B. Tech. in ELECTRICAL AND COMPUTER ENGINEERING

(BTC-ELC)

CURRICULUM AND SYLLABI

(2023)
GENERAL INFORMATION

ABBREVIATIONS USED IN THE CURRICULUM

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cat</td>
<td>Category</td>
</tr>
<tr>
<td>L</td>
<td>Lecture</td>
</tr>
<tr>
<td>T</td>
<td>Tutorial</td>
</tr>
<tr>
<td>P</td>
<td>Practical</td>
</tr>
<tr>
<td>Cr</td>
<td>Credits</td>
</tr>
<tr>
<td>ENGG</td>
<td>Engineering Sciences (including General, Core and Electives)</td>
</tr>
<tr>
<td>HUM</td>
<td>Humanities (including Languages and others)</td>
</tr>
<tr>
<td>SCI</td>
<td>Basic Sciences (including Mathematics)</td>
</tr>
<tr>
<td>PRJ</td>
<td>Project Work (including Seminars)</td>
</tr>
<tr>
<td>AES</td>
<td>Aerospace Engineering</td>
</tr>
<tr>
<td>AIE</td>
<td>Computer Science and Engineering - Artificial Intelligence</td>
</tr>
<tr>
<td>BIO</td>
<td>Biology</td>
</tr>
<tr>
<td>CCE</td>
<td>Computer and Communication Engineering</td>
</tr>
<tr>
<td>CHE</td>
<td>Chemical Engineering</td>
</tr>
<tr>
<td>CHY</td>
<td>Chemistry</td>
</tr>
<tr>
<td>CSE</td>
<td>Computer Science and Engineering</td>
</tr>
<tr>
<td>CVL</td>
<td>Civil Engineering</td>
</tr>
<tr>
<td>CUL</td>
<td>Cultural Education</td>
</tr>
<tr>
<td>EAC</td>
<td>Electronics and Computer Engineering</td>
</tr>
<tr>
<td>ECE</td>
<td>Electronics and Communication Engineering</td>
</tr>
<tr>
<td>EEE</td>
<td>Electrical and Electronics Engineering</td>
</tr>
<tr>
<td>ELC</td>
<td>Electrical and Computer Engineering</td>
</tr>
<tr>
<td>HUM</td>
<td>Humanities</td>
</tr>
<tr>
<td>MAT</td>
<td>Mathematics</td>
</tr>
<tr>
<td>MEE</td>
<td>Mechanical Engineering</td>
</tr>
<tr>
<td>PHY</td>
<td>Physics</td>
</tr>
</tbody>
</table>

Program Educational Objectives (PEOs)

PEO1: Graduate can demonstrate electrical and computer engineering problem solving skill along with proficiency in communication and professional excellence in project management and execution.

PEO2: Graduate can be employable in engineering services including ICT enabled sectors and also motivated for entrepreneurship.

PEO3: Graduate will be competent for higher studies in world class universities and research in industrial organizations.

PEO4: Graduate will manifest social commitment, environmental awareness and moral and ethical values in professional and other discourses.

Course Outcome (CO) – Statements that describe what students are expected to know, and are able to do at the end of each course. These relate to the skills, knowledge and behaviour that students acquire in their progress through the course.

Program Outcomes (POs) – Program Outcomes are statements that describe what students are expected to know and be able to do upon graduating from the Program. These relate to the skills, knowledge, attitude and behaviour that students acquire through the program. NBA has defined the Program Outcomes for each discipline.

Program Outcomes (POs) for B.Tech in Electrical and Computer Engineering

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

2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

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

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

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

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

8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

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

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

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

**Program Specific Outcomes (PSOs)**

**PSO1**: Design and develop autonomous systems by integrating knowledge of electrical and computer engineering domains.

**PSO2**: Apply computational and networking skills for secured smart electrical systems.

**PSO3**: Innovate sustainable solutions for interdisciplinary domains using emerging technologies and data-driven approaches.
## CURRICULUM

### SEMESTER I

<table>
<thead>
<tr>
<th>Cat.</th>
<th>Code</th>
<th>Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>HUM</td>
<td>23ENG101</td>
<td>Technical Communication</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>SCI</td>
<td>23MAT122</td>
<td>Calculus, Matrix Algebra and Ordinary Differential Equations</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>ENGG</td>
<td>23ELC101</td>
<td>Problem Solving and Algorithmic Thinking</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>ENGG</td>
<td>23MEE102</td>
<td>Engineering Graphics and 3D Modelling</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>SCI</td>
<td>23PHY105/23CHY109</td>
<td>Engineering Physics - A/Engineering Chemistry – B</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>SCI</td>
<td>23PHY185/23CHY188</td>
<td>Engineering Physics Lab - A/Engineering Chemistry Lab – B</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>ENGG</td>
<td>23MEE182</td>
<td>Manufacturing Practice-B</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>HUM</td>
<td>22ADM101</td>
<td>Foundations of Indian Heritage</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>HUM</td>
<td>22AVP103</td>
<td>Mastery Over Mind</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total</strong></td>
<td><strong>28</strong></td>
<td><strong>2</strong></td>
<td><strong>1</strong></td>
<td></td>
</tr>
</tbody>
</table>

### SEMESTER II

<table>
<thead>
<tr>
<th>Cat.</th>
<th>Code</th>
<th>Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCI</td>
<td>23MAT125</td>
<td>Complex Analysis and Transforms</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>SCI</td>
<td>23PHY105/23CHY109</td>
<td>Engineering Physics – A/Engineering Chemistry - B</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23ELC111</td>
<td>Electrical Circuit Analysis</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23ELC112</td>
<td>Electronic Devices &amp; Circuits</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23ELC113</td>
<td>Digital Electronics</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23ELC114</td>
<td>Computer Programming</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23EEE183</td>
<td>Electrical Engineering Practice</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>ENGG</td>
<td>23ELC181</td>
<td>Electrical, Electronics &amp; Digital lab</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>SCI</td>
<td>23PHY185/23CHY188</td>
<td>Engineering Physics Lab –A/Engineering Chemistry Lab – B</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>HUM</td>
<td>22ADM111</td>
<td>Glimpses of Glorious India</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total</strong></td>
<td><strong>28</strong></td>
<td><strong>2</strong></td>
<td><strong>4</strong></td>
<td></td>
</tr>
</tbody>
</table>

### SEMESTER III

<table>
<thead>
<tr>
<th>Cat.</th>
<th>Code</th>
<th>Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCI</td>
<td>23MAT224</td>
<td>Statistics and Foundations of Data Science</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>ENGG</td>
<td>23ELC201</td>
<td>Electric Machines</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23ELC202</td>
<td>Sensor Circuits &amp; Actuators</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23ELC203</td>
<td>Artificial Intelligence</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23ELC204</td>
<td>Computer Architecture</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>ENGG</td>
<td>23EEE201</td>
<td>Signals &amp; Systems</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>ENGG</td>
<td>23ELC205</td>
<td>Object Oriented Programming using Python</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23ELC281</td>
<td>Electric Machines Lab</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>ENGG</td>
<td>23ELC282</td>
<td>Sensor Circuits &amp; Actuators Lab</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>HUM</td>
<td></td>
<td>Amrita Value Program I</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>HUM</td>
<td>23LSE201</td>
<td>Life Skills for Engineers I</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>P/F</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td><strong>33</strong></td>
<td><strong>2</strong></td>
<td><strong>5</strong></td>
<td></td>
</tr>
</tbody>
</table>
### SEMESTER IV

<table>
<thead>
<tr>
<th>Cat.</th>
<th>Code</th>
<th>Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGG</td>
<td>23ELC211</td>
<td>Operating Systems</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23ELC212</td>
<td>Machine Learning ##</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>ENGG</td>
<td>23EEE215</td>
<td>Control Systems</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>ENGG</td>
<td>23EEE214</td>
<td>Microcontrollers and Applications</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>ENGG</td>
<td>23ELC213</td>
<td>Data Structures and Algorithms</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>HUM</td>
<td>23LSE211</td>
<td>Life Skills for Engineers II</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>HUM</td>
<td></td>
<td>Amrita Value Program 2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TOTAL</td>
<td>27</td>
<td>2</td>
<td>2</td>
<td>22</td>
</tr>
</tbody>
</table>

### SEMESTER V

<table>
<thead>
<tr>
<th>Cat.</th>
<th>Code</th>
<th>Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGG</td>
<td>23ELC301</td>
<td>Energy Systems</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23EEE301</td>
<td>Digital Signal Processing ##</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>ENGG</td>
<td>23ELC302</td>
<td>Embedded System Design using ARM</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>ENGG</td>
<td>23ELC303</td>
<td>Data Base Systems and Programming</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>ENGG</td>
<td></td>
<td>Professional Elective I*</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td></td>
<td>Professional Elective II*</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23ELC381</td>
<td>Energy Systems Lab</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>HUM</td>
<td>23LSE301</td>
<td>Life Skills for Engineers III</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>ENGG</td>
<td>23LIV390***</td>
<td>Live In Lab I ***</td>
<td></td>
<td></td>
<td>[3]</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>TOTAL</td>
<td>28</td>
<td>2</td>
<td>4</td>
<td>24+[3]</td>
</tr>
</tbody>
</table>

### SEMESTER VI

<table>
<thead>
<tr>
<th>Cat.</th>
<th>Code</th>
<th>Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGG</td>
<td>23ELC311</td>
<td>Power Electronics and Drives</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23ELC312</td>
<td>Computer Networks and IoT</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23ELC313</td>
<td>Theory of Computation and Compiler Design</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>ENGG</td>
<td></td>
<td>Professional Elective III*</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td></td>
<td>Professional Elective IV*</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23ELC382</td>
<td>Power Electronics and Drives Lab</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>ENGG</td>
<td>23ELC383</td>
<td>Computer Networks and IoT Lab</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>ENGG</td>
<td>23ELC384</td>
<td>Open Lab</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>HUM</td>
<td>23LSE311</td>
<td>Life Skills for Engineers IV</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>ENGG</td>
<td>23LIV490***</td>
<td>Live in Lab II ***</td>
<td></td>
<td></td>
<td>[3]</td>
<td></td>
</tr>
<tr>
<td>ENGG</td>
<td>23ELC397</td>
<td>Industry Internship</td>
<td>P/F</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>TOTAL</td>
<td>27</td>
<td>21+</td>
<td>[3]</td>
<td></td>
</tr>
</tbody>
</table>
### SEMESTER VII

<table>
<thead>
<tr>
<th>Cat.</th>
<th>Code</th>
<th>Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>HUM</td>
<td></td>
<td>Free Elective**</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>ENGG</td>
<td></td>
<td>Professional Elective V*</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>PRJ</td>
<td>23ELC498</td>
<td>Project Phase I</td>
<td>0</td>
<td>0</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td>ENGG</td>
<td>23ENV300</td>
<td>Environmental Science</td>
<td></td>
<td></td>
<td>P/F</td>
<td></td>
</tr>
<tr>
<td>HUM</td>
<td>23LAW300</td>
<td>Indian Constitution</td>
<td></td>
<td></td>
<td>P/F</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td></td>
<td>23</td>
<td>1</td>
<td>1</td>
<td>11</td>
</tr>
</tbody>
</table>

### SEMESTER VIII

<table>
<thead>
<tr>
<th>Cat.</th>
<th>Code</th>
<th>Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGG</td>
<td></td>
<td>Professional Elective VI*</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td></td>
<td>Professional Elective VII*</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>PRJ</td>
<td>23ELC499</td>
<td>Project Phase II</td>
<td>0</td>
<td>0</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td></td>
<td>24</td>
<td>1</td>
<td>2</td>
<td>12</td>
</tr>
</tbody>
</table>

**Total Credits** | 160

*Professional Elective* - Electives categorised under Engineering, Science, Mathematics, Live-in-Labs, and NPTEL Courses. Student can opt for such electives across departments/campuses. Students with CGPA of 7.0 and above can opt for a maximum of 3 NPTEL courses with the credits not exceeding 9.

** Free Electives - This will include courses offered by Faculty of Humanities and Social Sciences/ Faculty of Arts, Commerce and Media/ Faculty of Management/ Amrita Darshanam - (International Centre for Spiritual Studies).

** Simulation based Tutorials – These courses have simulation-based tutorials synchronized with theory. Software packages like MATLAB, LABVIEW, Python, ANSYS, etc. will be used for the tutorial. 1 theory and 1 tutorial slot in a week is to be combined as 2 continuous slots to offer the simulation-based tutorial.

*** Live-in-Labs - Students undertaking and registering for a Live-in-Labs project, can be exempted from registering for an Elective course in the higher semester.
# Professional Electives

## Power & Energy Systems

<table>
<thead>
<tr>
<th>Cat.</th>
<th>Code</th>
<th>Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGG</td>
<td>23EEE342</td>
<td>Smart Grid</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23EEE331</td>
<td>Deregulated Power System</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23EEE332</td>
<td>Energy Storage Systems</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23EEE333</td>
<td>Instrumentation for Renewable Energy Systems</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23EEE334</td>
<td>Power System Operation Control and Stability</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23EEE335</td>
<td>Renewable Energy Technologies</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23EEE336</td>
<td>Digital Power System Protection</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23EEE337</td>
<td>High Voltage Engineering</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23EEE338</td>
<td>Computer Aided Electrical Machine Design</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23EEE339</td>
<td>High Voltage Transmission Systems</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23EEE340</td>
<td>Switched Mode Power Converters</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23EEE341</td>
<td>Energy Audit and Conservation</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

## Embedded Systems, Control and Automation

<table>
<thead>
<tr>
<th>Cat.</th>
<th>Code</th>
<th>Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGG</td>
<td>23ELC341</td>
<td>Robotics and Automation</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23EEE352</td>
<td>Advanced Microcontrollers</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23EEE353</td>
<td>Digital Signal Processors</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23ELC342</td>
<td>Unmanned Aerial Vehicle</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23ELC343</td>
<td>FPGA based System Design</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23EEE354</td>
<td>Industrial Automation</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23ELC344</td>
<td>Wireless Sensor Networks</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23EEE355</td>
<td>Biomedical Instrumentation</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23EEE356</td>
<td>Advanced Control Systems</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23EEE357</td>
<td>Digital Control Systems</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23EEE358</td>
<td>Process Control and Instrumentation</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

## Automotive Systems & EV

<table>
<thead>
<tr>
<th>Cat.</th>
<th>Code</th>
<th>Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGG</td>
<td>23EEE361</td>
<td>Systems Engineering for Electric Vehicle</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23EEE369</td>
<td>Electric Vehicle Technology</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23EEE362</td>
<td>Automotive Control Systems</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23EEE363</td>
<td>Vehicular Dynamics and Control</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23EEE364</td>
<td>Automotive Electronics</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23EEE365</td>
<td>Electric Machines for Electric Vehicle</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23EEE366</td>
<td>Autonomous Vehicles</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23EEE367</td>
<td>Battery Management System</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23EEE368</td>
<td>Condition Monitoring and Predictive Maintenance</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

## Computing Technologies

<table>
<thead>
<tr>
<th>Cat.</th>
<th>Code</th>
<th>Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENGG</td>
<td>23ELC361</td>
<td>Digital Image Processing</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23ELC362</td>
<td>Big Data Analytics</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23ELC363</td>
<td>Cloud Computing</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23ELC364</td>
<td>Deep Learning</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23ELC365</td>
<td>Block chain Technology</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23ELC366</td>
<td>Cyber Security</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23ELC367</td>
<td>Natural Language Processing</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23ELC368</td>
<td>Green Computing</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>ENGG</td>
<td>23ELC369</td>
<td>Evolutionary Optimization Techniques</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Value Added Courses</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>e-Mobility Business and Policies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Renewable Energy Policies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethical Hacking</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Introduction to LabVIEW</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy Literacy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soft Computing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electro Magnetic Interference and Electro Magnetic Compatibility</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AUTOSAR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advanced Driver Assistance System</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Web Application Development</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mobile Application Development</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Robot Operating Systems</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wireless Communications</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment Component</th>
<th>Weightage</th>
<th>Theory and Lab integrated courses (LTP: 0 0 X / 1 0 X)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous Assessment</td>
<td>30</td>
<td>40</td>
</tr>
<tr>
<td>Mid Term Exam</td>
<td>30</td>
<td>20</td>
</tr>
<tr>
<td>End Semester/Project</td>
<td>40</td>
<td>40</td>
</tr>
</tbody>
</table>

### Continuous Assessment Weightage Split-up for Theory and Lab Integrated Courses

<table>
<thead>
<tr>
<th>Before Midterm (Quiz/Assignment)</th>
<th>CA1</th>
<th>CA2</th>
<th>CA3</th>
<th>CA4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quiz/Assignment</td>
<td>7.5</td>
<td>7.5</td>
<td>7.5</td>
<td>7.5</td>
</tr>
</tbody>
</table>

*Faculty have the flexibility to adopt Quiz/Assignment / mix of quiz and assignment, totalling up to four (4).

