COURSE LEVEL 1*

NX3252
(NAVAL WING) NCC CREDIT COURSE LEVEL - I

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
</tbody>
</table>

**NCC GENERAL**

NCC 1  Aims, Objectives & Organization of NCC  1
NCC 2  Incentives  2
NCC 3  Duties of NCC Cadet  1
NCC 4  NCC Camps: Types & Conduct  2

**NATIONAL INTEGRATION AND AWARENESS**

NI 1  National Integration: Importance & Necessity  1
NI 2  Factors Affecting National Integration  1
NI 3  Unity in Diversity & Role of NCC in Nation Building  1
NI 4  Threats to National Security  1

**PERSONALITY DEVELOPMENT**

PD 1  Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving  2
PD 2  Communication Skills  3
PD 3  Group Discussion: Stress & Emotions  2

**LEADERSHIP**

L 1  Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code  3
L 2  Case Studies: Shivaji, Jhasi Ki Rani  2

**SOCIAL SERVICE AND COMMUNITY DEVELOPMENT**

SS 1  Basics, Rural Development Programmes, NGOs, Contribution of Youth  3
SS 4  Protection of Children and Women Safety  1
SS 5  Road / Rail Travel Safety  1
SS 6  New Initiatives  2
SS 7  Cyber and Mobile Security Awareness  1

TOTAL : 30 PERIODS
<table>
<thead>
<tr>
<th>Topic</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCC GENERAL</td>
<td>6</td>
</tr>
<tr>
<td>NCC 1 Aims, Objectives &amp; Organization of NCC</td>
<td>1</td>
</tr>
<tr>
<td>NCC 2 Incentives</td>
<td>2</td>
</tr>
<tr>
<td>NCC 3 Duties of NCC Cadet</td>
<td>1</td>
</tr>
<tr>
<td>NCC 4 NCC Camps: Types &amp; Conduct</td>
<td>2</td>
</tr>
<tr>
<td>NATIONAL INTEGRATION AND AWARENESS</td>
<td>4</td>
</tr>
<tr>
<td>NI 1 National Integration: Importance &amp; Necessity</td>
<td>1</td>
</tr>
<tr>
<td>NI 2 Factors Affecting National Integration</td>
<td>1</td>
</tr>
<tr>
<td>NI 3 Unity in Diversity &amp; Role of NCC in Nation Building</td>
<td>1</td>
</tr>
<tr>
<td>NI 4 Threats to National Security</td>
<td>1</td>
</tr>
<tr>
<td>PERSONALITY DEVELOPMENT</td>
<td>7</td>
</tr>
<tr>
<td>PD 1 Self-Awareness, Empathy, Critical &amp; Creative Thinking, Decision Making and Problem Solving</td>
<td>2</td>
</tr>
<tr>
<td>PD 2 Communication Skills</td>
<td>3</td>
</tr>
<tr>
<td>PD 3 Group Discussion: Stress &amp; Emotions</td>
<td>2</td>
</tr>
<tr>
<td>LEADERSHIP</td>
<td>5</td>
</tr>
<tr>
<td>L 1 Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code</td>
<td>3</td>
</tr>
<tr>
<td>L 2 Case Studies: Shivaji, Jhasi Ki Rani</td>
<td>2</td>
</tr>
<tr>
<td>SOCIAL SERVICE AND COMMUNITY DEVELOPMENT</td>
<td>8</td>
</tr>
<tr>
<td>SS 1 Basics, Rural Development Programmes, NGOs, Contribution of Youth</td>
<td>3</td>
</tr>
<tr>
<td>SS 4 Protection of Children and Women Safety</td>
<td>1</td>
</tr>
<tr>
<td>SS 5 Road / Rail Travel Safety</td>
<td>1</td>
</tr>
<tr>
<td>SS 6 New Initiatives</td>
<td>2</td>
</tr>
<tr>
<td>SS 7 Cyber and Mobile Security Awareness</td>
<td>1</td>
</tr>
</tbody>
</table>

TOTAL: 30 PERIODS
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
PLUMBING WORK:
- Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.
- Preparing plumbing line sketches.
- Laying pipe connection to the suction side of a pump
- Laying pipe connection to the delivery side of a pump.
- Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

WOOD WORK:
- Sawing,
- Planing and
- Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.

Wood Work Study:
- Studying joints in door panels and wooden furniture
- Studying common industrial trusses using models.