### Continuous Assessment Weightage Split-up for Lab Courses

<table>
<thead>
<tr>
<th>Before Midterm</th>
<th>6 Weeks Task or Experiments</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>After Midterm</td>
<td>6 Weeks Task or Experiments</td>
<td>20</td>
</tr>
</tbody>
</table>

## List of courses in Amrita Value Programme I & II

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
<th>L-T-P</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>22ADM201</td>
<td>Strategic Lessons from Mahabharatha</td>
<td>1-0-0</td>
<td>1</td>
</tr>
<tr>
<td>22ADM211</td>
<td>Leadership from Ramayana</td>
<td>1-0-0</td>
<td>1</td>
</tr>
<tr>
<td>22AVP210</td>
<td>Kerala Mural Art and Painting</td>
<td>1-0-0</td>
<td>1</td>
</tr>
<tr>
<td>22AVP218</td>
<td>Yoga Therapy and Lessons</td>
<td>1-0-0</td>
<td>1</td>
</tr>
<tr>
<td>22AVP212</td>
<td>Introduction to Traditional Indian Systems of Medicine</td>
<td>1-0-0</td>
<td>1</td>
</tr>
<tr>
<td>22AVP201</td>
<td>Amma’s Life and Message to the modern world</td>
<td>1-0-0</td>
<td>1</td>
</tr>
<tr>
<td>22AVP204</td>
<td>Lessons from the Upanishads</td>
<td>1-0-0</td>
<td>1</td>
</tr>
<tr>
<td>22AVP205</td>
<td>Message of the Bhagavad Gita</td>
<td>1-0-0</td>
<td>1</td>
</tr>
<tr>
<td>22AVP206</td>
<td>Life and Message of Swami Vivekananda</td>
<td>1-0-0</td>
<td>1</td>
</tr>
<tr>
<td>22AVP207</td>
<td>Life and Teachings of Spiritual Masters of India</td>
<td>1-0-0</td>
<td>1</td>
</tr>
<tr>
<td>22AVP208</td>
<td>Insights into Indian Arts and Literature</td>
<td>1-0-0</td>
<td>1</td>
</tr>
<tr>
<td>22AVP213</td>
<td>Traditional Fine Arts of India</td>
<td>1-0-0</td>
<td>1</td>
</tr>
<tr>
<td>22AVP214</td>
<td>Principles of Worship in India</td>
<td>1-0-0</td>
<td>1</td>
</tr>
<tr>
<td>22AVP215</td>
<td>Temple Mural Arts in Kerala</td>
<td>1-0-0</td>
<td>1</td>
</tr>
<tr>
<td>22AVP218</td>
<td>Insights into Indian Classical Music</td>
<td>1-0-0</td>
<td>1</td>
</tr>
<tr>
<td>22AVP219</td>
<td>Insights into Traditional Indian Painting</td>
<td>1-0-0</td>
<td>1</td>
</tr>
<tr>
<td>22AVP220</td>
<td>Insights into Indian Classical Dance</td>
<td>1-0-0</td>
<td>1</td>
</tr>
<tr>
<td>22AVP221</td>
<td>Indian Martial Arts and Self Defense</td>
<td>1-0-0</td>
<td>1</td>
</tr>
<tr>
<td>22AVP209</td>
<td>Yoga and Meditation</td>
<td>1-0-0</td>
<td>1</td>
</tr>
</tbody>
</table>
# Professional Electives Under Science Stream

## Chemistry

<table>
<thead>
<tr>
<th>Cat.</th>
<th>Course Code</th>
<th>Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCI</td>
<td>23CHY240</td>
<td>Computational Chemistry and Molecular Modelling</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>SCI</td>
<td>23CHY241</td>
<td>Electrochemical Energy Systems and Processes</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>SCI</td>
<td>23CHY242</td>
<td>Fuels and Combustion</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>SCI</td>
<td>23CHY243</td>
<td>Green Chemistry and Technology</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>SCI</td>
<td>23CHY244</td>
<td>Instrumental Methods of Analysis</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>SCI</td>
<td>23CHY245</td>
<td>Batteries and Fuel Cells</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>SCI</td>
<td>23CHY246</td>
<td>Corrosion Science</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

## Physics

<table>
<thead>
<tr>
<th>Cat.</th>
<th>Course Code</th>
<th>Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCI</td>
<td>23PHY240</td>
<td>Advanced Classical Dynamics</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>SCI</td>
<td>23PHY241</td>
<td>Electrical Engineering Materials</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>SCI</td>
<td>23PHY242</td>
<td>Physics of Lasers and Applications</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>SCI</td>
<td>23PHY243</td>
<td>Concepts of Nanophysics and Nanotechnology</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>SCI</td>
<td>23PHY244</td>
<td>Physics of Semiconductor Devices</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>SCI</td>
<td>23PHY245</td>
<td>Astrophysics</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

## Mathematics

<table>
<thead>
<tr>
<th>Cat.</th>
<th>Course Code</th>
<th>Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCI</td>
<td>23MAT240</td>
<td>Statistical Inference</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>SCI</td>
<td>23MAT241</td>
<td>Introduction to Game Theory</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>SCI</td>
<td>23MAT242</td>
<td>Numerical Methods and Optimization</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

## Free Electives

## Free Electives Offered Under Management Stream

<table>
<thead>
<tr>
<th>Cat.</th>
<th>Course Code</th>
<th>Title</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>HUM</td>
<td>23MNG331</td>
<td>Financial Management</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>HUM</td>
<td>23MNG332</td>
<td>Supply Chain Management</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>HUM</td>
<td>23MNG333</td>
<td>Marketing Management</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>HUM</td>
<td>23MNG334</td>
<td>Project Management</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>HUM</td>
<td>23MNG335</td>
<td>Enterprise Management</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>HUM</td>
<td>23MNG336</td>
<td>Operations Research</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>HUM</td>
<td>23MEE321</td>
<td>Industrial Engineering</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>HUM</td>
<td>23MEE322</td>
<td>Managerial Statistics</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>HUM</td>
<td>23MEE323</td>
<td>Total Quality Management</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>HUM</td>
<td>23MEE324</td>
<td>Lean Manufacturing</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>HUM</td>
<td>23CSE321</td>
<td>Software Project Management</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>HUM</td>
<td>23CSE322</td>
<td>Financial Engineering</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>HUM</td>
<td>23CSE323</td>
<td>Engineering Economic Analysis</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>HUM</td>
<td>23CSE324</td>
<td>Information Systems</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Cat.</td>
<td>Course Code</td>
<td>Title</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>HUM</td>
<td>23CUL230</td>
<td>Achieving Excellence in Life - An Indian Perspective</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HUM</td>
<td>23CUL231</td>
<td>Excellence in Daily Life</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HUM</td>
<td>23CUL232</td>
<td>Exploring Science and Technology in Ancient India</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HUM</td>
<td>23CUL233</td>
<td>Yoga Psychology</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HUM</td>
<td>23ENG230</td>
<td>Business Communication</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HUM</td>
<td>23ENG231</td>
<td>Indian Thought through English</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HUM</td>
<td>23ENG232</td>
<td>Insights into Life through English Literature</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HUM</td>
<td>23ENG233</td>
<td>Technical Communication</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HUM</td>
<td>23ENG234</td>
<td>Indian Short Stories in English</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HUM</td>
<td>23FRE230</td>
<td>Proficiency in French Language (Lower)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HUM</td>
<td>23FRE231</td>
<td>Proficiency in French Language (Higher)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HUM</td>
<td>23GER230</td>
<td>German for Beginners I</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HUM</td>
<td>23GER231</td>
<td>German for Beginners II</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HUM</td>
<td>23GER232</td>
<td>Proficiency in German Language (Lower)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HUM</td>
<td>23GER233</td>
<td>Proficiency in German Language (Higher)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HUM</td>
<td>23HIN230</td>
<td>Hindi I</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HUM</td>
<td>23HIN231</td>
<td>Hindi II</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HUM</td>
<td>23HUM230</td>
<td>Emotional Intelligence</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HUM</td>
<td>23HUM231</td>
<td>Glimpses into the Indian Mind - the Growth of Modern India</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HUM</td>
<td>23HUM232</td>
<td>Glimpses of Eternal India</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HUM</td>
<td>23HUM233</td>
<td>Glimpses of Indian Economy and Polity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HUM</td>
<td>23HUM234</td>
<td>Health and Lifestyle</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HUM</td>
<td>23HUM235</td>
<td>Indian Classics for the Twenty-first Century</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HUM</td>
<td>23HUM236</td>
<td>Introduction to India Studies</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HUM</td>
<td>23HUM237</td>
<td>Introduction to Sanskrit Language and Literature</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HUM</td>
<td>23HUM238</td>
<td>National Service Scheme</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HUM</td>
<td>23HUM239</td>
<td>Psychology for Effective Living</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HUM</td>
<td>23HUM240</td>
<td>Psychology for Engineers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HUM</td>
<td>23HUM241</td>
<td>Science and Society - An Indian Perspective</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HUM</td>
<td>23HUM242</td>
<td>The Message of Bhagwat Gita</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HUM</td>
<td>23HUM243</td>
<td>The Message of the Upanishads</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HUM</td>
<td>23HUM244</td>
<td>Understanding Science of Food and Nutrition</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HUM</td>
<td>23HUM245</td>
<td>Service Learning</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HUM</td>
<td>23JAP230</td>
<td>Proficiency in Japanese Language (Lower)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HUM</td>
<td>23JAP231</td>
<td>Proficiency in Japanese Language (Higher)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HUM</td>
<td>23SAN230</td>
<td>Sanskrit I</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HUM</td>
<td>23SAN231</td>
<td>Sanskrit II</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HUM</td>
<td>23SWK230</td>
<td>Corporate Social Responsibility</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HUM</td>
<td>23SWK231</td>
<td>Workplace Mental Health</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HUM</td>
<td>23TAM230</td>
<td>Tamil I</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HUM</td>
<td>23TAM231</td>
<td>TAMIL II</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Syllabus

Course Objectives
- To introduce the students to the elements of technical style.
- To introduce the basic elements of formal correspondence.
- To introduce technical paper writing skills and methods of documentation.
- To improve oral presentation skills in formal contexts.

Course Outcomes
CO1: Understand and use the basic elements of formal correspondence and methods of documentation.
CO2: Learn to edit technical content for grammatical accuracy and appropriate tone and style.
CO3: Use the library and Internet resources for research purposes.
CO4: Demonstrate the ability to communicate effectively through group mock-technical presentations and other activities.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Syllabus

Unit 1

Unit 2

Unit 3

References
Course Objectives

• Introduce the concepts of shifting and scaling of functions, their continuity, one- and two-sided limits, differentiability.
• Introduce tangents, normals, binormals, curvatures, minima and maxima of functions of single variables.
• Understand basic concepts of eigen values and eigen vectors.
• Apply eigen values and eigen vectors for diagonalization and quadratic form.
• To familiar various methods for solving first and second order differential equations.
• Apply numerical techniques to solve the differential equations.

Course Outcomes

CO1: To understand the concepts of shifting, scaling of functions, limits, continuity, and differentiability. To learn definite integral, partial, and total derivatives.

CO2: To solve the system of equations. Also, understand the notion of eigenvalues and eigenvectors.

CO3: To analyze the possibility of diagonalization and hence compute a diagonal matrix, if possible.

CO4: To model the engineering problems as first order linear ordinary differential equations and to learn to solve them.

CO5: Solve the second order linear ordinary differential equations using variation of parameters, undetermined coefficients.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO1</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Syllabus

Unit 1

Unit 2

Unit 3

Textbooks

References

Course Objective

- To provide computational perspectives of problem solving and focus on design principles and methods of algorithms.

Course Outcomes

CO1: Develop logical reasoning for problem solving.
CO2: Apply constituents of algorithms to define and solve problems.
CO3: Analyse problems and algorithm by tracing its computational states.
CO4: Design and implement algorithm(s) for a given scenario.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Syllabus

Unit 1
Problem Solving and Algorithmic Thinking – Overview – problem definition, logical reasoning; Algorithm – definition, practical examples, properties, representation, algorithms Vs programs.

Unit 2
Algorithmic thinking – Constituents of algorithms – Sequence, Selection and Repetition, input-output; Computation – expressions, logic.

Unit 3
Algorithms vs programs, Problem Understanding and Analysis – problem definition, input output, variables, name binding, data organization: lists and arrays, Algorithms to programs.

Textbook

References
Course Objectives

- To understand the BIS and its importance in Technical Drawings.
- To acquire proficiency in orthographic and isometric projection techniques for 2D representation of 3D objects.
- To appreciate the significance of 3D modeling in engineering design and drafting.
- To familiarize with 3D modeling software.
- Develop lateral surface development principles for creating 2D representations of 3D objects.

Course Outcomes

CO1: Demonstrate proficiency in using BIS for drafting.
CO2: Construct engineering drawings using principles of orthographic and isometric projection.
CO3: Develop models using principles of lateral surface development.
CO4: Create proficiency in developing 3D solid models using the software.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
</tbody>
</table>

Syllabus


Orthographic and Isometric Projections in 3D: Understanding orthographic projections of points, lines, planes, and solids in 3D, Developing 2D projections of 3D models, Developing sectional views of 3D models of solids, Developing isometric projections from 3D models of solids, Real-world applications of orthographic projections.

Development of Lateral Surfaces: Developing lateral surfaces of right regular prisms, cylinders, pyramids, and cones Understanding the development of surfaces in 3D models, Real-world applications of surface development.

Advanced 3D Modeling Techniques: Advanced modeling techniques in 3D Modeling Software (Autodesk® Fusion 360®), Creating complex 3D models using multiple tools and techniques, Applications of advanced 3D modeling techniques in various industries, Exporting 3D models for prototyping and manufacturing.

Textbook


References

Course Objective

• This course covers basics of Electrostatics’ and Magneto statics starting with a review of Vectors. Essentials of Quantum mechanics required in understanding physics of semiconducting and Dielectric materials also is covered.

Course Outcomes

CO1: Understand electric field, electric potential concepts to solve problems in electrostatics.
CO2: Understand various atom models.
CO3: Apply the principles of Quantum Mechanics to simple applications in atoms, molecules and solids.
CO4: Understand the Physics behind Semiconducting materials and dielectric materials and its applications.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
</tbody>
</table>

Syllabus

Unit 1


Magnetic fields, Magnetic forces, Currents, Biot-Savart law, Divergence and Curl of magnetic field, Ampere’s law and its applications.

Unit 2


Unit 3

Semiconductors, Dielectrics Classification of semiconductors, doping, temperature dependence, minority carriers and recombination, diffusion and conduction equations, continuity equation.

Optical Properties Light propagation in a homogeneous medium, absorption, scattering, luminescence, phosphors, LEDs, polarization, LCDs, electro optic effects.

Textbooks


References

Course Objectives
- To introduce experiments for the understanding of physics concepts in the areas of electronics, optics, semiconductors, quantum mechanics and electricity and magnetism.
- To acquire experimental skills in studying electrical properties of metals and semiconductors, optical and quantum phenomena and measurement of magnetic field.

Course Outcomes
CO1: Be able to design and perform experiment to study the electrical property of metals and semiconductors.
CO2: Be able to design, perform experiments on dispersion, interference and diffraction.
CO3: Be able to design, perform experiments to measure magnetic field.
CO4: Perform experiment to study atomic spectrum of $H_2$ atom and quantum nature of light.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO3</td>
<td></td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

List of Experiments
1. Carey Foster’s bridge – finding resistance per unit length of the wire and to find the resistivity of the material of a given wire.
2. Spectrometer-Dispersive power of prism.
3. Radius of curvature of given convex lens by Newton’s rings method.
5. Band gap of a semiconductor.
7. Verifying the quantum nature of hydrogen atom by measuring the wavelengths of spectral lines in Balmer series.
8. Photoelectric Effect – Planck’s constant and work function of the given metal.
9. Measurement of the magnetic field of paired coils in a Helmholtz arrangement.
Course Objectives

- Impart the knowledge of general safety procedures that should be observed on the shop floor.
- Use modelling software to design and print simple geometry for additive manufacturing processes.
- Hands-on experience - arc welding and soldering operations.
- Use of different tools and accessories used for basic manufacturing processes.
- Familiarize with the essential pneumatic and electro-pneumatic components for automation and design pneumatic/electro pneumatic circuits for the given simple application
- Understanding the functioning of various sub-systems of automobiles, such as the power train, steering system, suspension system, and braking system and realize the importance of recent developments in automotive technologies.

Course Outcomes

CO1: Practice safety procedures in a shop floor environment.
CO2: Select appropriate tools and methods for basic manufacturing processes.
CO3: Build simple geometries using additive manufacturing process.
CO4: Perform basic metals joining using welding and soldering.
CO5: Design, simulate and test simple pneumatic and electro-pneumatic circuit for automation application.
CO6: Understand the functioning of automotive systems and realize the importance of recent developments in automotive technologies.

CO-PO MAPPING

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>CO1</th>
<th>CO2</th>
<th>CO3</th>
<th>CO4</th>
<th>CO5</th>
<th>CO6</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PO1</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PO2</td>
<td>2</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PO3</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>PO4</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PO5</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>PO6</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>3</td>
<td>-</td>
</tr>
</tbody>
</table>

Syllabus


Automation lab: Design, simulate and test pneumatic and electro-pneumatic circuits. Introduction to PLC – PLC programming for automation applications.

Automobile Engineering lab: Overview of automobiles – components – functioning of various sub-systems; Power train, steering system, suspension system and braking system. Introduction to electric vehicles, hybrid vehicles, alternate fuels. Introduction to E Mobility.
Course Objectives
- To introduce students to the depths and richness of the Indian heritage and knowledge traditions, and to enable them to obtain a synoptic view of the grandiose achievements of India in diverse fields. To equip students with a knowledge of their country and its eternal values.

Course Outcomes
CO1: Increase student understanding of true essence of India's cultural and spiritual heritage.
   Emancipating Indian histories and practices from manipulation, misunderstandings, and other ideological baggage thus, shows its contemporary relevance.
CO2: Understand the ethical and political strategic concepts to induce critical approach to various theories about India.
CO3: Familiarize students with the multidimension of man's interaction with nature, fellow beings and society in general.
CO4: Appreciate the socio-political and strategic innovations based on Indian knowledge systems.
   Gives an understanding of bringing Indian teaching into practical life.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>-</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Syllabus

Unit 1
Educational Heritage of Ancient India
Life and Happiness
Impact of Colonialism and Decolonization
A timeline of Early Indian Subcontinent

Unit 2
Pinnacle of Selflessness and ultimate freedom
Indian approach towards life
Circle of Life
Ocean of love; Indian Mahatmas.

Unit 3
Man's association with Nature
Celebrating life 24/7.
Metaphors and Tropes
Become A Strategic Thinker (Games / Indic activity)

Unit 4
India: In the Views of Other Scholars and Travellers
Personality Development Through Yoga.
Hallmark of Indian Traditions: Advaita Vedanta, Theory of oneness
Conversations on Compassion with Amma

Text Book
1. *Foundations of Indian Heritage* - In house publication
References
1. *The beautiful tree* by Dharampal.
3. *India, that is Bharat: Coloniality, Civilisation, Constitution* by J Sai Deepak.
4. *Awaken Children Dialogues with Mata Amritanandamayi.*
Course Objectives

- Mastery Over Mind (MaOM) is an Amrita initiative to implement schemes and organize university-wide programs to enhance health and wellbeing of all faculty, staff, and students (UN SDG -3).
- It gives an introduction to immediate and long-term benefits of MA OM meditation and equips every attendee to manage stressful emotions and anxiety, in turn facilitating inner peace and harmony.
- This course will enhance the understanding of experiential learning based on the University’s mission: “Education for Life along with Education for Living” and is aimed to allow learners to realize and rediscover the infinite potential of one’s true Being and the fulfilment of life’s goals.

Course Outcomes

**CO1:** Describe what meditation is and to understand its health benefits.
**CO2:** Understand the causes of stress and how meditation improves well-being.
**CO3:** Understand the science of meditation.
**CO4:** Learn and practice MA OM meditation in daily life.
**CO5:** Understand the application of meditation to improve communication and relationships.
**CO6:** Understand the power of meditation in compassion-driven action.

**CO-PO Mapping**

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>CO2</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>CO3</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>CO4</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>CO5</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>CO6</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
</tbody>
</table>

Syllabus

**Unit 1**
Describe Meditation and Understand its Benefits.

A: Importance of meditation. How does meditation help to overcome obstacles in life (Pre-recorded video with Swami Shubhamritananda Puri).

*Reading 1:* Why Meditate? (Swami Shubamritananda ji).


*Additional Reading:* Abhyasa Yoga: The Yoga of Practice. (Br. Achyutamrita Chaitanya).

B: Understand how meditation works. Understand how meditation helps in improving physical and mental health. Understand how meditation helps in the development of personality (Pre-recorded video with Dr. Ram Manohar).


**Unit 2**
Causes of Stress and How Meditation Improves Well-being.

A: Learn how to prepare for meditation. Understand the aids that can help in effectively practicing meditation. Understand the role of sleep, physical activity, and a balanced diet in supporting meditation. (Pre-recorded video with Dr. Ram Manohar).


Unit 3

The Science of Meditation.
A: A preliminary understanding of the Science of meditation. What can modern science tell us about this tradition-based method? (Pre-recorded video with Dr. Shyam Diwakar).
B: How meditation helps humanity according to what we know from scientific research. (Pre-recorded video with Dr. Shyam Diwakar)

Reading 1: Does Meditation Aid Brain and Mental Health (Dr Shyam Diwakar)

Unit 4

Practicing MA OM Meditation in Daily Life.
Guided Meditation Sessions following scripts provided (Level One to Level Five).