PART II ELECTRICAL ENGINEERING PRACTICES
- Introduction to switches, fuses, indicators and lamps - Basic switch board wiring with lamp, fan and three pin socket
- Staircase wiring
- Fluorescent Lamp wiring with introduction to CFL and LED types.
- Energy meter wiring and related calculations/calibration
- Study of Iron Box wiring and assembly
- Study of Fan Regulator (Resistor type and Electronic type using Diac/Triac/Quadrac)
- Study of emergency lamp wiring/Water heater
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) Study an elements of smart phone.
  b) Assembly and dismantle of LED TV.
  c) Assembly and dismantle of computer/ laptop

TOTAL = 60 PERIODS

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

1. 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.
2. Wire various electrical joints in common household electrical wire work.
3. 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.
4. Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.
BE3271  BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY

COURSE OBJECTIVES:
- To train the students in conducting load tests on electrical machines
- To gain practical experience in characterizing electronic devices
- To train the students to use DSO for measurements.

LIST OF EXPERIMENTS
1. Verification of ohms and Kirchhoff’s Laws.
2. Load test on DC Shunt Motor.
3. Load test on Self Excited DC Generator
4. Load test on Single phase Transformer
5. Load Test on Induction Motor
6. Characteristics of PN and Zener Diodes
7. Characteristics of BJT, SCR and MOSFET
8. Half wave and Full Wave rectifiers
9. Study of Logic Gates
10. Implementation of Binary Adder and Subtractor
11. Study of DSO

TOTAL: 60 PERIODS

COURSE OUTCOMES:
After completing this course, the students will be able to
1. Use experimental methods to verify the Ohm’s and Kirchhoff’s Laws.
2. Analyze experimentally the load characteristics of electrical machines
3. Analyze the characteristics of basic electronic devices
4. Use DSO to measure the various parameters

GE3272  COMMUNICATION LABORATORY

OBJECTIVES
- To identify varied group discussion skills and apply them to take part in effective discussions in a professional context.
- To be able to communicate effectively through writing.

UNIT I  12
Speaking: Role Play Exercises Based on Workplace Contexts, - talking about competition-discussing progress toward goals-talking about experiences-talking about events in life-discussing past events-Writing: writing emails (formal & semi-formal).

UNIT II  12
Speaking: discussing news stories-talking about frequency-talking about travel problems-discussing travel procedures-talking about travel problems-making arrangements-describing arrangements-discussing plans and decisions-discussing purposes and reasons-understanding common technology terms-Writing: - writing different types of emails.

UNIT III  12
Speaking: discussing predictions-describing the climate-discussing forecasts and scenarios-talking about purchasing-discussing advantages and disadvantages-making comparisons-
discussing likes and dislikes- discussing feelings about experiences-discussing imaginary scenarios Writing: short essays and reports-formal/semi-formal letters.

UNIT IV 12
Speaking: discussing the natural environment-describing systems-describing position and movement- explaining rules-(example- discussing rental arrangements)- understanding technical instructions-Writing: writing instructions-writing a short article.

UNIT V 12
Speaking: describing things relatively-describing clothing-discussing safety issues (making recommendations) talking about electrical devices-describing controlling actions- Writing: job application (Cover letter + Curriculum vitae)-writing recommendations.

TOTAL: 60 PERIODS

LEARNING OUTCOMES
- Speak effectively in group discussions held in a formal/semi formal contexts.
- Write emails and effective job applications.

Assessment Pattern
- One online / app based assessment to test speaking and writing skills
- Proficiency certification is given on successful completion of speaking and writing.

MA3351 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS L T P C 3 1 0 4

OBJECTIVES
- To introduce the basic concepts of PDE for solving standard partial differential equations.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 9+3
Formation of partial differential equations –Solutions of standard types of first order partial differential equations - First order partial differential equations reducible to standard types- Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT II FOURIER SERIES 9+3
Dirichlet’s conditions – General Fourier series – Odd and even functions – Half range sine series and cosine series – Root mean square value – Parseval’s identity – Harmonic analysis.

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9+3
Classification of PDE – Method of separation of variables - Fourier series solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction (Cartesian coordinates only).
UNIT IV  FOURIER TRANSFORMS  9+3

UNIT V  Z - TRANSFORMS AND DIFFERENCE EQUATIONS  9+3

TOTAL: 60 PERIODS

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

- Understand how to solve the given standard partial differential equations.
- Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
- Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.
- Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.
- Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVES:
1. To Learn the use scalar and vector analytical techniques for analyzing forces in statically determinate structures.
2. To introduce the equilibrium of rigid bodies, vector methods and free body diagram.
3. To study and understand the distributed forces, surface, loading on beam and intensity.
4. To learn the principles of friction, forces and to determine the apply the concepts of frictional forces at the contact surfaces of various engineering systems.
5. To develop basic dynamics concepts – force, momentum, work and energy;

UNIT I STATICS OF PARTICLES

UNIT II EQUILIBRIUM OF RIGID BODIES

UNIT III DISTRIBUTED FORCES
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
The Laws of Dry Friction, Coefficients of Friction, Angles of Friction, Wedge friction, Wheel Friction, Rolling Resistance, Ladder friction.

UNIT V DYNAMICS OF PARTICLES

OUTCOMES:
At the end of the course the students would be able to
1. Illustrate the vector and scalar representation of forces and moments
2. Analyse the rigid body in equilibrium
3. Evaluate the properties of distributed forces
4. Determine the friction and the effects by the laws of friction
5. Calculate dynamic forces exerted in rigid body
TEXT BOOKS:

REFERENCES:

<table>
<thead>
<tr>
<th>CO</th>
<th>PO</th>
<th>PSO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

Low (1) ; Medium (2) ; High (3)

PR3351 THERMODYNAMICS AND THERMAL ENGINEERING

COURSE OBJECTIVES:
1. To impart knowledge of basic principles of thermodynamics via real world engineering examples.
2. To analyse and evaluate air standard cycles.
3. To analyse and evaluate Steam power cycles.
4. Summarize the governing concepts of Refrigeration and Air conditioning.
5. To introduce various modes of heat transfer, related to real time scenarios of thermodynamics applied in engineering practice.

UNIT – I BASICS OF THERMODYNAMICS

UNIT – II AIR STANDARD CYCLE
Otto, Diesel, Dual and Brayton cycles - Air standard efficiency and Mean effective pressure.

UNIT – III VAPOUR POWER CYCLES
UNIT – IV  COMpressors AND jet propulsion  9

UNIT – V  HEAT TRANSFER  9
Conduction in simple plane, radial and composite walls – Basics of Convective heat transfer - Fundamentals of Radioactive heat transfer – Flow through heat exchangers (LMTD and NTU).

TOTAL: 45 PERIODS

COURSE OUTCOMES
Upon successful completion of the course, students should be able to:
CO1: Will demonstrate understanding of the nature of the thermodynamic processes for pure substances and interpret the Laws of Thermodynamics
CO2: Will analyses and evaluate air standard cycles
CO3: Will understand the vapour power cycles.
CO4: Will learn the air compressors for pneumatic applications and aircraft vehicle
CO5: Will get exposed to the basics and modes of heat transfer.

Mapping of COs with POs and PSOs

<table>
<thead>
<tr>
<th>COs/Pos&amp;P Sos</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td></td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td></td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td></td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td></td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td></td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>CO/PO &amp; PSO Average</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td></td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

1 – Slight, 2 – Moderate, 3 – Substantial

TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVES:
1. To provide students with fundamental knowledge and principles in material removal processes.
2. To understand the fundamentals aspects of metal cutting principles by studying various machining processes.
3. To study the constructional features and various operations related to milling, drilling and grinding.
4. To know the factors influencing the processes and their applications.
5. To recommend appropriate manufacturing process when provided a set of functional requirements and constraints.

UNIT – I  LATHE

UNIT – II  SHAPER, PLANER and SLOTTER

UNIT – III  DRILLING

UNIT – IV  MILLING
UNIT – V  GRINDING  

TOTAL: 45 PERIODS

COURSE OUTCOMES
Upon successful completion of the course, students should be able to:
CO1: Explain the features and applications of lathe, milling, drilling and grinding machines
CO2: Discuss the features and applications of reciprocating machine tools and like shaper, planer and slotting machine.
CO3: Explain the machine tool structures and machining economics.
CO4: Explain the working principles of various machines used in manufacturing.
CO5: Identify the appropriate production process and machines.

<table>
<thead>
<tr>
<th>COs/Pos&amp;P</th>
<th>SOs</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td></td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>CO2</td>
<td></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>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>CO3</td>
<td></td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td></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>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>CO5</td>
<td></td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>CO/PO &amp;</td>
<td></td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>PSO Average</td>
<td></td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

1 – Slight, 2 – Moderate, 3 – Substantial

TEXT BOOKS:

REFERENCES:
PR3302: ENGINEERING MATERIALS

**COURSE OBJECTIVES:**
1. To impart knowledge on the various microstructural features of metallic materials.
2. To illustrate the role of heat treatment on microstructure and properties.
3. To desire the various non-ferrous alloys and their applications.
4. To introduce the concepts of mechanical behaviour of the materials.
5. To describe the properties and applications of polymers and ceramics.

**UNIT – I  MICROSTRUCTURAL DEVELOPMENT AND METALLOGRAPHY**  9

**UNIT – II  HEAT TREATMENT AND KINETICS**  9

**UNIT – III  NON-FERROUS METALS**  9

**UNIT – IV  DEFORMATION AND FAILURE OF METALS**  9

**UNIT – V  NON-METALLIC MATERIALS**  9
Polymers- Thermo, Thermoset Polymers, Co and mixed Polymers- Commodity Polymers, PE, PS,PVS PMMA, PC, PET, ABS- Engineering Polymers, PA, PPS, PI, PFE- Natural and Synthetic rubbers, Elastomers- Adhesives- Ceramics- Natural and Synthetic Ceramic- Feldspar, Corundum, Garnet- WC, TC,TiC, Si3N4,Al2O3, CBN, PCD, Uses of abrasives and cutting tools.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**
Upon successful completion of the course, students should be able to:
CO1: Identify the microstructural features of ferrous materials.
CO2: Relate the heat treatment, microstructure and properties.
CO3: Understand the properties and uses of nonferrous alloys.
CO4: Correlate the mechanical behavior with the mechanisms of strengthening.
CO5: Suggest suitable polymer and ceramic for a given application.
### Mapping of COs with POs and PSOs