Reading 1: MA OM and White Flower Meditation: A Brief Note (Swami Atmananda Puri).

Unit 5

Improving Communication and Relationships.
How meditation and mindfulness influence interpersonal communication. The role of meditation in improving relationship quality in the family, at the university and in the workplace. (Pre-recorded video with Dr Shobhana Madhavan).


Unit 6

Meditation and Compassion-driven Action.
Understand how meditation can help to motivate compassion-driven action. (Pre-recorded video with Dr Shobhana Madhavan).


Textbooks

1. Meditation and Spiritual Life-Swami Yatiswarananda, Ramakrishna Math.
8. Books on Amma’s teachings like Awaken children, From Amma’s Heart etc.
Course Objectives
- To perform calculus for complex variables.
- To understand the residues and pole and evaluate the complete integrations.
- To understand and apply Laplace transform to solve differential equations.
- To understand the concepts of Fourier series and Fourier transforms.

Course Outcomes
CO1: To carry out differentiation for complex functions.
CO2: To perform integral calculus in complex variables.
CO3: To apply the Laplace transform for solving the ordinary differential equations.
CO4: To understand and apply the Fourier series for solving heat and wave equations.
CO5: To understand the Fourier transform and its properties.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Syllabus

Unit 1
Complex Analysis: Analytic Functions, Cauchy - Riemann Equations, Laplace Equation, Conformal mapping.

Unit 2

Unit 3
Fourier Series, Periodic functions, Full range and Half range Fourier series. Fourier integral. Fourier transform, properties of Fourier transform. Fourier series solution of one dimensional wave and heat equations.

Textbook

References
Course Objectives

- Apply numerical techniques to solve the differential equations.
- The objective of the course is to impart knowledge on the concepts of chemistry involved in the application of engineering materials that are used in the industry/day-to-day life.

Course Outcomes

CO1: Characterize the solids using X-ray diffraction technique and analyse the materials using computational tools.

CO2: Apply the fundamental principles of electrochemistry to illustrate the functioning of electrochemical energy systems.

CO3: Understand the application of polymers in fabricating integrated electronic devices.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Syllabus

Unit 1
Crystalline and amorphous solids, isotropy and anisotropy, Miller indices, space lattice and unit cell, Bravais lattices, the seven crystal systems and their Bravais lattices, X-ray diffraction - Bragg’s equation and experimental methods (powder method and rotating crystal technique), types of crystals – molecular, covalent, metallic and ionic crystals – close packing of spheres – hexagonal, cubic and body centred cubic packing, elements of symmetry in crystal systems, defects in crystals – stoichiometric, non-stoichiometric, extrinsic and intrinsic defects. Vesta – for visualization of crystal structures.
Solar energy – introduction, utilization and conversion, photovoltaic cells - design, construction and working, panels and arrays. Advantages and disadvantages of PV cells. DSSC (elementary treatment).

Unit 2
Faradays laws, origin of potential, electrochemical series, reference electrodes, Nernst equation, introduction to batteries – classification – primary, secondary and reserve (thermal) batteries. Characteristics – cell potential, current, capacity and storage density, energy efficiency. Construction, working and application of Leclanche cell – Duracell, Li-MnO2 cell, lead acid batteries. Ni-Cd battery, Lithium ion batteries. Fuel cell – construction and working of PEMFC.

Unit 3

References
Course Objective

- To impart knowledge on the operation and analysis of electrical circuits under steady state and transient conditions.

Course Outcomes

CO1: Understand the fundamental laws and formulate the equations for DC and AC electric networks.

CO2: Compute the steady state electrical quantities using network theorems and graph theory.

CO3: Analyze the behavior of electric circuits under transient conditions.

CO4: Evaluate three phase circuits and two port networks.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Syllabus

Unit 1

Unit 2

Unit 3

Textbook

References
Course Objective

- To impart knowledge on the fundamental concepts, design and development of analog electronic and integrated circuits for various applications.

Course Outcomes

CO1: Understand the working principle of Diodes, transistors, MOSFET and Operational Amplifier.
CO2: Analyse the characteristics of Diodes, transistors, MOSFET and Operational Amplifier.
CO3: Design electronic circuits using BJT, MOSFET and OPAMPs for various applications.

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>CO1</th>
<th>CO2</th>
<th>CO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>PO1</td>
<td>3</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>PO2</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PO3</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PO4</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PO5</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PO6</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PO7</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PO8</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PO9</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PO10</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PO11</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PO12</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PSO1</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PSO2</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PSO3</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Syllabus

Unit 1

Unit 2
MOSFET - Introduction, device structures and physical operations, Biasing, small signal operation and models, MOS CS Amplifiers, frequency and switching characteristics, Differential Amplifiers.

Unit 3

Textbooks

References

Course Objective

- To acquire the basic knowledge of digital logic to analyze, design and implement combinational and sequential logic circuits.

Course Outcomes

CO1: Understand the basics concepts of digital systems.
CO2: Develop logic functions using various minimization methods.
CO3: Implement logic functions using combinational logic circuits.
CO4: Analyse the synchronous and asynchronous sequential circuits.

### CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

### Syllabus

#### Unit 1

#### Unit 2
Design of complex combinational circuits, Combinational logic problem design, Combinational Logic design, Logic Design with PLA, Synchronous Sequential Circuit Design, Design of Sequential modules.

#### Unit 3
Programmable Logic Devices, Design of Arithmetic Circuits, Design of Memory Circuits, Algorithmic State Machines Chart, Design of Computer Instruction Set and the CPU.

### Textbook

### References

### 23ELC114 COMPUTER PROGRAMMING L-T-P-C: 2-0-2-3

Pre-requisite: Problem Solving and Algorithmic Thinking.

#### Course Objective
- To learn fundamentals of programming through C.

#### Course Outcomes
- CO1: Understand standard and user defined data types – arrays, strings, pointers, structures and union
- CO2: Familiarize typical programming constructs.
- CO3: Apply control structures for algorithms.
- CO4: Analyze programs through debugging for coding errors.

### CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>
Syllabus
Unit 1
Structure of C programs, data types, data input-output statements, control structures. Functions – inter function communication, standard functions, scope. Arrays – 1D & 2D arrays. Recursion – recursive functions.

Unit 2
Strings: fixed length and variable length strings, strings and characters, string input, output, array of strings, string manipulation functions, sorting of strings. Pointers: introduction, compatibility, arrays and pointers, Dynamic memory allocation, arrays of pointers, pointer arithmetic.

Unit 3
Structures: structure vs array comparison, complex structures, structures and functions, Union. Files and streams, file input output, command line arguments.

Textbook

References

Course Objective
• To develop practical skill in handling Electrical and Electronic appliances and installations.

Course Outcomes
CO1: Familiarize the electrical tools, electronic components, and safety measures.
CO2: Understand the operation of electrical and electronic appliances.
CO3: Perform domestic wiring and soldering.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Syllabus
Electrical: Study on power supply and protective devices, Study on basic electrical tools and electrical accessories, Study on various lighting technologies, Study on household appliances: Iron box, Fan, Refrigerator, Air conditioner, Food Mixer/grinder.

Domestic wiring practices: Glow an incandescent lamp using SPST switch, glow a fluorescent lamp using SPST switch, operate a fan and an incandescent lamp using two independent SPST switch, Operate a fluorescent lamp and a 3 pin socket using two independent SPST switch, Staircase wiring.
Course Objective
- To provide an understanding of operation and analysis of electrical and electronic circuits, and familiarize with their applications.

Course Outcomes
CO1: Demonstrate network theorems, fabricate circuits, and validate performance through simulation and hardware.
CO2: Illustrate electronic circuit performance through hardware and simulation.
CO3: Design of basic combinational and sequential circuits.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO CO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Syllabus
Hardware/Simulation experiments in Kirchhoff’s laws, Network Theorems, Transients, Resonance etc. Hardware/Simulation experiments in Diode Applications, BJT Characteristics and Amplifier Design, MOSFET Switching characteristics, Regulators, Oscillators. Logic gates, adders, MUX, DeMUX, Encoder, Decoder, Flip flop, Shift registers.

Textbooks
Course Objective

- To analyze the ions present in water using instrumental techniques.
- To understand the kinetics of chemical reactions and adsorption principles.
- To determine the rate of corrosion and its control.
- To synthesis nanoparticles and determine the surface charge of oxide particles.
- To estimate the amount of given substances using electrochemical methods.

Course Outcomes

CO1: Analyze the ions present in the given sample water.
CO2: Analyze the adsorption isotherm and determine the rate constant of a reaction.
CO3: Apply the solid state chemistry principles for preparing nanoparticles and determining the surface charge on oxides.
CO4: Apply the fundamental principles of electrochemistry for the analysis of given substance and understand the corrosion kinetics.

CO-PO Mapping

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

Syllabus

Chemical Kinetics and surface chemistry – understanding the principle of adsorption, determining the rate constant of a reaction. Electrochemistry – Evaluating the dissociation constant of acids, estimation of acid and ferrous ion present in water. Corrosion and control – anodization and Tafel plot.
Instrumentation techniques – Estimations of ions in water using flame photometer and UV-Visible spectrophotometer. Solid state - Determination of point of zero charge of metal oxide.

List of Experiments

1. Adsorption of acetic acid by charcoal.
2. Adsorption of dye on charcoal.
3. Determination of rate constant for acid catalyzed ester hydrolysis.
4. Estimation of ferrous ion by potentiometric titration.
5. Potentiometric titration of dibasic acid Vs strong base.
6. Conductometric titration of mixture of acid Vs NaOH.
7. Verification of Beer–Lambert law by UV-spectrophotometer.
8. Determination of point of zero charge of metal oxide.
10. Synthesis of silver nanoparticle by chemical reduction method.
11. Determination of sodium and potassium ions in water using Flame photometry.
13. Determination of optimum current density for the anodization of aluminium.
Course Objectives

- The course aims at introducing Bhārath in nutshell to the student, which includes the sources of Indian thoughts, eminent personalities who shaped various disciplines, India’s significant contribution to mankind, the current stature of India in geopolitics and the Indian approach to science and ecology.

Course Outcomes

CO1: Will be able to recognise the call of Upanishads and outstanding personalities for confronting the wicked in the real world while admiring the valour, pursuit and divinity in both classical and historical female characters of India.

CO2: Will get introduced to Acharya Chanakya, his works, and his views on polity and nation to find synchrony between public and personal life, alongside understanding India's cultural nuances and uniqueness concerning the comprehension of God across major global communities.

CO3: Will be able to appreciate Bhagavad Gita as the source of the Indian worldview through the various Yogic lessons enshrined in it, making it one of India's numerous soft powers, and also understand the faith-oriented mechanism of preserving nature.

CO4: Will be informed about the enormous contribution of Indian civilisation over two and a half millennia to humanity and develop awareness about India's approach toward science, devoid of dogmas and rooted in humanism.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO1</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO2</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO3</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO4</td>
<td>2</td>
<td></td>
<td>3</td>
<td></td>
<td></td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Syllabus

Chapter 1 – Face the Brutes
Chapter 2 – Role of Women in India
Chapter 3 – Acharya Chanakya
Chapter 4 – God and Iswara
Chapter 5 – Bhagavad Gita: From Soldier to Samsarin to Sadhaka
Chapter 6 – Lessons of Yoga from Bhagavad Gita
Chapter 7 – Indian Soft powers
Chapter 8 – Preserving Nature through Faith
Chapter 9 - Ancient Indian Cultures (Class Activity)
Chapter 10 - Practical Vedanta
Chapter 11 - To the World from India
Chapter 12 - Indian Approach to Science

Text Book

1. *Glimpses of Glorious India* - (In-house publication)

References

1. *Fear Not: Be Strong* (Swami Tathagatananda).
Course Objectives
• To perform data pre-processing methods for some data sets.
• To understand the data visualization methods and descriptive statistics and apply to some data sets.
• To understand discrete and continuous random variables and to compute important measures.
• To understand and apply correlations and regressions for given data set.

Course Outcomes
CO1: Understand the data pre-processing methods.
CO2: Understand various the data visualization methods and understand the basics of the descriptive statistics.
CO3: Understand the basics of probability, random variables and distributions.
CO4: Understand and apply the basic concepts of correlations and regressions to the given data.
CO5: Understand and apply the basic concepts of sampling techniques and simple hypothetical testing to the given data.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
</tbody>
</table>

Syllabus

Unit 1
Introduction, Causality and Experiments, Data pre-processing: Data cleaning, Data reduction, Data transformation, Data discretization. Overlaid Graphs, plots, and summary statistics of exploratory data analysis, Randomness.

Unit 2

Unit 3

Textbooks

References
Course Objective

- Introduce the fundamental concepts, operation, and application of electrical machines.

Course Outcomes

CO1: Understand the basic principles, construction, and application of electrical machines.
CO2: Develop steady state equations and equivalent circuit of electrical machines.
CO3: Select suitable technique for starting, braking and speed control of electrical machines.
CO4: Test and analyse the performance characteristics of electrical machines.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>-</td>
</tr>
</tbody>
</table>

Syllabus

Unit 1
Review of electric and magnetic circuits – Principles of electromechanical energy conversion, DC Machines: Construction, working, types and characteristics, Starting, Speed Control and Braking of DC Motors, Efficiency and Testing – Applications.

Unit 2

Unit 3
Synchronous machines – Construction and working, generators and motors, types-salient pole and non-salient pole, characteristics, performance evaluation- regulation, efficiency, testing, parallel operation – Applications.

Textbook

References
Course Objective
- To understand the operating principles and selection of different sensors and actuators for various applications.

Course Outcomes
CO1: Understand the characteristics and operating principles of different types of sensors.
CO2: Select different actuators for various applications.
CO3: Apply different analog and digital signal conditioning techniques for sensor circuits.
CO4: Design and analyse sensor-based applications.

CO-PO Mapping

<table>
<thead>
<tr>
<th>CO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Syllabus

Unit 1

Unit 2

Unit 3

Textbooks

References
Group, 1999.


ARTIFICIAL INTELLIGENCE  

Pre-requisites: Probability and statistics, matrix algebra.

Course Objective

- To learn concepts of Artificial Intelligence and develop programs for self-learning agents.

Course Outcomes

CO1: Understand concepts of state space and Intelligent agents.
CO2: Apply search algorithms for real world applications.
CO3: Develop planning strategies for structured environment.
CO4: Familiarise propositional logic and inference for AI applications.

CO-PO Mapping

<table>
<thead>
<tr>
<th>CO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Syllabus

Unit 1

Unit 2

Unit 3
Planning and Constraint Satisfaction – Domains, Forward and Backward Search. Logic and Inferences – Propositional Logic, First Order Logic, predicate logic, applications.

Textbook

References
CO4: Validate the learned concepts through simulation.

## CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

## Syllabus

### Unit 1

### Unit 2
Introduction to multicycle at a path, Pipelining Technique – Design Issues, Hazards: Structural Hazards, Data Hazards and Control Hazards, Static Branch Prediction, Dynamic Branch Prediction.

### Unit 3

## Textbook

## References

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>23EEE201</td>
<td>SIGNALS &amp; SYSTEMS</td>
<td>L-T-P-C: 3-1-0-4</td>
</tr>
</tbody>
</table>

## Pre-requisites
Vector calculus, Laplace, Fourier Transforms.

## Course Objective
- To understand various types of signals and systems and analyze their properties using continuous and discrete transforms in time and frequency domain.

## Course Outcomes
**CO1:** Understand the classification of signals and systems.
**CO2:** Evaluate LTI output using linear convolution technique.
**CO3:** Analyse signals and systems in time and frequency domains.
**CO4:** Validate time and frequency responses of various signals in LTI systems using simulations.

## CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>-</td>
</tr>
</tbody>
</table>

23EEE201 SIGNALS & SYSTEMS L-T-P-C: 3-1-0-4
Syllabus

Unit 1

Unit 2

Unit 3

Textbook

References
4. Virtual labs, NPTEL Videos, Simulation demos etc.
Course Objective

To learn the fundamentals of programming using object-oriented approach through Python.

Course Outcomes

CO1: Familiarize python programming constructs.
CO2: Apply the concepts of classes, objects, and inheritance for modularity.
CO3: Analyse polymorphism and overloading for standard applications.
CO4: Understand exceptions for building robust programs.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Syllabus

Unit 1

Unit 2
Polymorphism - overloading, overriding, Inheritance – constructors, abstract classes, and methods- static, final methods.

Unit 3
Exceptions – exception handling. Input / Output Basics – Reading and Writing Console – Reading and Writing Files

Textbook

References
CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Syllabus
Course Objective
- Implement sensors and actuators-based applications using software and hardware.

Course Outcomes
CO1: Understand the characteristics of different types of sensors and actuators.
CO2: Calibrate sensors and communicate data for processing.
CO3: Develop hardware application using sensors and actuators.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO CO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Syllabus
Study the characteristics of measurement system, thermal, electrical, and magnetic sensors, mechanical sensors using software and develop hardware circuits for an application.
Study the characteristics of actuator systems – rotary actuators, motors, valves and solenoids using software and develop hardware circuits for an application.
Course Objectives

- Through a study of the Rāmāyaṇa, the student should gain a deeper understanding of the ethical grandeur of Indian culture, and be inspired to follow the ideals of the characters depicted therein.

Course Outcomes

CO1: Appreciate the significance of Rāmāyaṇa as an itihāsa, and important aspects of Bālakāṇḍa.
CO2: Understand the family values and ideal human relationships portrayed in the Ayodhyakāṇḍa and Aranyakāṇḍa of Rāmāyaṇa.
CO3: Understand dharma and its nuances, emphasizing its applicability in an individual’s life through Kishkindhakāṇḍa and Sundarakāṇḍa of Ramayana.
CO4: Appreciate the triumph of dharma over adharma through Yuddhakāṇḍa of Rāmāyaṇa.
CO5: Appreciate the spiritual values from Rāmāyaṇa in resolving personal and social conflicts through varied effective presentations of important episodes of the Rāmāyaṇa.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>CO3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>CO4</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>CO5</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>3</td>
</tr>
</tbody>
</table>

Syllabus

Unit 1

Unit 2
Aranya-Kāṇḍa: Tale of the forest life.

Unit 3
Kishkindha-Kāṇḍa: The Empire of Holy Monkeys.
Sundara-Kāṇḍa: Heart of the Ramayana.

Unit 4
Yuddha-Kāṇḍa: The most popular part of the Ramayana.
Uttara-Kāṇḍa: An attempt to explain the untold stories.

Unit 5
Ramayana and Modern-day learning
Ecological Awareness in the Ramayana
Different Ramayana: Epic that connects the world.

Textbooks/ References
1. Leadership Lessons from the Ramayana, ASCSS.
Pre-requisite: An open mind and the urge for self-development, basic English language skills, knowledge of high school level mathematics.