<table>
<thead>
<tr>
<th>COs/Pos&amp;P SOs</th>
<th>PEs</th>
<th>PSOs</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>CO2</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>CO4</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>CO/PO &amp; PSO Average</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

1 – Slight, 2 – Moderate, 3 – Substantial

### TEXT BOOKS:

### REFERENCES:
COURSE OBJECTIVES:
1. To introduce the students about properties of the fluids, behaviour of fluids under static conditions.
2. To impart basic knowledge of the dynamics of fluids and boundary layer concept.
3. To expose to the applications of the conservation laws to a) flow measurements b) flow through pipes (both laminar and turbulent) and c) forces on pipe bends.
4. To exposure to the significance of boundary layer theory and its thicknesses.
5. To expose the students to basic principles of working of hydraulic machineries and to design Pelton wheel, Francis and Kaplan turbine, centrifugal and reciprocating pumps.

UNIT I FLUID PROPERTIES AND FLOW CHARACTERISTICS 10+3
Properties of fluids – Fluid statics - Pressure Measurements - Buoyancy and floatation - Flow characteristics - Eulerian and Lagrangian approach - Concept of control volume and system - Reynold’s transportation theorem - Continuity equation, energy equation and momentum equation - Applications.

UNIT II FLOW THROUGH PIPES AND BOUNDARY LAYER 9+3
Reynold’s Experiment - Laminar flow through circular conduits - Darcy Weisbach equation - friction factor - Moody diagram - Major and minor losses - Hydraulic and energy gradient lines - Pipes in series and parallel - Boundary layer concepts - Types of boundary layer thickness.

UNIT III DIMENSIONAL ANALYSIS AND MODEL STUDIES 8+3
Fundamental dimensions - Dimensional homogeneity - Rayleigh’s method and Buckingham Pi theorem - Dimensionless parameters - Similitude and model studies - Distorted and undistorted models.

UNIT IV TURBINES 9+3

UNIT V PUMPS 9+3
Classification of pumps - Centrifugal pumps - Working principle - Heads and efficiencies – Velocity triangles - Work done by the impeller - Performance curves - Reciprocating pump working principle - Indicator diagram and its variations - Work saved by fitting air vessels - Rotary pumps.

OUTCOMES:
On completion of the course, the student is expected to be able to
1. Understand the properties and behaviour in static conditions. Also, to understand the conservation laws applicable to fluids and its application through fluid kinematics and dynamics
2. Estimate losses in pipelines for both laminar and turbulent conditions and analysis of pipes connected in series and parallel. Also, to understand the concept of boundary layer and its thickness on the flat solid surface.
3. Formulate the relationship among the parameters involved in the given fluid phenomenon and to predict the performances of prototype by model studies
4. Explain the working principles of various turbines and design the various types of turbines.
5. Explain the working principles of centrifugal, reciprocating and rotary pumps and design the centrifugal and reciprocating pumps.
**TEXT BOOKS:**

**REFERENCES:**

| CO | PO | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 1  |    | 3  | 3  | 2  | 2  | 1  | 2  | 2  | 1  | 2  | 1  | 2  | 3  | 2  | 3  |
| 2  |    | 3  | 3  | 3  | 2  | 1  | 2  | 2  | 1  | 2  | 1  | 1  | 2  | 3  | 2  |
| 3  |    | 3  | 3  | 3  | 3  | 1  | 2  | 2  | 1  | 2  | 1  | 1  | 2  | 3  | 3  |
| 4  |    | 3  | 3  | 3  | 3  | 1  | 2  | 2  | 1  | 2  | 1  | 1  | 3  | 3  | 2  |
| 5  |    | 3  | 3  | 3  | 3  | 1  | 2  | 2  | 1  | 2  | 1  | 1  | 3  | 3  | 2  |

Low (1); Medium (2); High (3)

**MF3361  MACHINING TECHNOLOGY LABORATORY**

**COURSE OBJECTIVES:**
- To Study and practice the various operations that can be performed in lathe, shaper, drilling, milling machines etc.
- To equip with the practical knowledge required in the core industries.
- To prepare the process planning sheets for all the operations and then follow the sequences during the machining processes.

**LIST OF EXPERIMENTS**
1. Lathe: Facing, Plain turning, Step Turning
2. Lathe: Taper Turning, Threading, Knurling
3. Lathe: Multi start Threading, Burnishing
4. Shaper: Cube
5. Shaper: Cube, V-Block
6. Drilling: Counter sinking, Counter Boring, Tapping
7. Milling Vertical: Surfacing, Pocket Milling
8. Milling Horizontal: Polygonal shape milling
9. Grinding: Surface & Cylindrical grinding
10. Slotting: Machining an internal spline
11. Tool angle grinding with tool and Cutter Grinder
12. Measurement of cutting forces in Milling / Turning Process

**TOTAL : 60 PERIODS**
COURSE OUTCOMES:
Upon the completion of this course the students will be able to

- Select appropriate turning process to obtain finished components.
- Select appropriate milling process to obtain finished components.
- Select appropriate shaper and slotting process to obtain finished components.
- Select appropriate grinding process to obtain optimum surface finish.
- Coordinate various machining process in sequence to get desired design in final components.

PR3311 METALLURGY AND MATERIALS TESTING LABORATORY

COURSE OBJECTIVES:
1. To study the testing methods and quantifying techniques for the mechanical properties of engineering materials.
2. To study the property changes by various heat treatments.
3. To gain practical knowledge in Microstructural analysis of various steels, cast iron, Nonferrous Materials and Heat-Treated steels.

LIST OF EXPERIMENTS
1. Cooling curve- Pure metal and alloy (Pb-Sn).
2. Specimen preparation for macro – examination.
7. Tension test of mild steel.
8. Torsion test of mild steel.
11. Compression test for Helical spring.
12. Fatigue test
13. Creep test.

TOTAL: 60 PERIODS

COURSE OUTCOMES
Upon successful completion of the course, students should be able to:
CO1: Awareness of procedure and methods of testing materials for evaluation of mechanical properties.
CO2: Experience in metallographic techniques and familiarization of microstructure of typical ferrous and non-ferrous alloys.
CO3: Ability to interpret the experimental results in relation with the applications.
Mapping of COs with POs and PSOs

<table>
<thead>
<tr>
<th>COs/Pos &amp; PSOs</th>
<th>POs</th>
<th>PSOs</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CO/PO &amp; PSO Average</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

1 – Slight, 2 – Moderate, 3 – Substantial

GE3361 PROFESSIONAL DEVELOPMENT

OBJECTIVES:
To be proficient in important Microsoft Office tools: MS WORD, EXCEL, POWERPOINT:
- To be proficient in using MS WORD to create quality technical documents, by using standard templates, widely acceptable styles and formats, variety of features to enhance the presentability and overall utility value of content.
- To be proficient in using MS EXCEL for all data manipulation tasks including the common statistical, logical, mathematical etc., operations, conversion, analytics, search and explore, visualize, interlink, and utilizing many more critical features offered.
- To be able to create and share quality presentations by using the features of MS PowerPoint, including: organization of content, presentability, aesthetics, using media elements and enhance the overall quality of presentations.

MS WORD:
Create and format a document
Working with tables
Working with Bullets and Lists
Working with styles, shapes, smart art, charts
Inserting objects, charts and importing objects from other office tools
Creating and Using document templates
Inserting equations, symbols and special characters
Working with Table of contents and References, citations
Insert and review comments
Create bookmarks, hyperlinks, endnotes footnote
Viewing document in different modes
Working with document protection and security
Inspect document for accessibility

10 Hours

MS EXCEL:
Create worksheets, insert and format data
Work with different types of data: text, currency, date, numeric etc.
Split, validate, consolidate, Convert data
Sort and filter data
Perform calculations and use functions: (Statistical, Logical, Mathematical, date, Time etc.,)
Work with Lookup and reference formulae
Create and Work with different types of charts

10 Hours
Use pivot tables to summarize and analyse data
Perform data analysis using own formulae and functions
Combine data from multiple worksheets using own formulae and built-in functions to generate results
Export data and sheets to other file formats
Working with macros
Protecting data and Securing the workbook

**MS POWERPOINT:**
Select slide templates, layout and themes
Formatting slide content and using bullets and numbering
Insert and format images, smart art, tables, charts
Using Slide master, notes and handout master
Working with animation and transitions
Organize and Group slides
Import or create and use media objects: audio, video, animation
Perform slideshow recording and Record narration and create presentable videos

**TOTAL: 30 PERIODS**

**OUTCOMES:**
On successful completion the students will be able to
- Use MS Word to create quality documents, by structuring and organizing content for their day to day technical and academic requirements
- Use MS EXCEL to perform data operations and analytics, record, retrieve data as per requirements and visualize data for ease of understanding
- Use MS PowerPoint to create high quality academic presentations by including common tables, charts, graphs, interlinking other elements, and using media objects.
PR3401 METAL CASTING TECHNOLOGY

COURSE OBJECTIVES:
1. To impart knowledge about principles/methods of casting with detail design of gating/riser system needed for casting, defects in cast objects and requirements for achieving better casting.
2. To understand the basic principle, procedure and applications of various Foundry and Welding methods.
3. To inculcate the principle, thermal and metallurgical aspects during solidification of metal and alloys.
4. To impart knowledge to the students about the principles of melting and pouring.
5. To impart knowledge on casting design.