Course Objectives
- Assist students in inculcating Soft Skills and developing a strong personality
- Help them improve their presentation skills
- Support them in developing their problem solving and reasoning skills
- Facilitate the enhancement of their communication skills

Course Outcomes
CO1 - Soft Skills: To develop greater morale and positive attitude to face, analyse, and manage emotions in real life situations, like placement process.
CO2 - Soft Skills: To empower students to create better impact on a target audience through content creation, effective delivery, appropriate body language and overcoming nervousness, in situations like presentations, Group Discussions and interviews.
CO3 - Aptitude: To analyze, understand and employ the most suitable methods to solve questions on arithmetic and algebra.
CO4 - Aptitude: To investigate and apply suitable techniques to solve questions on logical reasoning and data analysis.
CO5 - Verbal: To infer the meaning of words and use them in the right context. To have a better understanding of the basics of English grammar and apply them effectively.
CO6 - Verbal: To identify the relationship between words using reasoning skills. To develop the capacity to communicate ideas effectively.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Syllabus

Soft Skills
Soft Skills and its importance: Pleasure and pains of transition from an academic environment to work-environment. New-age challenges and distractions. Learning to benefit from constructive criticisms and feedback, Need for change in mindset and up-skilling to keep oneself competent in the professional world.
Managing Self: Knowing oneself, Self-perception, Importance of positive attitude, Building and displaying confidence, Avoiding being overconfident, Managing emotions, stress, fear. Developing Resilience and handling failures. Self-motivation, Self-learning, and continuous knowledge up-gradation / Life-long learning. Personal productivity - Goal setting and its importance in career planning, Self-discipline, Importance of values, ethics and integrity, Universal Human Values.

Aptitude
Problem Solving I

**Numbers:** Types, Power Cycles, Divisibility, Prime, Factors & Multiples, HCF & LCM, Surds, Indices, Square roots, Cube Roots and Simplification.

**Percentage:** Basics, Profit, Loss & Discount, and Simple & Compound Interest.

**Ratio, Proportion & Variation:** Basics, Alligations, Mixtures, and Partnership.

**Averages:** Basics, and Weighted Average.

**Data Interpretation:** Tables, Bar Diagrams, Venn Diagrams, Line Graphs, Pie Charts, Caselets, Mixed Varieties, Network Diagrams and other forms of data representation.

**Verbal**

**Vocabulary:** Familiarize students with the etymology of words, help them realize the relevance of word analysis and enable them to answer synonym and antonym questions. Create an awareness about the frequently misused words, commonly confused words and wrong form of words in English.

**Grammar (Basic):** Help students learn the usage of structural words and facilitate students to identify errors and correct them.

**Reasoning:** Stress the importance of understanding the relationship between words through analogy questions.

**Speaking Skills:** Make students conscious of the relevance of effective communication in today’s world through various individual speaking activities.

**References:**

5. The hard truth about Soft Skills, by Amazon Publication.
6. Verbal Skills Activity Book, CIR, AVVP
7. English Grammar & Composition, Wren & Martin
8. Nova’s GRE Prep Course, Jeff Kolby, Scott Thornburg & Kathleen Pierce
9. Cracking the New GRE 2012
10. Kaplan’s – GRE Comprehensive Programme
14. How to Prepare for Data Interpretation for the CAT, Arun Sharma.

**Evaluation Pattern**

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>External</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous Assessment (CA)* – Soft Skills</td>
<td>30</td>
<td>-</td>
</tr>
<tr>
<td>Continuous Assessment (CA)* – Aptitude</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>Continuous Assessment (CA)* – Verbal</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
<td>50</td>
</tr>
</tbody>
</table>

**Pass / Fail**

*CA - Can be presentations, speaking activities and tests.*
Course Objective
- To introduce the concepts of operating systems, its components and services.

Course Outcomes
CO1: Understand the architecture and functionalities of operating systems.
CO2: Analyse process scheduling algorithms.
CO3: Apply the concepts of process synchronization.
CO4: Familiarize storage and memory allocation techniques.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>CO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Syllabus

Unit 1

Unit 2

Unit 3

Textbook

References
Course Objective

- To understand the idea of learning by machines, training, classification, and prediction techniques.

Course Outcomes

CO1: Understand the basic concepts of optimization for learning.
CO2: Design microcontroller frameworks for classification problems.
CO3: Develop prediction models using regression.
CO4: Analyse modern tools for real world scenarios.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Syllabus

Unit 1

Unit 2
Regression models and implementation – Linear regression, Logistic Regression, SVR, Random Forest. Performance measurements of models: MSE, Mean absolution deviation (MAD), R-squared -coefficient of determination.

Unit 3

References

Course Objective
• To impart knowledge on control system design in time and frequency domains.

Course Outcomes
CO1: Model dynamic systems in time domain and frequency domain.
CO2: Analyse the system behaviour in time and frequency domains.
CO3: Evaluate the stability of the control system.
CO4: Design the compensators and controllers for desired response.
CO5: Implement control systems concepts using hardware and simulation.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>-</td>
</tr>
</tbody>
</table>

Syllabus
Unit 1
Introduction to control systems, Mathematical models of physical systems- transfer function, block diagram representation, Signal flow graph. Feedback control system characteristics, Control over system dynamics & disturbance, Performance of feedback control systems. Use of software tools to analyze and design of control system.

Unit 2

Unit 3
Lab Practice: Experiments in modelling, design and analysis of controllers using Simulation / Hardware.

Textbook

References
Pre-requisite: Digital Electronics.

Course Objective
- To design microcontroller-based solutions for real world applications.

Course Outcomes
**CO1**: Understand the concepts of microprocessors and microcontrollers.
**CO2**: Comprehend microcontroller architecture and instruction set.
**CO3**: Develop programs for PIC16FXXX microcontroller.
**CO4**: Demonstrate real world applications through simulation and hardware.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

Syllabus

**Unit 1**
Introduction to micro controllers – Architecture and programming, Register files, Memory Organisation, Tristate logic, Busses-Memory Address register-Memory addressing-Read and write operations, ROM – RAM – PROM – EPROM-E2PROM.

**Unit 2**
PIC16FXXX architecture, operation, data and program memory organization, special function registers, addressing modes, instruction set. Assembler, assembler directives, simple programs, conditional branching. Subroutines, nested subroutines, interrupts, ISR, priority.

**Unit 3**

Textbook

References
Course Objective

- To understand linear and nonlinear data structures and perform complexity analysis.

Course Outcomes

CO1: Understand complexity analysis of algorithms.
CO2: Apply operations of linear data structures using ADT, array, linked list.
CO3: Comprehend the operations of non-linear data structures using linked list.
CO4: Familiarize searching and sorting algorithms using data structures.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Syllabus

Unit 1

Unit 2

Unit 3

Textbooks


References

Pre-requisite: An inquisitive mind, basic English language skills, knowledge of high school level mathematics.

Course Objectives
- Assist students in inculcating Soft Skills and developing a strong personality
- Help them improve their presentation skills
- Aid them in developing their problem solving and reasoning skills
- Facilitate them in improving the effectiveness of their communication

Course Outcomes
CO1 - Soft Skills: To develop greater morale and positive attitude to face, analyse, and manage emotions in real life situations, like placement process.
CO2 - Soft Skills: To empower students to create better impact on a target audience through content creation, effective delivery, appropriate body language and overcoming nervousness, in situations like presentations, Group Discussions and interviews.
CO3 - Aptitude: To analyze, understand and employ the most suitable methods to solve questions on arithmetic and algebra.
CO4 - Aptitude: To investigate and apply suitable techniques to solve questions on logical reasoning and data analysis.
CO5 - Verbal: To learn to use more appropriate words in the given context. To have a better understanding of the nuances of English grammar and become capable of applying them effectively.
CO6 - Verbal: To be able to read texts critically and arrive at/predict logical conclusions. To learn to organize speech and incorporate feedback in order to convey ideas with better clarity.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CO6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

Syllabus

Soft Skills

Communication: Process, Language Fluency, Non-verbal, Active listening. Assertiveness vs. aggressiveness. Barriers in communication. Digital communication

Presentations: Need, importance, preparations, research and content development, structuring and ensuring flow of the presentation. Ways and means of making an effective presentation: Understanding and connecting with the audience – using storytelling technique, managing time, appropriate language, gestures, posture, facial expressions, tones, intonations and grooming. Importance of practice to make an impactful presentation.

Aptitude

Problem Solving II
Equations: Basics, Linear, Quadratic, Equations of Higher Degree and Problems on ages.
Logarithms, Inequalities and Modulus: Basics
Time, Speed and Distance: Basics, Average Speed, Relative Speed, Boats & Streams, Races and Circular tracks.
Logical Reasoning: Arrangements, Sequencing, Scheduling, Venn Diagram, Network Diagrams, Binary Logic, and Logical Connectives.

Verbal
**Vocabulary**: Aid students learn to use their vocabulary to complete the given sentences with the right words. Usage of more appropriate words in different contexts is emphasized.

**Grammar (Basic-intermediate)**: Help students master usage of grammatical forms and enable students to identify errors and correct them.

**Reasoning**: Emphasize the importance of avoiding the gap (assumption) in arguments/statement/communication.

**Reading Comprehension (Basics)**: Introduce students to smart reading techniques and help them understand different tones in comprehension passages.

**Speaking Skills**: Make students be aware of the importance of impactful communication through individual speaking activities in class.

**Writing Skills**: Introduce formal written communication and keep the students informed about the etiquette of email writing.

**References**:
5. The hard truth about Soft Skills, by Amazon Publication.
6. Verbal Skills Activity Book, CIR, AVVP
7. English Grammar & Composition, Wren & Martin
8. Nova’s GRE Prep Course, Jeff Kolby, Scott Thornburg & Kathleen Pierce
9. Cracking the New GRE 2012
10. Kaplan’s – GRE Comprehensive Programme
14. How to Prepare for Data Interpretation for the CAT, Arun Sharma.

**Evaluation Pattern**

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>External</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous Assessment (CA)* – Soft Skills</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Continuous Assessment (CA)* – Aptitude</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>Continuous Assessment (CA)* – Verbal</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
<td>50</td>
</tr>
</tbody>
</table>

*CA - Can be presentations, speaking activities and tests.*
Course Objectives

• Through a study of the Mahabharata, the student should gain a deeper understanding of the ethical grandeur of Indian culture, and be inspired to follow the ideals of the characters depicted therein.

Course Outcomes

CO1: Understand the impact of *itihasas* on Indian civilization with a special reference to the *Adiparva* of Mahabharata.

CO2: Enabling students to importance of fighting *adharma* for the welfare of the society through Sabha and Vanaparva.

CO3: Understand the nuances of dharma through the contrast between noble and ignoble characters of the epic as depicted in the Vana, Virata, Udyoga and Bhishma parvas.

CO4: Getting the deeper understanding of the Yuddha Dharma through the subsequent Parvas viz., Drona, Karna, Shalya, Saupitika Parvas.

CO5: Making the students appreciative of spiritual instruction on the ultimate triumph of dharma through the presentations of the important episodes of the MB with special light on Shanti, Anushasana, Ashwamedhika, Ashramvasika, Mausala, Mahaprasthanika and Swargarohana Parvas.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>CO1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>CO3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>CO4</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>CO5</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>1</td>
</tr>
</tbody>
</table>

Syllabus

**Unit 1**
Introduction and Summary of the Mahabharata.
A Preamble to the Great Itihasa.
Unbroken Legacy.

**Unit 2**
Dharmic Insights of a Butcher.
The Vows We Take.
Kingship and Polity Acumen.

**Unit 3**
Karna – The Maestro that Went Wide off the Mark.
Tactics of Krishna.
Yajnaseni.

**Unit 4**
Popular Regional Tales.
Maha Prasthanam – The Last Journey.

**Unit 5**
Mahabharata - An All-Encompassing Text.
Mahābhārata- Whats and WhatNots.
Nyayas in Mahabharata.

Textbooks/ References
1. Leadership Lessons from the Mahabharat, ASCSS
Course Objective
- To familiarize with the structure, operation, and analysis of components in power system network.

Course Outcomes
CO1: Understand the operations of generation, transmission, and distribution systems.
CO2: Model power system components and networks.
CO3: Perform load flow, fault, and stability analysis of power system.
CO4: Monitor and control the power system network.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Syllabus

Unit 1

Unit 2

Unit 3

Virtual lab platforms / simulation demos can be used for effective classroom teaching.

Textbook

References
**Pre-requisite:** Signals and Systems.

**Course Objective**
- To explore various digital signal processing techniques for real time applications.

**Course Outcomes**
- **CO1:** Understand the frequency analysis of signals in discrete domain.
- **CO2:** Apply FFT for frequency analysis of signals in discrete domain.
- **CO3:** Design, analyze and build digital filters.
- **CO4:** Implement DSP algorithms and digital filters.

**CO-PO Mapping**

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

**Syllabus**

**Unit 1**

**Unit 2**

**Unit 3**

Simulation experiments on DFT, FFT, Filter design, Noise models and their impact on signal/noise ratio, Application in power systems.

**Textbooks**

**References**
Pre-requisite: Microcontrollers and applications.

Course Objective

- To develop real world applications using advanced microcontrollers.

Course Outcomes

CO1: Understand the basics of embedded systems.
CO2: Comprehend embedded computing architecture.
CO3: Develop programs for ARM based microcontrollers.
CO4: Demonstrate ARM based real time applications through simulation and hardware.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

Syllabus

Unit 1

Unit 2

Unit 3
Introduction to ARM based Microcontrollers – Peripherals – Ports, Timers, PWM, ADC, UART, SPI, I2C – Application development – Bare - metal Programming, Rapid Prototyping with libraries. Case studies with real world automation applications.

Textbooks


References

Course Objective
- To learn fundamentals of database management systems and understand how to connect database to front-end programs.

Course Outcomes
CO1: Understand relational data modelling, and formulate relational algebraic queries.
CO2: Develop Entity-Relationship models for different database requirements.
CO3: Design and build normalized databases.
CO4: Apply SQL statements and PL/SQL programs for relational database operations.
CO5: Implement CURD operations for relational databases using Python SQLite.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Syllabus

Unit 1
Introduction: Overview of DBMS, File vs. DBMS, elements of DBMS. Database design: E–R model, Notations, constraints, cardinality and participation constraints, ER design issues, Weak and strong entity sets, Extended ER features. Relational Data Model: Introduction to relational model, Structure of relational mode, domain, keys, tuples to relational models.

Unit 2
Relational Database Design: Functional dependency, Reduction of ER model to Relational model, Normalization: 1NF, 1NF, 2NF, 3NF. Decomposition Using Functional Dependencies including establishing keys and relationships. SQL: Various DDLs, DMLs, DCLs.

Unit 3
Python and databases: Development tools, drivers, and modules, Design a database within RDBMS and SQLite. Database connectivity with python. CRUD statements using python programming language. Python wrappers within RDBMS. An overview of NoSQL databases.

Text Book

References
Course Objective
- To plan, monitor, control and protect the power system.

Course Outcomes
CO1: Perform load flow, short circuit, and stability studies.
CO2: Apply passive and active compensation techniques for power flow control.
CO3: Analyse the operation of power system.
CO4: Develop protection scheme for power system components and systems.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td></td>
<td></td>
<td>3</td>
<td></td>
<td>3</td>
<td></td>
<td></td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Syllabus
Experiments on analysing the performance of transmission line, perform load flow analysis, short circuit analysis, transient stability analysis, shunt and series compensation techniques, enhancement of steady state stability, monitoring, control and protection of a power system network.
Pre-requisite: Willingness to learn, communication skills, basic English language skills, knowledge of high school level mathematics.

Course Objectives

- Help students understand corporate culture, develop leadership qualities and become good team players
- Assist them in improving group discussion skills
- Help students to sharpen their problem solving and reasoning skills
- Empower students to communicate effectively

Course Outcomes

CO1 - Soft Skills: To improve the inter-personal communication and leadership skills, vital for arriving at win-win situations in Group Discussions and other team activities.

CO2 - Soft Skills: To develop the ability to create better impact in a Group Discussions through examination, participation, perspective-sharing, ideation, listening, brainstorming and consensus.

CO3 - Aptitude: To identify, investigate and arrive at appropriate strategies to solve questions on geometry, statistics, probability and combinatorics.

CO4 - Aptitude: To analyze, understand and apply suitable methods to solve questions on logical reasoning.

CO5 - Verbal: To be able to use diction that is more refined and appropriate and to be competent in spotting grammatical errors and correcting them.

CO6 - Verbal: To be able to logically connect words, phrases, sentences and thereby communicate their perspectives/ideas convincingly.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>CO6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>
Syllabus

Soft Skills


Group Discussions: Advantages of group discussions, Types of group discussion and Roles played in a group discussion. Personality traits evaluated in a group discussion. Initiation techniques and maintaining the flow of the discussion, how to perform well in a group discussion. Summarization/conclusion.

Aptitude

Problem Solving III

Geometry: 2D, 3D, Coordinate Geometry, and Heights & Distance.


Statistics: Mean, Median, Mode, Range, Variance, Quartile Deviation and Standard Deviation.

Logical Reasoning: Blood Relations, Direction Test, Syllogisms, Series, Odd man out, Coding & Decoding, Cryptarithmetic Problems and Input - Output Reasoning.

Verbal

Vocabulary: Create an awareness of using refined language through idioms and phrasal verbs.

Grammar (Upper Intermediate-Advanced): Train Students to comprehend the nuances of Grammar and empower them to spot errors in sentences and correct them.

Reasoning: Enable students to connect words, phrases and sentences logically.

Oral Communication Skills: Aid students in using the gift of the gab to interpret images, do a video synthesis, try a song interpretation or elaborate on a literary quote.

Writing Skills: Practice closet tests that assess basic knowledge and skills in usage and mechanics of writing such as punctuation, basic grammar and usage, sentence structure and rhetorical skills such as writing strategy, organization, and style.

References:

5. The hard truth about Soft Skills, by Amazon Publication.

6. Verbal Skills Activity Book, CIR, AVVP

7. English Grammar & Composition, Wren & Martin

8. Public Sector – Engineer Management Trainee Recruitment Exam (General English)

9. Nova’s GRE Prep Course, Jeff Kolby, Scott Thornburg & Kathleen Pierce


11. Quantitative Aptitude for All Competitive Examinations, Abhijit Guha.


13. How to Prepare for Data Interpretation for the CAT, Arun Sharma.


15. Quantitative Aptitude for Competitive Examinations, R S Aggarwal.


**Evaluation Pattern**

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>External</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous Assessment (CA)* – Soft Skills</td>
<td>30</td>
<td>-</td>
</tr>
<tr>
<td>Continuous Assessment (CA)* – Aptitude</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>Continuous Assessment (CA)* – Verbal</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
<td>50</td>
</tr>
</tbody>
</table>

*CA - Can be presentations, speaking activities and tests.
Course Objectives
- Identify and analyse the various challenge indicators present in the village by applying concepts of Human Centered Design and Participatory Rural Appraisal.
- User Need Assessment through Quantitative and Qualitative Measurements
- Designing a solution by integrating Human Centered Design concepts
- Devising proposed intervention strategies for Sustainable Social Change Management

Course Outcomes
CO1: Learn ethnographic research and utilise the methodologies to enhance participatory engagement.
CO2: Prioritize challenges and derive constraints using Participatory Rural Appraisal.
CO3: Identify and formulate the research challenges in rural communities.
CO4: Design solutions using human centered approach.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO3</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>3</td>
</tr>
</tbody>
</table>

Syllabus
This initiative is to provide opportunities for students to get involved in coming up with technology solutions for societal problems. The students shall visit villages or rural sites during the vacations (after 4th semester) and if they identify a worthwhile project, they shall register for a 3-credit Live-in-Lab project, in the fifth semester.