UNIT – I CASTING PROCESSES

UNIT – II SPECIAL CASTING PROCESSES

UNIT – III SOLIDIFICATION PROCESS

UNIT – IV MELTING AND POURING

UNIT – V CASTING DESIGN
Solidification of pure metals and alloys-shrinkage in cast metals-design of sprue, runner, gate and risers-problems in design and manufacture of thin and unequal sections - design for directional solidification, minimum distortion and for overall economy - design problems of L,T,V,X and Y junctions.

TOTAL: 45 PERIODS

COURSE OUTCOMES
Upon successful completion of the course, students should be able to:
CO1: Understand the process of Pattern making, Moulding and core making
CO2: Analyze the thermal, metallurgical aspects during solidification in casting and welding and their role on quality of cast or weld objects.
CO3: Understand the process of solidification of casting process.
CO4: The student will be able to melt and pour metals.
CO5: The student will be able design cast alloys.

Mapping of COs with POs and PSOs

<table>
<thead>
<tr>
<th>COs/Pos&amp;P</th>
<th>POs</th>
<th>PSOs</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOs</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>2</td>
</tr>
</tbody>
</table>

Mapping of COs with POs

<table>
<thead>
<tr>
<th>CO1</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

Mapping of COs with PSOs

<table>
<thead>
<tr>
<th>CO1</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Mapping of COs with POS

<table>
<thead>
<tr>
<th>CO1</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>-----</td>
<td>----</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>CO/PO &amp; PSO Average</td>
<td>3</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

1 – Slight, 2 – Moderate, 3 – Substantial

**TEXT BOOKS:**

**REFERENCES:**

**PR3451 MATERIALS JOINING TECHNOLOGY**

<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>

**COURSE OBJECTIVES:**
1. To study SMAW, GMAW, GTAW, Oxy-acetylene welding and resistance spot welding processes.
2. To study the various types of resistance welding process.
3. To study the various solid state welding process.
4. To study advanced welding process.
5. To study the various welding design and testing methods.

**UNIT – I GAS AND ARC WELDING PROCESSES**
Fundamental principles – Air Acetylene welding, Oxyacetylene welding, Carbon arc welding, shielded metal arc welding, Submerged arc welding, TIG and MIG welding, Plasma arc welding and Electro slag welding processes - advantages, limitations and applications.

**UNIT – II RESISTANCE WELDING PROCESSES**
Spot welding, Seam welding, Projection welding, Resistance Butt welding, Flash Butt welding, Percussion welding and High frequency resistance welding processes - advantages, limitations and applications.

**UNIT – III SOLID STATE WELDING PROCESSES**
Cold welding, Diffusion bonding, Explosive welding, Ultrasonic welding, Friction welding, Forge welding, Roll welding and Hot pressure welding processes - advantages, limitations and applications.

**UNIT – IV OTHER WELDING PROCESSES**
UNIT – V  DESIGN OF WELD JOINTS, WELDABILITY AND TESTING OF WELDMENTS

Various weld joint designs – Welding defects – causes and remedies - Weldability of Aluminium, Copper, and Stainless steels. Destructive and nondestructive testing of weldments.

TOTAL: 45 PERIODS

COURSE OUTCOMES

Upon successful completion of the course, students should be able to:

CO1: To understand the basic working principles SMAW, GMAW, GTAW, Oxy-acetylene welding and resistance spot welding processes
CO2: To know the various types of the resistance welding process
CO3: To familiarise about the various solid state welding process
CO4: To know the advanced welding process
CO5: To apply the various welding design and testing methods

Mapping of COs with POs and PSOs

<table>
<thead>
<tr>
<th>COs/POs &amp; PSOs</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>CO2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>CO3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>CO4</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>1</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</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>1</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>CO/PO &amp; PSO Average</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

1 – Slight, 2 – Moderate, 3 – Substantial

TEXT BOOKS:

REFERENCES:

ML3391  MECHANICS OF SOLIDS  L  T  P  C
3  0  0  3

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

1. Applying the principle concepts behind stress, strain and deformation of solids for various engineering applications.
2. Analyzing the transverse loading on beams and stresses in beam for various engineering applications.
3. Understanding the torsion principles on shafts and springs for various engineering applications.
4. Acquiring knowledge on the deflection of beams for various engineering applications.
5. Interpreting the thin and thick shells and principal stresses in beam for various engineering applications