Thematic Areas
- Agriculture & Risk Management
- Education & Gender Equality
- Energy & Environment
- Livelihood & Skill Development
- Water & Sanitation
- Health & Hygiene
- Waste Management & Infrastructure

The objectives and the projected outcome of the project will be reviewed and approved by the department chairperson and a faculty assigned as the project guide.
Course Objective
- To impart knowledge on the characteristics of power semiconductor devices, operation of different power conversion circuits for various applications and development of electrical drives.

Course Outcomes
CO1: Understand the characteristics of power semiconductor devices, power converters and drives.
CO2: Analyze the behaviour of converters and their control techniques for electric drives.
CO3: Design various converter circuits under different operating modes.
CO4: Evaluate the performance of power converters for drive applications.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Syllabus

Unit 1
Power semiconductor Devices: Diode, SCR, MOSFET, IGBT, safe operating area, selection of devices for various applications. Heat sink, Harmonic Analysis. AC to DC converters: Single phase and three phase thyristor full bridge rectifiers. DC to DC converters: Buck, Boost, Buck-Boost converters.

Unit 2
DC to AC converters: Basic concepts of VSI, operation of single-phase full bridge inverter, PWM modulation strategies: Single phase Sinusoidal PWM (unipolar, bipolar), Three phase PWM inverters. Single phase PWM rectifiers, control scheme of PWM rectifiers, applications of PWM rectifiers.

Unit 3

Textbook

References
Pre-requisite: Microcontrollers and Applications.

Course Objective
- To introduce the basic concepts and operation of computer networks and IoT devices.

Course Outcomes
CO1: Understand layered approach of network design in computer networks.
CO2: Familiarize protocol layers and services in computer networks.
CO3: Comprehend IoT devices, components, and networks.
CO4: Design IoT solutions for real world applications.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td></td>
<td>2</td>
<td>3</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

Syllabus

Unit 1

Unit 2

Unit 3

Textbooks

References
Course Objective
- To introduce to the mathematical foundations of computations.

Course Outcomes
CO1: Apply Finite state machines for lexical analyser.
CO2: Demonstrate the push down automata model for a given language.
CO3: Develop algorithms for structural correctness of source programs.
CO4: Analyse intermediate representation and procedure calls in Turing machines.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO CO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

Syllabus

Unit 1
Automata and Languages: Chomsky hierarchy of languages – Introduction to finite state Automata – Regular Expressions – Nondeterministic Finite Automata – equivalence of NFAs and DFAs – Minimization of DFA. Lexical Analysis.

Unit 2
Non-Regular Languages -Context free languages – Context Free Grammar -Chomsky normal form – Push Down Automata – parse tree derivations- Ambiguous grammar, removing ambiguity. Top down and bottom up parser-LR(0), LR(1), LALR.

Unit 3
Turing Machines – Non-deterministic Turing Machines – intermediate representation – procedure calls.

Textbooks

References
Course Objective
- To understand the characteristics of power semiconductor devices, and power converters for drives.

Course Outcomes
CO1: Understand the characteristics of power semiconductor devices, power electronic converters and drives.
CO2: Build power converter circuits with suitable control techniques.
CO3: Analyze the performance of power converters for drive applications.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Syllabus

Textbooks
Pre-requisite: Microcontrollers and Applications.

Course Objective
• To develop real world applications using networking and IoT concepts.

Course Outcomes
CO1: Analyse protocol layers and services in computer networks using simulation software.
CO2: Develop programs for various network algorithms.
CO3: Develop IoT devices and networks.
CO4: Demonstrate IoT solutions for real world applications.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

Syllabus

Simulation study of various communication networks using communication network simulators, Network analysis tools and packet data frame formats, Error correction, routing and cryptographic algorithms, End, edge and server devices, TCP/IP connection using microcontroller board & PC/Laptop, IoT network for real-world applications.

Textbooks

References

Course Objective
• To empower with practical experience to reinforce theoretical concepts, teamwork, technical writing and publication skills.

Course Outcomes
CO1: Solve real time problems through the acquired theoretical knowledge in core courses.
CO2: Manage the time and cost of the product development.
CO3: Communicate the scientific findings through oral and writing modes with clarity and justification.
CO4: Work as a team and effectively utilize the advanced tools.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Syllabus

This is a hands-on section for the students. By the sixth semester, the students are adept in different core streams like Power Electronics, Power Systems, Electrical Machines, Energy Systems and Digital Signal Processing etc. The students will apply their acquired knowledge and develop an application related to one or more of the core areas and implement a pragmatic setup, justifying the application.
Pre-requisite: Self-confidence, presentation skills, listening skills, basic English language skills, knowledge of high school level mathematics.

Course Objectives
- Help students prepare resumes and face interviews with confidence
- Support them in developing their problem-solving ability
- Assist them in improving their problem solving and reasoning skills
- Enable them to communicate confidently before an audience

Course Outcomes
CO1 - Soft Skills: To acquire the ability to present themselves confidently and showcase their knowledge, skills, abilities, interests, practical exposure, strengths and achievements to potential recruiters through a resume, video resume, and personal interview.
CO2 - Soft Skills: To have better ability to prepare for facing interviews, analyse interview questions, articulate correct responses and respond appropriately to convince the interviewer of one’s right candidature through displaying etiquette, positive attitude and courteous communication.
CO3 - Aptitude: To manage time while applying suitable methods to solve questions on arithmetic, algebra and statistics.
CO4 - Aptitude: To investigate, understand and use appropriate techniques to solve questions on logical reasoning and data analysis.
CO5 - Verbal: To use diction that is less verbose and more precise and to use prior knowledge of grammar to correct/improve sentences.
CO6 - Verbal: To understand arguments, analyze arguments and use inductive/deductive reasoning to arrive at conclusions. To be able to generate ideas, structure them logically and express them in a style that is comprehensible to the audience/recipient.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>CO2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>3</td>
<td>3</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>CO3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>CO6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Syllabus
Soft Skills
Facing an interview: Importance of verbal & aptitude competencies, strong foundation in core competencies, industry orientation / knowledge about the organization, resume writing (including cover letter, digital profile and video resume), being professional. Importance of good
communication skills, etiquette to be maintained during an interview, appropriate grooming and mannerism.

**Aptitude**

**Problem Solving II**

**Sequence and Series**: Basics, AP, GP, HP, and Special Series.

**Data Sufficiency**: Introduction, 5 Options Data Sufficiency and 4 Options Data Sufficiency.

**Logical reasoning**: Clocks, Calendars, Cubes, Non-Verbal reasoning and Symbol based reasoning.

**Campus recruitment papers**: Discussion of previous year question papers of all major recruiters of Amrita Vishwa Vidyapeetham.

**Competitive examination papers**: Discussion of previous year question papers of CAT, GRE, GMAT, and other management entrance examinations.

**Miscellaneous**: Interview Puzzles, Calculation Techniques and Time Management Strategies.

**Verbal**

**Vocabulary**: Empower students to communicate effectively through one-word substitution.

**Grammar**: Enable students to improve sentences through a clear understanding of the rules of grammar.

**Reasoning**: Facilitate the student to tap his reasoning skills through Syllogisms, critical reasoning arguments and logical ordering of sentences.

**Reading Comprehension** *(Advanced)*: Enlighten students on the different strategies involved in tackling reading comprehension questions.

**Public Speaking Skills**: Empower students to overcome glossophobia and speak effectively and confidently before an audience.

**Writing Skills**: Practice formal written communication through writing emails especially composing job application emails.

**References:**

5. The hard truth about Soft Skills, by Amazon Publication.
6. Verbal Skills Activity Book, CIR, AVVP
7. English Grammar & Composition, Wren & Martin
8. Public Sector – Engineer Management Trainee Recruitment Exam (General English)
9. Nova’s GRE Prep Course, Jeff Kolby, Scott Thornburg & Kathleen Pierce
10. A Modern Approach to Verbal Reasoning – R.S. Aggarwal
14. How to Prepare for Data Interpretation for the CAT, Arun Sharma.
15. How to Prepare for Logical Reasoning for the CAT, Arun Sharma.
18. A Modern Approach to Verbal & Non-Verbal Reasoning, R S Aggarwal

**Evaluation Pattern**

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>External</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous Assessment (CA)* – Soft Skills</td>
<td>30</td>
<td>-</td>
</tr>
<tr>
<td>Continuous Assessment (CA)* – Aptitude</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>Continuous Assessment (CA)* – Verbal</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
<td>50</td>
</tr>
</tbody>
</table>

*CA - Can be presentations, speaking activities and tests.*
Course Objectives

- Proposal writing to bring in a detailed project planning, enlist the materials required and propose budget requirement.
- Use the concept of Co-design to ensure User Participation in the Design Process in order to rightly capture user needs/requirements.
- Building and testing a prototype to ensure that the final design implementation is satisfies the user needs, feasible, affordable, sustainable, and efficient.
- Real time project implementation in the village followed by awareness generation and skill training of the users (villagers).

Course Outcomes

CO1: Learn co-design methodologies and engage participatorily to finalise a solution.
CO2: Understand sustainable social change models and identify change agents in a community.
CO3: Learn Project Management to effectively manage the resources.
CO4: Lab scale implementation and validation.
CO5: Prototype implementation of the solution.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>CO5</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Syllabus

The students shall visit villages or rural sites during the vacations (after 6th semester) and if they identify a worthwhile project, they shall register for a 3-credit Live-in-Lab project, in the fifth semester.

Thematic Areas

- Agriculture & Risk Management
- Education & Gender Equality
- Energy & Environment
- Livelihood & Skill Development
- Water & Sanitation
- Health & Hygiene
- Waste Management & Infrastructure
Course Objectives
- To expose the students to industry setting and get acquainted with its various functions.
- To gain direct experience so as to relate and reinforce the concepts learned in the class room.
- To promote collaboration between industry/Research Laboratory and the institution.

Course Outcomes
CO1: Familiarize with the industry environment/Research Laboratory.
CO2: Understand the application of theoretical concepts in a practical setting.
CO3: Prepare technical documents/presentations related to the work completed.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>CO3</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td>1</td>
</tr>
</tbody>
</table>

Syllabus
Students have to undergo minimum of one week of practical training in Electrical, Electronics Engineering or allied industries/research laboratory of their choice with the approval of the department. At the end of the training student should submit a report and certificate of completion to the department in the prescribed format.

Evaluation Pattern
This course is mandatory and a student has to pass this course to be eligible for the award of degree. The student shall make a report. The committee constituted by the department which will assess the student based on the report submitted.
Course Objective

- To comprehend, design, develop, implement, and test the functionality of a project work and prepare a technical paper in an approved format and present it.

Course Outcomes

CO1: Ability to investigate an engineering problem and design/develop the proof of concept of its solution.
CO2: Ability to estimate and manage the cost and time of the project.
CO3: Ability to present the project with clarity and ethics in both oral and written mode.
CO4: Ability to develop a team and effectively participate in the team to execute the project.
CO5: Ability to support the environmental, social and engineering discipline through the project.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>CO3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>CO4</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO5</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>3</td>
</tr>
</tbody>
</table>
Course Objectives

- To study the nature and facts about environment
- To appreciate the importance of environment by assessing its impact on the human world
- To study the integrated themes and biodiversity, pollution control and waste management

Course Outcomes

**CO1**: Ability to understand aspects of nature and environment.

**CO2**: Ability to analyse impact of environment on human world.

**CO3**: Ability to comprehend pollution control and waste management.

**CO-PO Mapping**

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Syllabus

**Unit 1**

**Unit 2**

**Unit 3**

**Textbook**

**References**
Course Objectives
- To know about Indian constitution.
- To know about central and state government functionalities in India.
- To know about Indian society.

Course Outcomes
CO1: Understand the functions of the Indian government.
CO2: Understand and abide the rules of the Indian constitution.
CO3: Understand and appreciate different cultures among the people.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Syllabus

Unit 1

Unit 2
Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review.

Unit 3

Text Books

References
Course Objective
- The project shall be focused on the synthesis of the knowledge gained over the past seven semesters, by taking up a work of relevance to Electrical & Computer Engineering covering design/ development/ realization/ application/ performance analysis/ state-of-the-art technology.

Course Outcomes
CO1: Ability to investigate on an engineering problem and suggest the proof of concept of its solution.
CO2: Ability to estimate and manage the cost and time of the project.
CO3: Ability to present the project with clarity and ethics in both oral and written mode.
CO4: Ability to develop a team and effectively participate in the team to execute the project.
CO5: Ability to support the environmental, social and engineering discipline through the project.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>CO4</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO5</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>3</td>
</tr>
</tbody>
</table>
Pre-requisite: Energy Systems.

Course Objective
To understand and evaluate Smart Grid technologies.

Course Outcomes
CO1: Understand the fundamental concepts and challenges in smart grid.
CO2: Familiarize with various smart grid technologies.
CO3: Comprehend standards and protocols for smart grid operation.
CO4: Apply computational intelligence in smart grid applications.

CO-PO Mapping

<table>
<thead>
<tr>
<th>CO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

Syllabus

Unit 1

Unit 2

Unit 3

Textbooks/ References

Course Objective
- To expose the deregulated power market operation, pricing mechanisms and electricity regulation and policies followed in India.

Course Outcomes
CO1: Understand the operation of deregulated power system and electricity market.
CO2: Comprehend Indian power sector acts, regulations, and policies.
CO3: Apply different pricing mechanisms and market strategies.
CO4: Deploy technologies for transmission congestion management, market settlement, and tariff computation.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Syllabus

Unit 1
Power Sector in India – Classical operation of power systems, least-cost operation, marginal cost, incremental cost - inter-utility interchanges. Fundamentals of deregulated power systems: Requirements and key issues - restructuring models - Independent system operators (ISOs).

Unit 2
Electricity market: Evolution and types of electricity markets - Competitive market - supply and demand functions, Market equilibrium - Market power and mitigation. Transmission Open Access: transmission pricing - pricing schemes - Concept of distribution factors – Location based marginal pricing.

Unit 3

Textbooks / References
Course objective

- To understand the different energy storage technologies and its applications to Electric Vehicle and Micro Grid.

Course Outcomes

CO1: Understand the role of energy storage systems and its technologies.
CO2: Apply energy storage technology in renewable energy integrations and micro grids.
CO4: Expose to various management techniques applied to energy storage systems.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>-</td>
</tr>
</tbody>
</table>

Syllabus

Unit 1

Unit 2
Energy storage systems- configurations and applications. Charge and discharge mechanism of Batteries, Comparison of storage systems - Energy density, power density Storage for renewable energy Integration: Solar energy, Wind energy, Electric vehicle. Energy storage in Microgrid and Smart grid.

Unit 3
Management of storage systems, Battery Management Systems, Management of Hybrid Energy Storage Systems (HESS), Increase of energy conversion efficiencies by introducing energy storage, Storage technology for energy management, Economics of Energy storage.

Textbooks/ References

Pre-requisites: Measurements and instrumentation, Control Systems.

Course Objective
- To acquaint with the theory and working principles of different types of instruments, monitoring, communication interfaces and controls used in power plants based on renewable energy technology.

Course Outcomes
CO1: Familiarize with various components/equipment in renewable energy-based power plants.
CO2: Understand the basic principles of transducers used in electrical and mechanical measurements in power plants.
CO3: Familiarize with monitoring and control of power plants.
CO4: Examine various communication interfaces for instrumentation systems in industries.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PS01</th>
<th>PS02</th>
<th>PS03</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Syllabus

Unit 1

Unit 2
Passive electrical transducers, Resistive, thermal radiation detectors, resistive strain, resistive pressure, linear variable differential transformer. Active electrical transducers, Thermoelectric-thermocouples, RTD, piezoelectric, Hall Effect, and photoelectric transducers.

Unit 3
SCADA, Smart meters (net metering), Phasor measurement unit, basic measurements/sensing with ADC, CCP modules in PIC microcontrollers. PLC: architecture, programming and ladder diagram. Communication Technologies: wired, wireless. RF-Zigbee, Bluetooth, WiFi, Ethernet, GSM, GPRS, Data acquisition systems, data loggers. CAN bus and MOD bus systems. Overview of IoT and Industry 4.0.

Textbooks / References
Pre-requisites: Energy Systems / Energy Systems I & II.

Course Objective
- To provide an insight into the relevance and possibilities of economic operation, control and stability aspects of power system.

Course Outcomes
CO1: Understand the principles of power system operation, control, and stability.
CO2: Develop mathematical model of power system controls.
CO3: Perform economic load dispatch and power system stability studies.
CO4: Design power system controllers.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>CO1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

Syllabus

Unit 1
Power system operation – state transition and control, SCADA in power systems-data acquisition, state estimation, security assessment and security enhancement – functions of control centers, - system load variations – system load characteristics. Economic load dispatch with and without losses – solution by iteration method (no derivation of loss coefficient) – Base point and participation factor. Real and Reactive power flows and control.

Unit 2
Basic P-f and Q-V loops, Load frequency control- modeling, analysis and control of single and multi-area – tie line with frequency bias control. Economic controller added to LFC. Need for Automatic Voltage regulator – various excitation systems-Modeling – static and dynamic analysis – Reactive power-voltage control devices.

Unit 3

Textbooks / References
Course Objective
• To introduce different renewable energy sources, its characteristics, and analyse renewable energy conversion systems.

Course Outcomes
CO1: Understand the need and means for renewable energy utilisation.
CO2: Illustrate the schemes to produce electricity from renewable resources.
CO3: Assess renewable energy potential availability.
CO4: Analyse the characteristics and control of various energy storage systems and RE energy conversion systems.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Syllabus

Unit 1

Unit 2

Unit 3
Other renewable energy technologies: Introduction to Biomass – gasifiers, digester, Small hydro, Wave, Tidal, Ocean thermal and Geothermal energy systems.

Textbooks / References
Pre-requisites: Energy Systems/ Electrical energy systems I and II.

Course Objective
- To impart knowledge on various digital power system protection schemes.

Course Outcomes
CO1: Understand the elements and principle of protection.
CO2: Apply signal processing and mathematical approach towards protection.
CO3: Develop suitable digital protection schemes for power system components.
CO4: Analyze the application of artificial intelligence (AI) in digital relaying.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO4</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Syllabus

Unit 1

Unit 2

Unit 3
Earth Fault Protection using Overcurrent Relays, Directional Overcurrent Relaying, Directional Overcurrent Relay Coordination (Tutorial), Introduction to Distance Relaying, Setting of Distance Relays, Differential Protection of Bus, Transformer and Generator, Introduction to wide area measurement (WAM).

Textbooks / References
Course Objective
• To impart knowledge on high voltage generation, measurement, and testing.

Course Outcomes
CO1: Formulate uniform and non-uniform electric field scenarios in different geometric boundaries.
CO2: Analyze the breakdown behavior of gas, liquid, and solid dielectric materials.
CO3: Familiarize with non-destructive test techniques for measuring dielectric properties.
CO4: Comprehend power apparatus testing as per standards and procedures for high voltage applications.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
</tr>
</tbody>
</table>

Syllabus

Unit 1
Introduction: different types of dielectrics, uniform and non-uniform electric field, electric field in some geometric boundaries.
Conduction and breakdown in gases: Collision process, ionization process, Townsend’s theory, streamer theory, Pashen’s law, breakdown in non-uniform fields and corona discharges- Vacuum insulation.
Conduction and breakdown in liquid dielectrics; Classification of liquid dielectrics, breakdown in liquid dielectric.
Different types of solid dielectric materials-breakdown in solid dielectrics-field configuration in the presence of voids.
Breakdown in composite dielectric.

Unit 2
Generation of high voltages- ac voltages, dc voltages, impulse voltages. Generation of impulse currents.
Measurement of high voltages and currents – High DC, AC and impulse voltages, Direct, Alternating and Impulse currents.

Unit 3
Non-destructive insulation test techniques, measurement of insulation resistance under dc voltage, measurement of loss angle and capacitance, partial discharge measurement.
Testing of high voltage apparatus based in International and Indian standards-non-destructive testing-testing of insulators- bushings-cables-isolators and circuit breakers-transformers-surge arresters.

Textbooks / References
Course Objective

- To equip students with the knowledge and skills necessary to design efficient, reliable, and cost-effective machines using modern computer-aided design and analysis tools.

Course Outcomes

CO1: Understand the basic design concepts of electrical machines.

CO2: Develop comprehensive design of DC and AC machines.

CO3: Formulate design problem based on the performance requirement of electrical machines.

CO4: Develop computer aided design of electrical machines.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Syllabus

Unit 1

Introduction to Computer aided machine design, different approaches of computer aided design, Advantages and Limitations of Computer aided machine design, Mathematical formulation of general machine design problem, review of different electrical machines for overall design and flow chart of the design problem, review of Programming techniques (LP & NLP only), Methods of solution, Unconstrained optimization problems, constrained optimization problems.

Unit 2

Optimization problems-constrained optimization problems, Selection of variables for optimal design, Formulation of design equations- Objective function; Constraint functions, Algorithms for optimal design. Design of armature, Windings and field systems of DC machines – Programming techniques (LP & NLP only), Methods of solution, Unconstrained.

Unit 3

Optimal design of power transformer: Design of magnetic circuit, Design of windings, Selection of variables for optimal design, Formulation of design equations, Objective function, Constraint functions, Algorithms for optimal design. Optimal design for 3-phase alternator: Design of stator, windings, field system, selection of variables for optimal design, Algorithms for optimal design.


Textbooks / References

Course Objective

- To impart knowledge on EHVAC and HVDC transmission systems

Course Outcomes

CO1: Familiarize with the AC and DC transmission systems.
CO2: Understand EHVAC transmission system and reactive power compensation.
CO3: Analyse converter control of HVDC transmission systems.
CO4: Examine various faults and protection schemes in HVDC systems.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Syllabus

Unit 1
Comparison of EHV AC and DC transmission, modern trends in AC and DC transmission, Corona and corona loss in transmission lines.
EHV AC Systems: Limitations of extra-long AC transmission, Voltage profile and voltage gradient of conductor, Electrostatic field of transmission line, Reactive Power planning and control, traveling and standing waves, EHV cable transmission system.
Reactive VAR requirements, Static VAR systems, design concepts and analysis for system dynamic performance.

Unit 2
Introduction of HVDC power transmission technology, Analysis and Control of HVDC converter and systems: Necessity of control of a DC link, rectifier control, compounding of rectifiers, power reversal of DC link, voltage dependent current order limit (VDCOL) characteristics of the converter, inverter extinction angle control, pulse phase control, starting and stopping of DC link, constant power control.

Unit 3
Harmonics and filters: Generation of harmonics by converters, characteristic variation of harmonic currents with variation of firing angle and overlap angle.
Fault and protection schemes in HVDC systems: Nature and types of faults, faults on AC side of the converter stations, converter faults, fault on DC side of the systems, protection against over currents and over voltages, protection of filter units.

Textbooks / References

Prerequisites: Power Electronics/ Power Electronics & Drives.

Course Objective
- To introduce the concepts and design of converters, feedback controllers, protection circuits, driver circuits and magnetic elements for switched mode power supply applications.

Course Outcomes

CO1: Understand the principles of steady state and dynamic operation of isolated and non-isolated converters and various control techniques of power supplies.

CO2: Analyse the operation of isolated and non-isolated switch mode converters and resonant converter.

CO3: Evaluate the performance of isolated and non-isolated switch mode converters and control schemes, and resonant converters.

CO4: Design converters, controller, protection, driver circuits and high frequency magnetic elements for SMPS.

CO5: Validate isolated and non-isolated switch mode converters, various control schemes, protection, driver circuits and high frequency magnetic elements for SMPS using simulation and hardware.

CO-PO Mapping

<table>
<thead>
<tr>
<th>CO-PO Mapping</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>PO/PSO</td>
</tr>
<tr>
<td>---------------</td>
</tr>
<tr>
<td>CO1</td>
</tr>
<tr>
<td>CO2</td>
</tr>
<tr>
<td>CO3</td>
</tr>
<tr>
<td>CO4</td>
</tr>
<tr>
<td>CO5</td>
</tr>
</tbody>
</table>

Syllabus

Unit 1
DC-DC Switched Mode Converters: Operating principles, Steady state analysis for continuous and discontinuous current operations, Performance calculations of Boost converter, Buck-boost converter, Cuk converter, SEPIC and Interleaved Converters, Comparison of DC-DC converters.

Unit 2
Switched Mode DC Power Supplies: Overview of linear and switched mode power supplies, Isolated converters: Flyback converter, Forward converter, Push pull converter, Half bridge converter & Full bridge converter.

Unit 3
Design of snubbers, drive circuits, design of high frequency inductors and transformers, Voltage feed forward - PWM control and current mode control, Feedback compensators and design, unity power factor rectifiers.

Introduction to resonant converters – classification of resonant converters – Basic resonant circuit concepts. Zero current and Zero voltage switching, introduction to ZVT.

Textbooks / References
Course Objective

- To familiarize with energy audit by identifying energy conservation and management opportunities in various sectors.

Course Outcomes

CO1: Understand energy scenario and policies of India and World in the past, present and future.

CO2: Estimate energy efficiency in electrical appliances and thermal systems.

CO3: Evaluate techno-economic feasibility of various energy management techniques in domestic, commercial, and industrial sectors.

CO4: Analyze energy audit observations.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-</td>
</tr>
</tbody>
</table>

Syllabus

Unit 1


Unit 2


Unit 3

Energy Audit: Definition, need, functions and methodologies of preliminary as well as detailed energy audits; Pre-audit, audit and post-audit measures, Benchmarking, optimizing the input energy requirements, fuel and energy substitution, Instruments for energy audit, Energy Service Companies (ESCOs), Energy Conservation Practice – Case Studies. Overview of Blockchain Technology, Renewable energy large capacity grid support using batteries.

Textbooks / References

Pre-requisite: Microcontrollers & Applications.

Course Objective
- Introduction to robotics, control of manipulators and mobile robots.

Course Outcomes
CO1: Understanding building blocks of robots.
CO2: Learning on kinematic and inverse kinematic models of manipulators.
CO3: Exposure to systems and navigation of wheeled mobile robots.
CO4: Exposure to applications of robotics.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Syllabus

Unit 1
Recent Trends in Robotics: Stand-alone and Networked Robots, ROS, MATLAB Robotics Toolbox.

Unit 2

Unit 3
Mobile Robots: Anatomy, Mobility, Types based on mobility mechanisms. Navigation: Mapping, Localization, Path planning
Case Study: Autonomous robots, Swarm robots, Collaborative robots, Applications of robotics.

Textbooks/ References
Pre-requisite: Microcontrollers and Applications

Course Objective

- To acquire in-depth knowledge of advanced microcontrollers with equal emphasis on hardware and software, to design and develop state-of-the-art embedded applications.

Course Outcomes

CO1: Understand the architecture and functional modules of advanced microcontrollers.
CO2: Ability to program dsPIC/MSP430 microcontrollers in assembly language and C.
CO3: Learn and program various peripherals of dsPIC/MSP430 microcontrollers.
CO4: Implement dsPIC/MSP430 based system for various real-world applications.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>CO1</th>
<th>CO2</th>
<th>CO3</th>
<th>CO4</th>
</tr>
</thead>
<tbody>
<tr>
<td>PO1</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>PO2</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>PO3</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>PO4</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>PO5</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PO6</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PO7</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PO8</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PO9</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PO10</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PO11</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PO12</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PSO1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>PSO2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>PSO3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Syllabus

Unit 1

Unit 2

Unit 3
MSP430 microcontrollers and peripherals: MSP430F2274- MSP430X22X2 device pin out, DA Package, Functional block diagram description, Inputs, Outputs, Timers, ADC.

Textbooks/References

5. B. Venkat Ramani and Bhaskar, “Digital Signal Processory”.


Course objective

- To familiarise about digital signal processors and implement signal processing algorithms for real time applications.

Course Outcomes

CO1: Understand the architecture of Digital Signal Processors (DSPs).
CO2: Analyse instruction set and addressing modes of DSPs.
CO3: Implement basic signal processing operations.
CO4: Develop real time signal processing applications.

### CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

### Syllabus

#### Unit 1


#### Unit 2


#### Unit 3

Blackfin Processor: Blackfin 5xx DSP – Architecture- Instruction set – Addressing modes.

### Textbooks / References


### Pre-requisites:

Control systems, Microcontrollers and applications.

### Course Objective

- To understand UAVs with focus on quadcopters from system perspective and the subsystems involved.

### Course Outcomes

CO1: To develop specialist knowledge and to understand the dynamics of Unmanned Air Vehicle (UAV) systems.
CO2: To understand the design and working principle of Drones.
CO3: To enable the students to identify sensors, actuators, and the control structure of Drones.
CO4: To enable students to develop real world applications and case studies using Drones.

### CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
Syllabus

Unit 1
Overview of UAV systems, Classes and Missions of UAVs, Definitions and Terminology, UAV fundamentals, Examples of UAV systems – very small, small, Medium and Large UAV. Air Vehicle Basic Aerodynamics: Basic Aerodynamics equations, Aerodynamics control, pitch control, lateral control.

Unit 2

Unit 3

Textbooks / References
1. Introduction to UAV Systems-Paul Gerin Fahlstrom, Thomas James Gleason, John Wiley Publications.
Pre-requisite: Digital System Design.

Course Objective
- To provide understanding of digital system design using FPGA.

Course Outcomes
CO1: Understand the complex digital logic circuits and its design issues.
CO2: Model, simulate, and synthesize and analyse digital system.
CO3: Design of sequential circuits and FSM.
CO4: Implement digital circuits on FPGA.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>3</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

Syllabus

Unit 1

Unit 2

Unit 3
Digital FPGA’s – Introduction, Logic Block Architecture, Routing Architecture, Programmable Interconnections, Design Flow, Xilinx/Altera FPGA, Boundary Scan, Programming FPGA’s – Constraint Editor, Static Timing Analysis, Hardware-software co-simulation, Debugging FPGA Design, Chipscope Pro, Case Study.

Textbooks / References
Course Objective
- To understand various control architecture and its communication employed for industrial automation.

Course Outcomes
CO1: Illustrate the architecture of automation system for industrial processes.
CO2: Understand the operating principles of various sensors used in the controlled process.
CO3: Comprehend the role of controller and PLC in industrial automation.
CO4: Apply suitable communication systems for automation.
CO5: Identify suitable electric drives for an industrial application.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>-</td>
</tr>
</tbody>
</table>

Syllabus

Unit 1
Introduction to industrial automation and control architecture of industrial automation system, measurement systems specifications, Sensors and transducers, Data acquisition, signals conditioning. Introduction to process control, PID control, controller tuning method, implementation of PID controllers, feed forward and ratio control, special control structures: predictive control, control of systems with inverse response.

Unit 2
Programmable logic control systems: introduction to sequence or logic control and programmable logic controllers, the software environment and programming of PLCs, formal modelling of sequence control specifications. Programming, programming of PLCs: sequential function charts, the PLC hardware environment. Principles of interface, serial interface and its standards, Parallel interfaces, and buses. Fieldbus: Use of fieldbuses in industrial plants, functions, international standards, performance, use of Ethernet networks, fieldbus advantages and disadvantages, Fieldbus design, installation, brief introduction to types of communication protocols: HART & MODBUS.

Unit 3

Textbooks / References
7. Liuping Wang, “PID and Predictive Control of Electric Drives and Power Supplies Using MATLAB / Simulink”.

Pre-requisite: Microcontrollers & Applications.

Course Objective
- To study WSN protocols and implementation aspects for networked applications.

Course Outcomes
CO1: Understand Adhoc networks and their applications.
CO2: Comprehend protocols of wireless sensor networks.
CO3: Identify node architecture in wireless sensor networks.
CO4: Design applications using wireless sensor networks.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

Syllabus

Unit 1

Unit 2

Unit 3
Sensor node: Architecture, Components, Design Challenges – Real life deployment of WSN. Case study: Real world applications – Agriculture/ Home automation/ Smart City/ Health care/ Smart Grid/ Smart Transportation/ Wildlife monitoring/ Forest fire monitoring/ Weather monitoring.

Textbooks / References
Pre-requisites: Sensors and Sensor Circuit Design/Electrical Measurements.

Course Objective
- To introduce the concept of signals, its acquisition, conditioning and imaging techniques used in bio-medical instrumentation.

Course Outcomes
CO1: Understand the basics of bio-medical signals and sensors.
CO2: Apply the concepts of sensors and transducers for acquiring bio-signals and related signal conditioning circuits.
CO3: Familiarize the therapeutic and diagnostic methods used in bio-medical instrumentation systems.
CO4: Comprehend the modern methods of imaging techniques used for bio-medical applications.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>2</td>
</tr>
</tbody>
</table>

Syllabus

Unit 1

Unit 2

Unit 3

Textbooks / References
Pre-requisite: Control Systems.

Course Objective

- To introduce the basics of linear and nonlinear control systems in state space framework.

Course Outcomes

CO1: Understand the concept of state space, dynamics of nonlinear system and adaptive control.

CO2: Model linear and nonlinear systems in state space framework.

CO3: Examine the characteristics of non-linear systems.

CO4: Analyze the stability of non-linear systems.

CO5: Design state feedback controller and state observers.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Syllabus

Unit 1
State space modelling: Introduction, concept of state, state variables and state model, state modeling of linear systems, linearization of state equations. State space representation using physical variables, phase variables & canonical variables.

Unit 2
State space analysis: Derivation of transfer function from state model, Eigen values, Eigen vectors, generalized Eigen vectors. Solution of state equation, state transition matrix and its properties, computation using Laplace transformation, power series method, Cayley-Hamilton method, concept of controllability & observability, methods of determining the same.

Unit 3
State space design- Pole placement technique: stability improvements by state feedback, necessary and sufficient conditions for arbitrary pole placement, state regulator design, and design of state observer, Controllers- P, PI, PID. Non-linear systems: Introduction, behavior of non-linear system, common physical non linearity-saturation, friction, backlash, dead zone, relay, multi- variable non-linearity. Phase plane method, singular points, stability of nonlinear system, limit cycles, Liapunov stability criteria. Introduction to adaptive and optimal control techniques. State space modelling, design and analysis of advanced controllers using Simulation /Online platforms.

Textbooks / References
Pre-requisite: Control Systems.

Course objective
- To characterize the discrete-time system in both time and frequency domains and design digital controllers.

Course Outcomes
CO1: Understand the concepts of sampling and Z-transform.
CO2: Solve the pulse transfer function of discrete time systems.
CO3: Analyze the behavior and stability of discrete time systems in Z-plane.
CO4: Develop lag-lead compensators in closed loop systems for the desired time/frequency response.
CO5: Design digital state-feedback controllers and state-observers.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Syllabus

Unit 1

Unit 2
Stability analysis of closed loop systems in the z-plane: root loci, frequency domain analysis, Stability tests. Discrete equivalents. Digital controller design for SISO systems: design based on root locus method in the z-plane, design based on frequency response method, design of compensators, design of PID Controller.

Unit 3

Textbooks / References
Pre-requisite: Control Systems.

Course Objective
- To model and design controllers for process control systems.

Course Outcomes
CO1: Understand the feedback and feedforward controllers.
CO2: Develop transfer function and state-space models of linear processes.
CO3: Design single loop and multi loop controllers.
CO4: Outline the automation in process control.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Syllabus

Unit 1

Unit 2

Unit 3

Textbooks / References

Course Objective
- To impart knowledge on electric drives, energy storage, energy management and vehicular communication in electric vehicles.

Course Outcomes
CO1: Familiarize with electric vehicles, drives, energy storage, and energy management systems.
CO2: Apply electric drive concepts in electric vehicles.
CO3: Develop charging and regeneration systems.
CO4: Design electric drive systems with different topologies.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Syllabus

Unit 1
Introduction to Electric Vehicles, System Engineering and Simulation. Overview of electric vehicles, including the history of EV, EV Components, Performance specifications and basic design concepts, Benefits and limitation of EV as compared with IC Engine based Vehicles. The basics of system engineering, definition, and principles of system engineering, system requirement specification, simulation techniques, and its application in EV design and validation Various forces acting on the moving vehicle (Rolling resistance force, Aerodynamic drag force, Acceleration force, Climbing force, etc.), Vehicle motion equations, Longitudinal vehicle dynamics modelling and simulation, EV component sizing, Drive cycle analysis.

Unit 2
Basics of Electro Chemistry, working principle of Li-ion cell, Electrode potential, Gibbs free energy, Nernst Equation, materials for electrodes, electrolyte, separator, current collector. Battery cell performance parameters, performance comparison for different cell chemistries Different form factors for Li-ion battery cell, battery pack sizing, Modularized design of battery pack. Battery management system, Basic BMS hardware features Sensors and its interface with BMS hardware, Communication protocols. RC equivalent circuit model for Li-ion cell. Cell characteristics, Offline methods for cell parameter identifications. BMS Functions: SoC and SoH estimation, Cell balancing techniques. Battery safety, thermal management of batteries, advanced battery technologies. Fuel Cell based energy storage and its analysis, Hybridization of different energy storage devices. Battery Chargers- Basic requirements for charging systems, Classification of Charging Architectures, Charging Controls, Current Regulations, charging standards and technologies.

Unit 3
3 Phase traction inverter topologies, overview of inverter h/w design and various h/w components, SPWM and SVPWM technique’s for switching, Comparison of switching strategies, modulation index and output voltage, over modulation techniques, Harmonics and switching losses considerations, Harmonics and switching losses considerations. Overview of Electrical machines used for EV applications. Importance of PMSM machines, working principle, factors influencing torque production SPM and IPM machines. Concept of reluctance torque, D-q axis model for PMSM machines, concept of rotor reference frame and its usage in simplifying control analysis. Steady state voltage and torque equations for PMSM machines. Clarke and Park transformations. Control schemes in Constant torque and constant power region. Flux weakening and MTPA Control strategy for PMSM machines. The
integration of electric vehicle systems, including powertrain, Battery and regenerative braking systems and overall control systems. Performance analysis under different drive cycles. Simulation study for overall vehicle systems.

Textbooks / References
Pre-requisites: Electrical machines, Power electronics & Drives

Course Objective
- To impart knowledge on electric drives, energy storage and energy management in electric vehicles with special reference to big data analytics and communication networks.

Course Outcomes
CO1: Understand the electric vehicles architecture, vehicle propulsion system and vehicular communication protocols.

CO2: Apply the concepts of electric drives, energy storage and communication in xEV.

CO3: Demonstrate big data analytics in vehicular network control.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

Syllabus

Unit 1

Unit 2

Unit 3

Textbook / References
Pre-requisite: Control Systems.