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS

UNIT II TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM

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

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

UNIT V THICK & THIN SHELLS & PRINCIPAL STRESSES
Stresses in thin cylindrical shell due to internal pressure, circumferential and longitudinal stresses and deformation in thin cylinders – spherical shells subjected to internal pressure – Deformation in spherical shells – Lame’s theory – Application of theories of failure – Stresses on inclined planes –principal stresses and principal planes – Mohr’s circle of stress.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Apply the principle concepts behind stress, strain and deformation of solids for various engineering applications.
2. Analyze the transverse loading on beams and stresses in beam for various engineering applications.
3. Solve problems based on the torsion principles involved in shafts and springs for various engineering applications.
4. Interpret the results of the deflection of beams.
5. Analyze the thin and thick shells and principal stresses in beam for various engineering applications

TEXT BOOKS:
REFERENCES:

<table>
<thead>
<tr>
<th></th>
<th>PO</th>
<th></th>
<th>PSO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td></td>
<td>9</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td></td>
<td>9</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>Avg</td>
<td>3</td>
<td>3</td>
<td>1.8</td>
</tr>
</tbody>
</table>

PR3402 FLUID POWER AUTOMATION L T P C
3 0 0 3

COURSE OBJECTIVES:
1. To understand the basic principles of fluid power.
2. Know the different properties of hydraulic fluids and their effects.
3. Explain the working principles of various pumps.
4. To understand the working principle of hydraulic and pneumatic components and its selection.
5. To design hydraulic and pneumatic circuits for different applications.

UNIT – I INTRODUCTION TO FLUID POWER

UNIT – II FLUID POWER ACTUATORS
Fluid Power drives - Hydraulic motors, Pneumatic power supply - compressors, air distribution, air motors. Actuators - Selection and specification, cylinders, mounting, cushioning- Hydrostatic transmission drives and characteristics; Accumulators –Intensifiers.

UNIT – III FLUID POWER CONTROL ELEMENTS
Control valves - pressure, flow, direction - working principle and construction - Special type - valves - Cartridge, modular, proportional, and servo - Selection and actuation method - Hydraulic supply components -pipe fittings - Fluid conditioning elements.
UNIT – IV  HYDRAULIC AND PNEUMATIC CIRCUITS DESIGN  9
Regenerative, speed control and synchronizing circuits - Design of Hydraulic and pneumatic circuits for automation, selection and specification of circuit components, sequencing circuits, cascade, and Karnaugh - Veitch map method.

UNIT – V  ELECTRO PNEUMATICS AND PLC CIRCUITS  9
Use of electrical timers, switches, solenoid, relays and proximity sensors electro pneumatic sequencing - PLC - elements, functions and selection - PLC programming - Ladder diagram and different programming methods - Sequencing circuits.

TOTAL: 45 PERIODS

COURSE OUTCOMES
Upon successful completion of the course, students should be able to:
CO1: To understand the fundamentals of pneumatics and hydraulics and its principles.
CO2: To understand constructional and operational features about the hydraulic and pneumatic drives system.
CO3: To identify pneumatic and hydraulic components and their functions.
CO4: To design basic and advanced pneumatic and hydraulic circuits for industrial applications.
CO5: To understand the basic concepts, elements and functions of Programmable Logic Controller.

<table>
<thead>
<tr>
<th>COs/Pos &amp; PSOs</th>
<th>POs</th>
<th>PSOs</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO/PO &amp; PSO Average</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Mapping of COs with POs and PSOs

1 – Slight, 2 – Moderate, 3 – Substantial

TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVES:
1. To understand the basic components and layout of linkages in the assembly of a system/machine and also learn about the mechanisms
2. To understand the basic concepts of toothed gearing and kinematics of gear trains and the effects of friction in motion transmission and in machine components.
3. To learn about the concepts in friction
4. To understand the principles in force analysis
5. To learn about the basic concept of static and dynamic balancing and vibration

UNIT I KINEMATIC OF MACHINES 12

UNIT II GEAR AND GEAR TRAINS 12

UNIT III FRICTION 12
Sliding and Rolling Friction angle – friction in threads – Friction Drives – Belt and rope drives.

UNIT IV FORCE ANALYSIS 12

UNIT V BALANCING AND VIBRATION 12

COURSE OUTCOMES
At the end of the course, the student able to:
CO1: Recognize the basic terminologies of kinematics and dynamics of machines
CO2: Interpret the various concepts of kinematics and dynamics including forces and frictions
CO 3: Show the motions parameters on the various mechanisms, gears and gear trains.
CO 4: Apply the mechanism, gears and gear train for the design of new machines.
CO 5: Analyze the working of various mechanism, gears and gear train.