Course Objective
- To impart knowledge on modeling and analysis of vehicle dynamics and design controllers for automotive systems.

Course Outcomes
CO1: Understand vehicle dynamics and road-driver models.
CO2: Diagnose vehicle faults using fault models.
CO3: Analyze the ABS control systems.
CO4: Develop a complete driver model with path, road surface and wind strength.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Syllabus

Unit 1

Unit 2

Unit 3
Road and Driver Models: Road Model- Requirements of The Road Model, Definition of the Course Path, Road Surface and Wind Strength; PID Driver Model; Hybrid Driver Model – Vehicle Control Tasks, Characteristics of Human as a Controller, Information Handling, Complete Driver Model.

Textbooks/References
Pre-requisite: Control Systems.

Course Objective
- To understand the concept of vehicle dynamics and analyze the parameters for adaptive vehicular control

Course Outcomes
CO1: Understand concepts in vehicle dynamics and control.
CO2: Illustrate control system architecture and adaptive vehicular control.
CO3: Design and develop controllers for braking system in Electric vehicle.
CO4: Analyze the electronic stability control in Electric Vehicles.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

Syllabus

Unit 1

Unit 2

Unit 3

Textbooks / References
Pre-requisites: Circuits Analysis and Control Systems.

Course Objective

• To introduce the electrical, electronics and communication networks and components used in Electric Vehicles

Course Outcomes

CO1: Understand the basic principles of electronic systems, power train control systems, electrical and communication systems in electric vehicles.

CO2: Analyze the performance of various control systems, engine management and electrical networks and components in electric vehicles.

CO3: Design electronic systems, power train, engine management, battery, and communication systems for electric vehicles.

CO-PO Mapping

<table>
<thead>
<tr>
<th>CO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Syllabus

Unit 1
Introduction to Electronic systems in Automotives – Sensors and Actuators for body electronics, power train and chassis systems. Body electronics domain- Automotive alarms, Lighting, Central locking and electric windows, Climatic Control, Driver information, Parking, etc.

Unit 2
Power train and chassis control domain – Engine management, Transmission control, ABS, ESP, Traction Control, Active Suspension, passive safety, Adaptive Cruise Control, etc. Hardware implementation example of simple automotive systems using Sensors, Controller, Actuators etc.

Unit 3

Textbooks / References

Pre-requisites: Electrical machines and Power Electronics

Course Objective
- To impart knowledge on various electrical machines used in electric vehicles, its operation, control and design.

Course Outcomes
CO1: Understand the principle of various electrical machines used in electric vehicles.
CO2: Apply the concept of power electronic converters and its control for electrical machines used in electric vehicles.
CO3: Analyse the performance of various electric drive systems suitable for electric vehicles.
CO4: Design various electrical machines used in electric vehicles.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

Syllabus

Unit 1
Introduction to Motor Drive technology, DC Motor Drives – Converter, Control, Design Criteria and Examples for EV, Induction Motor Drives – Converter (PWM, Soft-switching), Control (VVVF, FOC, DTC), Design Criteria and Examples for EV, Permanent Magnet Brushless Motor Drives – Inverter requirements, Control (PMSM, Brushless DC), Design Criteria and Examples (Planetary geared for PMSM, Outer rotor for Brushless DC).

Unit 2
Switched Reluctance Motor Drives – Converter topologies, Control, Design Criteria and Examples.

Unit 3
Finite Element Analysis: Induction Motor, PMSM.

Textbooks / References
Pre-requisites: C/Python, Microcontrollers & Applications.

Course Objective
- To gain knowledge on different systems and strategies of autonomous vehicles.

Course Outcomes
CO1: Familiarize the various electronic systems in autonomous vehicles.
CO2: Illustrate different sensor systems in autonomous mobility.
CO3: Understand communication networks in autonomous vehicles.
CO4: Comprehend operations and real-world applications in autonomous driving.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Syllabus

Unit 1

Unit 2

Unit 3

Textbooks / References
Pre-requisites: Basics of Electrical Engineering (or equivalent subject), Control System, Circuit Network, Chemistry, Physics.

Course Objective
- Introduce batteries, their parameters, modelling, charging requirements and battery management system.

Course Outcomes
CO1: Understand the principle of battery and battery management system.
CO2: Interpret the concept associated with battery charging / discharging process.
CO3: Familiarize various cell balancing techniques and parameter estimation.
CO4: Design battery model for real-time applications.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>CO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

Syllabus

Unit 1
Batteries-Working principle of battery, primary and secondary (flow) batteries, battery performance evaluation methods. Introduction to Battery Management System, Cells & Batteries, Nominal voltage and capacity, C rate, Energy and power, Cells connected in series, Cells connected in parallel, Electrochemical and lithium-ion cells, Rechargeable cell, Charging and Discharging Process, Overcharge and Undercharge, Modes of Charging

Unit 2
Introduction and BMS functionality, Battery pack topology, BMS Functionality, Voltage Sensing, Temperature Sensing, Current Sensing, BMS Functionality, High-voltage contactor control, Isolation sensing, Thermal control, Protection, Communication Interface, Range estimation, State-of-charge estimation, Cell total energy and cell total power. Battery state of charge estimation (SOC), voltage-based methods to estimate SOC, Model-based state estimation, Battery Health Estimation, Lithium-ion aging: Negative electrode, Lithium-ion aging: Positive electrode, Cell Balancing, Causes of imbalance, Circuits for balancing

Unit 3
Equivalent-circuit models (ECMs), Physics-based models (PBM), Empirical modelling approach, Physics-based modelling approach, Simulating an electric vehicle, Vehicle range calculations, Case study- battery packs. Design principles of battery BMS, Battery dynamics based on life and BMS, energy balancing with multi-battery system.

Textbooks / References
Pre-requisites: Electrical machines and Signal processing.

Course Objective
- To impart knowledge on condition monitoring of electrical machines through theoretical and practical approach using finite element analysis, signal processing and artificial intelligence.

Course Outcomes
CO1: Understand the occurrence of various faults and their causes in electrical machines.
CO2: Modelling of faults in electrical machines.
CO3: Analyze the faults using finite element and various signal-processing approaches.
CO4: Apply artificial intelligence techniques for fault diagnosis.

CO-PO Mapping

<table>
<thead>
<tr>
<th>CO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Syllabus

Unit 1

Unit 2

Unit 3
Application of pattern recognition to fault diagnosis, Digital signal processing requirements for fault diagnosis, Application of artificial intelligence techniques for fault diagnosis.

Textbooks / References
Course Objective

- To study the techniques of filtering, feature extraction and other methods for processing images in different domains.

Course Outcomes

CO1: Understand the 2D images.
CO2: Comprehend basic image processing operations.
CO3: Apply filters to images in spatial and frequency domain.
CO4: Analyze different image segmentation techniques.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Syllabus

Unit 1

Unit 2

Unit 3

Textbooks / References

Course Objective

- To study handling of big data using large scale data storage technologies and streaming platforms.

Course Outcomes

CO1: Understand the core concepts of big data problems.
CO2: Comprehend the big data storage frameworks.
CO3: Apply big data analytics using Hadoop and Spark.
CO4: Analyse modern tools and applications for real world scenarios.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>CO1</th>
<th>CO2</th>
<th>CO3</th>
<th>CO4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>PO1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PO2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PO3</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>PO4</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>PO5</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>PO6</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PO7</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PO8</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PO9</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PO10</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>PO11</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PO12</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PSO1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>PSO2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>PSO3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Syllabus
Unit 1
Introduction to big data, Challenges with Big data, Big data enabling technologies, Hadoop stack for big data, RDBMS vs Hadoop, hadoop distributed file system (HDFS), Hadoop MapReduce 1.0, Hadoop MapReduce 2.0 (Part-I), YARN architecture, MapReduce Examples, Parallel Programming with spark, Introduction to Spark, Spark Built-in-Libraries, Design of Key-Value Stores, Pig on Hadoop.

Unit 2

Unit 3
Decision Trees for Big Data Analytics, Big Data Predictive Analytics, Parameter Servers, Page Rank Algorithm in Big Data, Spark GraphX and Graph Analytics, Case study.

Textbooks /References

Pre-requisite: Computer Programming I.

Course Objective
- To understand the basics of cloud computing technology and services.

Course Outcomes
CO1: Understand basic concepts of cloud computing.
CO2: Familiarize the architecture of cloud services and deployment.
CO3: Apply virtualization techniques in cloud.
CO4: Analyse cloud applications, security and privacy.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>CO1</th>
<th>CO2</th>
<th>CO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>3</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>PO1</td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>PO2</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PO3</td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>PO4</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>PO5</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>PO6</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>PO7</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>PO8</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>PO9</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>PO10</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>PO11</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>PO12</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>PSO1</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>PSO2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>PSO3</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>
Syllabus

Unit 1
Introduction to cloud computing: Evolution of cloud computing, Definition of cloud computing, NIST reference model, Service delivery model, Deployment models, Benefits and challenges of cloud adoption, Introduction to popular cloud platforms,

Unit 2

Unit 3

Textbook

23ELC364 DEEP LEARNING L-T-P-C: 3-0-0-3

Pre-requisite: Machine Learning.

Course Objective
• To study deep learning concepts and apply them to real-world applications.

Course Outcomes
CO1: Understand architecture and working of Convolutional Neural network.
CO2: Analyze the performance of different pretrained deep networks on latest software platforms.
CO3: Comprehend parameter tuning, regularization, training, and error optimization.
CO4: Familiarize with deep learning models with memory elements.

CO-PO Mapping

Syllabus

Unit 1
Neural Networks Review: Feed forward network, Gradient Descent based Back propagation algorithm.
Convolutional Neural Networks (CNN). Different layers and functionalities, data augmentation. Cost function, Training, parameters and hyper-parameters. Regularization, Vanishing Gradient, learning algorithms.

**Unit 2**
Pre-trained models AlexNet, VGGNet GoogleNet, ResNet and transfer Learning. YOLO. HuggingFace. Different applications, latest pre-trained models can be undertaken in TensorFlow/Pytorch across the Units.

**Unit 3**
Introduction to different data including images, NLP, videos. Models with memory elements and their variants: Recurrent Neural Networks (RNN), LSTM. Autoencoders, transformers.

**Reference/Textbook**

---

**23ELC365 BLOCKCHAIN TECHNOLOGY L-T-P-C: 3-0-0-3**

**Course Objective**
- To understand the fundamentals of crypto currency and application of blockchain in implementing crypto currency.

**Course Outcomes**
CO1: Understand the concepts of crypto currency, blockchain, and distributed ledger technologies.
CO2: Comprehend the application and impact of blockchain technology in the financial and other industries.
CO3: Evaluate security issues relating to blockchain and crypto currency.
CO4: Design and analyse the impact of blockchain technology.

**CO-PO Mapping**

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>CO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

**Syllabus**

**Unit 1**
The story of a transaction: From Transactions to Blocks – Blocks and Distributed Consensus – Basic interaction with a Bitcoin node. Keys and Addresses: Basic cryptography – From private keys to addresses. The Bitcoin Script language: Introduction to the Bitcoin Script language – Script writing and execution – Tools and libraries to access Bitcoin’s API and scripting capabilities.

**Unit 2**
Unit 3
Comparing Bitcoin and Ethereum – Historical comparison – Conceptual distinction between a payment system and a
decentralized applications platform - Differences in their architectures from security-first aspect to a rich feature set -
Future roadmap for them, following their own paths with probable interconnections. Contract code walk-through:
Demonstration of smart contract – Introduction to Solidity – Contract lifecycle – Solidity Building blocks – Popular
contracts already in deployment.

Textbooks / References
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder, “Bitcoin and
3. William Mougayar, “The Business Blockchain: Promise, Practice, and Application of the Next Internet
## Pre-requisite

Computer Programming I.

## Course Objective

- To understand the relevance and potential of computer security for ever increasing number of applications.

## Course Outcomes

**CO1:** Understand and apply the fundamental concepts of computer security to different components of computing systems.

**CO2:** Identify the basic cryptographic techniques using existing software in information security.

**CO3:** Describe malicious attacks, threats, and protocols for security vulnerabilities and its impact on a systems infrastructure.

## CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

## Syllabus

### Unit 1


### Unit 2


### Unit 3


## Textbooks / References


---

## Pre-requisite

Calculus, Linear Algebra, Probability and Random processes.

## Course Objective

- To study the phonological, morphological and syntactic processing. These areas will be approached from linguistic and algorithmic perspective. Also focusses on the computational properties of natural languages and algorithms used to process them, and match between grammar formalisms and linguistic data that needs to be covered.
Course Outcomes

CO1: Understand the models, methods, and algorithms of statistical Natural Language Processing (NLP) for common NLP tasks.

CO2: Comprehend mathematical and statistical models for NLP.

CO3: Illustrate linguistic phenomena and linguistic features relevant to each NLP task.

CO4: Develop probabilistic models in code.

CO5: Apply learning models to NLP tasks such as speech recognition, machine translation, spam filtering, text classification, and spell checking.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

Syllabus

Unit 1
Introduction- Human languages, models, ambiguity, processing paradigms; Phases in natural language processing, applications. Text representation in computers, encoding schemes. Linguistics resources- Introduction to corpus, elements in balanced corpus, TreeBank, PropBank, WordNet, VerbNet etc. Resource management with XML, Management of linguistic data with the help of GATE, NLTK. Regular expressions, Finite State Automata, word recognition, lexicon. Morphology, acquisition models, Finite State Transducer, N-grams, smoothing, entropy, HMM, ME, SVM, CRF.

Unit 2

Unit 3

Textbooks / References
Course Objective
- Introduce the concept of green IT, environmental perspectives on IT use, standards and certifications related to sustainable IT products for sustainable development with environmental perceptive.

Course Outcomes
CO1: Understand the concepts of technologies that conform to low-power computation.
CO2: Comprehend green (power-efficient) technologies for components of one single computer, such as CPU, memory and disk and appreciate cutting edge designs for these components.
CO3: Describe variety of technologies applied in building a green system and to identify the various key sustainability and green IT trends.
CO4: Illustrate various laws, standards and protocols for regulating green IT.
CO5: Apply range of tools to monitor and design green systems.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO3</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>CO4</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>CO5</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>-</td>
</tr>
</tbody>
</table>

Syllabus

Unit 1

Unit 2
Virtualizing of IT systems – Role of electric utilities, Telecommuting, teleconferencing and teleporting – Materials recycling – Best ways for Green PC – Green Data center – Green Grid framework. Applying Computing towards Sustainability, Smart Buildings and the Smart Grid, sensing, modeling and controlling the energy usage of buildings, as well as new operating systems and software stacks for the smart infrastructure.

Unit 3

Textbooks / References
Course Objective

- To classify the problem around us as optimization or modelling or simulation problems and solve using evolutionary algorithms.

Course Outcomes

CO1: Understand the structure, components and adaptive parameter settings of evolutionary algorithms.

CO2: Design hybrid, multi-objective, interactive evolutionary algorithms for static/dynamic and constrained/unconstrained optimization problems.

CO3: Apply algorithms for evolutionary learning and neuroevolution strategies.

CO4: Analyze the performance of evolutionary algorithms for given toy and real-world problems.

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</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>
<td></td>
</tr>
<tr>
<td>CO4</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>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Syllabus

Unit 1

Type of Problems - Introduction to Evolutionary Computation – Evolutionary Algorithms (EAs) – Different components of EAs– population representation techniques, mutation and crossover techniques, population management models, parent and survivor selection, fitness, fitness landscape, fitness sharing and crowding – Summary of popular variant of EAs.

Unit 2

Parameter of EAs – parameter control and parameter tuning, Working with EAs – Performance metrics and test problems. Hybridizing EAs – memetic algorithms, Nonstationary and Noisy optimization, Multi-objective EAs – Constraint handling – Interactive EAs.

Unit 3

Special forms of evolution – co-evolution and speciation, ensemble EAs, evolutionary learning, neuroevolution, design and analysis of EAs – design of experiments, empirical and statistical comparison of EAs, applications of EAs – toy problems (viz., eight-queen problem and knapsack problem) and real-world problems.

Textbooks / References

Courses offered under the framework of
Amrita Values Programmes I and II

22AVP201 Message from Amma’s Life for the Modern World

Amma’s messages can be put to action in our life through pragmatism and attuning of our thought process in a positive and creative manner. Every single word Amma speaks and the guidance received in on matters which we consider as trivial are rich in content and touches the very inner being of our personality. Life gets enriched by Amma’s guidance and She teaches us the art of exemplary life skills where we become witness to all the happenings around us still keeping the balance of the mind.

22ADM211 Leadership from the Ramayana

Introduction to Ramayana, the first Epic in the world – Influence of Ramayana on Indian values and culture – Storyline of Ramayana – Study of leading characters in Ramayana – Influence of Ramayana outside India – Relevance of Ramayana for modern times.

22ADM201 Strategic Lessons from the Mahabharata

Introduction to Mahabharata, the largest Epic in the world – Influence of Mahabharata on Indian values and culture – Storyline of Mahabharata – Study of leading characters in Mahabharata – Kurukshetra War and its significance - Relevance of Mahabharata for modern times.

22AVP204 Lessons from the Upanishads

Introduction to the Upanishads: Sruti versus Smrti - Overview of the four Vedas and the ten Principal Upanishads - The central problems of the Upanishads – The Upanishads and Indian Culture – Relevance of Upanishads for modern times – A few Upanishad Personalities: Nachiketas, SatyakamaJabala, Aruni, Shvetaketu.

22AVP205 Message of the Bhagavad Gita


22AVP206 Life and Message of Swami Vivekananda

Brief Sketch of Swami Vivekananda’s Life – Meeting with Guru – Disciplining of Narendra - Travel across India - Inspiring Life incidents – Address at the Parliament of Religions – Travel in United States and Europe – Return and reception India – Message from Swamiji’s life.

22AVP207 Life and Teachings of Spiritual Masters India

Sri Rama, Sri Krishna, Sri Buddha, AdiShankaracharya, Sri Ramakrishna Paramahamsa, Swami Vivekananda, Sri RamanaMaharshi, Mata Amritanandamayi Devi.

22AVP208 Insights into Indian Arts and Literature

The aim of this course is to present the rich literature and culture of Ancient India and help students appreciate their deep influence on Indian Life - Vedic culture, primary source of Indian Culture – Brief introduction and appreciation of a few of the art forms of India - Arts, Music, Dance, Theatre.

22AVP209 Yoga and Meditation

The objective of the course is to provide practical training in YOGA ASANAS with a sound theoretical base and theory classes on selected verses of Patanjali’s Yoga Sutra and Ashtanga Yoga. The coverage also includes the effect of yoga on integrated personality development.

22AVP210 Kerala Mural Art and Painting
Mural painting is an offshoot of the devotional tradition of Kerala. A mural is any piece of artwork painted or applied directly on a wall, ceiling or other large permanent surface. In the contemporary scenario Mural painting is not restricted to the permanent structures and are being done even on canvas. Kerala mural paintings are the frescos depicting mythology and legends, which are drawn on the walls of temples and churches in South India, principally in Kerala. Ancient temples, churches and places in Kerala, South India, display an abounding tradition of mural paintings mostly dating back between the 9th to 12th centuries when this form of art enjoyed Royal patronage. Learning Mural painting through the theory and practice workshop is the objective of this course.