TEXT BOOKS:
REFERENCES:

Mapping of COs with POs and PSOs

<table>
<thead>
<tr>
<th>COs/POs &amp; PSOs</th>
<th>POs 1</th>
<th>POs 2</th>
<th>POs 3</th>
<th>POs 4</th>
<th>POs 5</th>
<th>POs 6</th>
<th>POs 7</th>
<th>POs 8</th>
<th>POs 9</th>
<th>POs 10</th>
<th>POs 11</th>
<th>POs 12</th>
<th>PSOs 1</th>
<th>PSOs 2</th>
<th>PSOs 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>CO/PO &amp; PSO Average</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

1 – Slight, 2 – Moderate, 3 – Substantial

GE3451 ENVIRONMENTAL SCIENCES AND SUSTAINABILITY

UNIT - I : ENVIRONMENT AND BIODIVERSITY

UNIT – II : ENVIRONMENTAL POLLUTION

UNIT – III : RENEWABLE SOURCES OF ENERGY.
Energy management and conservation, New Energy Sources: Need of new sources. Different types new energy sources. Applications of- Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy.
UNIT - IV : SUSTAINABILITY AND MANAGEMENT
Development, GDP, Sustainability - concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols-Sustainable Development Goals-targets, indicators and intervention areas Climate change-Global, Regional and local environmental issues and possible solutions-case studies. Concept of Carbon Credit, Carbon Footprint. Environmental management in industry- A case study.

UNIT - V : SUSTAINABILITY PRACTICES

TEXT BOOKS:
5. Bradley, A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning.

REFERENCES:
PR3411  FOUNDORY AND WELDING LABORATORY  L  T  P  C
0  0  4  2

COURSE OBJECTIVES:
1. To train the students to make the simple joints by various welding techniques.
2. To train the students to make the simple standard grill structures.
3. To train the students in the area of non-ferrous metal casting with the simple shapes.
4. To study the basic requirements of given moulding sand by standard tests.
5. To train the students to make the simple casting demonstration.

WELDING
1. Welding of basic joints using gas and arc welding.
2. Welding of pipes in different positions.
3. GTAW / GMAW of ferrous and non-ferrous metals.

FOUNDERY
1. Green and Dry Strength of Moulding sand.
2. Permeability testing.
3. Determining the clay content.
4. Sieve analysis of dry silica sand.
5. Determining the moisture content.

TOTAL: 60 PERIODS

COURSE OUTCOMES
Upon successful completion of the course, students should be able to:
CO1: The students would gain practical knowledge on welding of simple weld joints.
CO2: The students would gain practical knowledge on making simple grill.
CO3: The students to understand the casting procedure of different methods and quality of moulding sand tests.

<table>
<thead>
<tr>
<th>COs/POs &amp; PSOs</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>CO3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>CO/PO &amp; PSO Average</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

1 – Slight, 2 – Moderate, 3 – Substantial
COURSE OBJECTIVES:
1. To supplement the principles learnt in kinematics and Dynamics of Machinery.
2. To understand how certain measuring devices are used for dynamic testing.

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

TOTAL: 60 PERIODS

COURSE OUTCOMES
Upon successful completion of the course, students should be able to:
CO1: Ability to demonstrate the principles of kinematics and dynamics of machinery.
CO2: Ability to use the measuring devices for dynamic testing.
CO3: Ability to develop models.

Mapping of COs with POs and PSOs

<table>
<thead>
<tr>
<th>COs/Pos&amp;P PSOs</th>
<th>POs</th>
<th>PSOs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>CO1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CO/PO &amp; PSO Average</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

1 – Slight, 2 – Moderate, 3 – Substantial
COURSE OBJECTIVE:
1. To study the mechanical properties of metals, wood and spring by testing in laboratory.
2. To verify the principles studied in fluid mechanics and machinery theory by performing experiments in laboratory.

UNIT – I STRENGTH OF MATERIALS

LIST OF EXPERIMENTS
1. Tension test on mild steel rod
2. Torsion test on mild steel rod
3. Hardness test on metal (Rockwell and Brinell Hardness)
4. Compression test on helical spring
5. Deflection test on carriage spring

UNIT – II FLUID MECHANICS AND MACHINES LABORATORY

LIST OF EXPERIMENTS
1. (a) Determination of coefficient of discharge of a venturimeter
   (b) Determination of friction factor for flow through pipes
2. (a) Determination of metacentric height
   (b) Determination of forces due to impact of jet on a fixed plate
3. Characteristics of centrifugal pumps
4. Characteristics of reciprocating pump
5. Characteristics of Pelton wheel turbine

TOTAL: 60 PERIODS

OUTCOMES: On completion of the course, the student is expected to be able to
1. Determine the tensile, torsion and hardness properties of metals by testing
2. Determine the stiffness properties of helical and carriage spring
3. Apply the conservation laws to determine the coefficient of discharge of a venturimeter and finding the friction factor of given pipe
4. Apply the fluid static and momentum principles to determine the metacentric height and forces due to impact of jet
5. Determine the performance characteristics of turbine, rotodynamic pump and positive displacement pump.

<table>
<thead>
<tr>
<th>CO</th>
<th>PO</th>
<th>PSO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

Low (1) ; Medium (2) ; High (3)