22AVP213 Traditional Fine Arts of India

India is home to one of the most diverse Art forms world over. The underlying philosophy of Indian life is “Unity in Diversity” and it has led to the most diverse expressions of culture in India. Most art forms of India are an expression of devotion by the devotee towards the Lord and its influence in Indian life is very pervasive. This course will introduce students to the deeper philosophical basis of Indian Art forms and attempt to provide a practical demonstration of the continuing relevance of the Art.

22AVP214 Principles of Worship in India

Indian mode of worship is unique among the world civilizations. Nowhere in the world has the philosophical idea of reverence and worshipfulness for everything in this universe found universal acceptance as it in India. Indian religious life even today is a practical demonstration of the potential for realization of this profound truth. To see the all-pervading consciousness in everything, including animate and inanimate, and constituting society to realise this truth can be seen as the epitome of civilizational excellence. This course will discuss the principles and rationale behind different modes of worship prevalent in India.

22AVP215 Temple Mural Arts in Kerala

The traditional percussion ensembles in the Temples of Kerala have enthralled millions over the years. The splendor of our temples makes art enthusiast spellbound, warmth and grandeur of color combination sumptuousness of the outline, crowding of space by divine or heroic figures often with in vigorous movement are the characteristics of murals.

The mural painting specially area visual counterpart of myth, legend, gods, dirites, and demons of the theatrical world, Identical myths are popular the birth of Rama, the story of Bhīma and Hanuman, Shiva, as Kirata, and the Jealousy of Uma and ganga the mural painting in Kerala appear to be closely related to, and influenced by this theatrical activity the art historians on temple planes, wood carving and painting the architectural plane of the Kerala temples are built largely on the pan-Indians almost universal model of the Vasthupurusha.

22AVP218 Insights into Indian Classical Music

The course introduces the students into the various terminologies used in Indian musicology and their explanations, like Nadam, Sruti, Svaram – svara nomenclature, Stayi, Graha, Nyasa, Amsa, Thala-, Saptatalas and their angas, Shadangas, Vadi, Samavadi, Anuvadi. The course takes the students through Carnatic as well as Hindustani classical styles.

22AVP219 Insights into Traditional Indian Painting

The course introduces traditional Indian paintings in the light of ancient Indian wisdom in the fields of aesthetics, the Shadanga (Sixs limbs of Indian paintings) and the contextual stories from ancient texts from where the paintings originated. The course introduces the painting styles such as Madhubani, Kerala Mural, Pahari, Cheriyal, Rajput, Tanjore etc.

22AVP220 Insights into Indian Classical Dance

The course takes the students through the ancient Indian text on aesthetics the Natyasastra and its commentary the AbhinavaBharati. The course introduces various styles of Indian classical dance such as Bharatanatyam, Mohiniyatton, Kuchipudi, Odissy, Katak etc. The course takes the students through both contextual theory as well as practice time.
22AVP221 Indian Martial Arts and Self Defense

The course introduces the students to the ancient Indian system of self-defense and the combat through various martial art forms and focuses more on traditional Kerala’s traditional KalariPayattu. The course introduces the various exercise technique to make the body supple and flexible before going into the steps and techniques of the martial art. The advanced level of this course introduces the technique of weaponry.

PROFESSIONAL ELECTIVES UNDER SCIENCE STREAM

CHEMISTRY

23CHY240 COMPUTATIONAL CHEMISTRY AND MOLECULAR MODELLING L-T-P-C: 3-0-0-3

Course Outcomes:

CO1: Get to understand the structure of molecules using symmetry.
CO2: Understanding Quantum mechanical approach to calculate the energy of a system.
CO3: Applying mathematical knowledge and quantum mechanical approach in finding out the characteristics-reactivity, stability, etc., of the molecule.
CO4: To get a brief idea about molecular mechanics based chemical calculations.
CO5: To get an idea about general methodology of molecular modeling.

Syllabus

Unit

1
Introduction: Stability, symmetry, homogeneity and quantization as the requirements of natural changes - Born - Haber cycle – Energetic – kinetics - Principles of spectra.

Computational techniques: Introduction to molecular descriptors, computational chemistry problems involving iterative methods, matrix algebra, Curve fitting.


Introduction to Quantum mechanics - Schrodinger equation - Position and momentumMO formation - Operators and the Hamiltonian operator - The quantum oscillator Oscillator Eigen value problems - Quantum numbers - labeling of atomic electrons.

Unit 2
Molecular Symmetry: Elements of symmetry - Point groups - Determination of point groups of molecules.

Huckel’s MO theory: Approximate and exact solution of Schrodinger equation - Expectation value of energy - Huckel’s theory and the LCAO approximation - Homogeneous simultaneous equations - Secular matrix - Jacobi method - Eigen vectors: Matrix as operator - Huckel’s coefficient matrix - Wheeland’s method - Hoffmann’s EHT method - Chemical applications such as bond length, bond energy, charge density, dipole moment, Resonance energy.

Unit 3
Self consistent fields: Elements of secular matrix - Variational calculations - Semi empirical methods - PPP self consistent field calculation - Slater determinants - Hartree equation - Fock equation – Roothaan - Hall equation - Semi empirical models and approximations.

Ab-initio calculations: Gaussian implementations – Gamess - Thermodynamic functions - Koopman’s theorem - Isodesmic reactions, DFT for larger molecules - Computer aided assignments/mini projects with softwares - Introduction to HPC in Chemical calculations.
Molecular modelling software engineering - Modeling of molecules and processes
Signals and signal processing in Chemistry - QSAR studies and generation of molecular descriptors - Applications of chemical data mining - Familiarization with open source softwares useful for molecular modeling - Introduction to molecular simulation - M.D. simulation.

TEXTBOOKS:

REFERENCES:

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
Course Outcomes:

CO1: Understand the fundamental concepts of electrochemistry through electrode potential and reaction kinetics
CO2: Learn the application of the electrochemical principles for the functioning and fabrication of industrial batteries and fuel cells
CO3: Acquire knowledge in solving numerical problems on applied electrochemistry
CO4: Analysis and practical problem solving in fabrication of batteries and fuel cells
CO5: Application of concepts and principle in industrial electrochemical processes
CO6: Evaluation of comprehensive knowledge through problem solving

Syllabus

Unit 1

Background Theory: Origin of potential - electrical double layer - reversible electrode potential - standard hydrogen electrode - emf series - measurement of potential - reference electrodes (calomel and silver/silver chloride) indicator and ion selective electrodes - Nernst equation - irreversible processes - kinetic treatment - Butler-Volmer equation - Overpotential, activation, concentration and IR overpotential - its practical significance - Tafel equation and Tafel plots - exchange current density and transfer coefficients.

Unit 2

Batteries: Primary batteries: The chemistry, fabrication and performance aspects, packing classification and rating of the following batteries: (The materials taken their function and significance, reactions with equations, their performance in terms of discharge, capacity, and energy density to be dealt with). Zinc-carbon (Leclanche type), zinc alkaline (Duracell), zinc/air, zinc-silver oxide batteries; lithium primary cells - liquid cathode, solid cathode and polymer electrolyte types and lithium-ferrous sulphide cells (comparative account).

Unit 3

Secondary batteries: ARM (alkaline rechargeable manganese) cells, Lead acid and VRLA (valve regulated (sealed)lead acid), nickel-cadmium, nickel-zinc, nickel- metal hydride batteries, lithium ion batteries, ultra thin lithium polymer cells (comparative account). Advanced Batteries for electric vehicles, requirements of the battery - sodium-beta and redox batteries.

Electrochemical Processes: Principle, process description, operating conditions, process sequence and applications of Electroforming – production of waveguide and plated through hole (PTH) printed circuit boards by electrodeposition; Electroless plating of nickel, copper and gold; Electropolishing of metals; Anodizing of aluminium; Electrochemical machining of metals and alloys.

TEXTBOOKS:

REFERENCES:

**Evaluation Pattern**

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.*
Course Objectives:

To provide the basic knowledge about fuels, rocket propellants and explosives.

Course Outcomes:

CO1: Understand the types of fuels and variation in their properties
CO2: Able to analyze the fuel content
CO3: Obtain knowledge in identifying a proper fuel as per the requirement
CO4: Ability to know the preparation and working of propellants and explosives

Syllabus Unit

1

Fuels - Solid fuels - Classification, preparation, cleaning, analysis, ranking and properties - action of heat, oxidation, hydrogenation, carbonization, liquefaction and gasification.

Liquid fuels – Petroleum - origin, production, composition, classification, petroleum processing, properties, testing - flow test, smoke points, storage and handling.


2

Gaseous fuels - Types, natural gas, methane from coal mine, water gas, carrier gas, producer gas, flue gas, blast furnace gas, biomass gas, refinery gas, LPG - manufacture, cleaning, purification and analysis. Fuels for spark ignition engines, knocking and octane number, anti knock additives, fuels for compression, engines, octane number, fuels for jet engines and rockets.

Flue gas analysis by chromatography and sensor techniques.

3


Rocket propellants and Explosives - classification, brief methods of preparation, characteristics; storage and handling.

TEXTBOOK:


REFERENCES:


Evaluation Pattern
<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
Course Objectives:

1. Understand the principles of green chemistry and its contribution to the development of sustainable products
2. Possess knowledge of the migration from a hydrocarbon-based economy to carbohydrate-based economy
3. Evaluate the deficiencies of traditional process and acknowledge the invent of new processes
4. Distinctly map the culmination of academic research to industrial chemistry

Course Outcomes:

CO1: Understand the evolving concept of Green Chemistry and its application to the manufacture of sustainable products
CO2: Appreciate the need for Renewable energy and Feed stock along with carbon sequestration through the fundamentals of Green Chemistry Techniques
CO3: Develop a coherence to evaluate systematic deficiencies in traditional Chemical science process and products
CO4: Undertake a purposeful Journey through the microscopic domain of academic research to the macroscopic domain of Industrial chemistry

Syllabus Unit

Unit 1
Our environment and its protection, chemical pollution and environmental regulations, environmental chemistry, pollution prevention strategies, challenges to the sustainability of chemical industry, Pollution Prevention Act 1990, USA, Green Chemistry and its 12 principles, toxicity of chemicals, material safety data sheet (MSDS), concept of zero pollution technologies, atom economy, functional toxicity vs non-functional toxicity, alternative solvents, energy minimization, microwave and sonochemical reactions, renewable feed stock, carbon dioxide as a feed stock.

Unit 2
Greener strategies of the synthesis of ibuprofen synthesis, teriphtalic acid etc. phase behaviour and solvent attributes of supercritical CO2, use of supercritical carbon dioxide as a medium chemical industry, use of ionic liquids as a synthetic medium, gas expanded solvents, superheated water, etc. Synthesis of various chemicals from bio mass, polycarbonate synthesis and CO2 fixation, green plastics, green oxidations, etc.

Unit 3
Processes involving solid catalysts – zeolites, ion exchange resins, Nafion/silica nano composites and enhanced activity. Polymer supported reagents, green oxidations using TAML catalst, membrane reactors. Green chemistry in material science, synthesis of porous polymers, green nanotechnology.

REFERENCES:

1. Hand Book of Green Chemistry and Technology; by James Clarke and Duncan Macquarrie; Blakwell Publishing.

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
Course Outcomes:

CO1: To develop an understanding of principle and working of the range of instrumental methods in analytical chemistry

CO2: To provide an understanding and skills in contemporary methods of separation and appropriate selection of instruments for the successful analysis of chemical compounds

CO3: To impart skills in the scientific method of planning, conducting, reviewing, reporting experiments and problem solving in chemical analysis.

Syllabus Unit

1 Error Analysis and Sampling: Accuracy - Precision - Classification of Errors - Minimization of errors - Standard deviation - Coefficient of variance - F-test - t-test - Significant figures. Sampling - Basis of sampling, Sampling and physical state - Safety measures of sampling.

Separation Techniques: Brief outline of column, paper and thin layer chromatography - Ion exchange methods - principle and application – HPLC.

Unit 2
Gas chromatography - principle and applications – gel chromatography.


Unit 3

Thermal and Diffraction techniques: Principles and applications of DTG - DTA DSC - X-ray - Electron Diffraction Studies - SEM, TEM.

TEXTBOOKS:


REFERENCES:

**Evaluation Pattern**

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
Course Objective:
To provide sound knowledge on the application of electrochemistry in energy storage systems.

Course Outcome

CO1: Understand the fundamental concepts of electrochemistry through electrode potential and reaction kinetics and fuel cells
CO2: Learn the application of the electrochemical principles for the functioning and fabrication industrial batteries
CO3: Analysis of practical problem solving in fabricating batteries and fuel cells
CO4: Evaluation of comprehensive knowledge through problem solving

Syllabus

Unit 1
Background Theory: Origin of potential - electrical double layer - reversible electrode potential - standard hydrogen electrode - emf series - measurement of potential - reference electrodes (calomel and silver/silver chloride) indicator and ion selective electrodes - Nernst equation - irreversible processes - kinetic treatment - Butler- Volmer equation - Overpotential, activation, concentration and IR overpotential - its practical significance - Tafel equation and Tafel plots - exchange current density and transfer coefficients.

Unit 2
Batteries: Primary batteries: The chemistry, fabrication and performance aspects, packing classification and rating of the following batteries: (The materials taken their function and significance, reactions with equations, their performance in terms of discharge, capacity, and energy density to be dealt with). Zinc-carbon (Leclanche type), zinc alkaline (Duracell), zinc/air batteries; Lithium primary cells - liquid cathode, solid cathode and lithium-ferrous sulphide cells (comparative account).

Secondary batteries: Lead acid and VRLA (valve regulated (sealed) lead acid), nickel-cadmium, nickel-zinc, nickel-metal hydride batteries, lithium ion batteries, ultrathin lithium polymer cells (comparative account). Advanced Batteries for electric vehicles, requirements of the battery - sodium-beta and redox batteries.

Unit 3
Fuel Cells: Description, working principle, anodic, cathodic and cell reactions, fabrication of electrodes and other components, applications, advantages, disadvantages and environmental aspects of the following types of fuel cells: Proton Exchange Membrane Fuel Cells, alkaline fuel cells, phosphoric acid, solid oxide, molten carbonate, direct methanol fuel cells.

Membranes for fuel cells: Nafion – Polymer blends and composite membranes; assessment of performance – recent developments.


TEXTBOOKS:

REFERENCES:

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
Course Outcome:

CO1: Development of skill in identifying the nature and type of corrosion
CO2: Understanding the mechanism of various types of corrosion
CO3: Analysing the problem and find out a solution to combat corrosion in any sort of environment.

CO-PO Mapping

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
<th>PSO4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>-</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Syllabus Unit

1
Basic principles: Free energy concept of corrosion - different forms of corrosion - Thermodynamic & Kinetic aspects of corrosion: The free energy criterion of corrosion possibility - Mechanism of Electrochemical corrosion - Galvanic and Electrochemical series and their significance.

Corrosion Control: Materials selection - metals and alloys - metal purification - non metallic - changing medium.

Unit 2
Anodic and cathodic protection methods - Coatings - metallic and other inorganic coatings - organic coatings - stray current corrosion - cost of corrosion control methods.


Unit 3
Stress and fatigue corrosion at the design and in service condition - control of bacterial corrosion.


TEXTBOOKS:

REFERENCES:
**Evaluation Pattern**

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.*
Course Outcomes:

CO1: Able to use the Lagrangian formalism to solve simple dynamical system
CO2: Able to understand Hamiltonian formalism and apply this in solving dynamical systems
CO3: Able to apply Lagrangian formalism in bound and scattered states with specific reference to Kepler’s laws and Scattering states
CO4: Able to solve problems in the Centre of Mass frame and connect it to Laboratory Frame of Reference
CO5: Understand and solve problems in rigid body rotations applying of Euler’s equations.

CO-PO Mapping

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Syllabus Unit

1  
Introduction to Lagrangian dynamics
Survey of principles, mechanics of particles, mechanics of system of particles, constraints, D'Alembert's principle and Lagrange's equation, simple applications of the Lagrangian formulation, variational principles and Lagrange's equations, Hamilton's principles, derivation of Lagrange's equations from Hamilton's principle, conservation theorems and symmetry properties.

Unit 2  
Central field problem
Two body central force problem, reduction to the equivalent one body problem, Kepler problem, inverse square law of force, motion in time in Kepler's problem, scattering in central force field, transformation of the scattering to laboratory system, Rutherford scattering, the three body problem.

Rotational kinematics and dynamics
Kinematics of rigid body motion, orthogonal transformation, Euler's theorem on the motion of a rigid body.

Unit 3  
Angular momentum and kinetic energy of motion about a point, Euler equations of motion, force free motion of rigid body.
Practical rigid body problems
Heavy symmetrical spinning top, satellite dynamics, torque-free motion, stability of torque-free motion - dual-spin spacecraft, satellite maneuvering and attitude control - coning maneuver - Yo-yo despination mechanism - gyroscopic attitude control, gravity-gradient stabilization.

TEXTBOOKS:

REFERENCE BOOKS:

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
**Course Outcomes**

CO1: To understand the nature of interaction between atoms in crystalline solid materials that determines their dielectric, magnetic and electrical properties.

CO2: Analyze the relation between the macroscopic dielectric constant and the atomic structure of an insulator.

CO3: Fundamental concepts of magnetic fields required to illustrate the magnetic dipoles. This forms the basis to understand the magnetic properties of dia, para, ferro, antiferro and ferri magnetic materials.

CO4: Fundamentals concerned with conduction mechanism in metals and superconductors.

CO5: Understand the basics for classification of materials based on its conductivity, nature of chemical bonds in Si and Ge, carrier density, energy band structure and conduction mechanism in intrinsic and extrinsic semiconductors.

**CO-PO Mapping**

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>CO2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>CO3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>CO4</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>CO5</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td>1</td>
<td>-</td>
</tr>
</tbody>
</table>

**Syllabus Unit**

1

Conducting materials: The nature of chemical bond, crystal structure Ohm’s law and the relaxation time, collision time, electron scattering and resistivity of metals, heat developed in a current carrying conductor, thermal conductivity of metals, superconductivity.

Semiconducting materials: Classifying materials as semiconductors, chemical bonds in Si and Ge and it’s consequences, density of carriers in intrinsic semiconductors, conductivity of intrinsic semiconductors, carrier densities in n type semiconductors, n type semiconductors, Hall effect and carrier density.

**Unit 2**

Magnetic materials: Classification of magnetic materials, diamagnetism, origin of permanent, magnetic dipoles in matter, paramagnetic spin systems, spontaneous magnetizaiton and Curie Weiss law, ferromagnetic domains and coercive force, anti ferromagnetic materials, ferrites and it’s applications.

**Unit 3**

Dielectric materials: Static dielectric constant, polarization and dielectric constant, internal field in solids and liquids, spontaneous polarization, piezoelectricity.

PN junction: Drift currents and diffusion currents, continuity equation for minority carriers, quantitative treatment of
the p-n junction rectifier, the n-p-n transistor.

**TEXTBOOK:**


**REFERENCES:**


**Evaluation Pattern**

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
Unit 1

Review of some basic concepts and principle of laser.


Unit 2

Properties of LASERS

Gain mechanism, threshold condition for PI (derivation), emission broadening - line width, derivation of FWHM natural emission line width as deduced by quantum mechanics - additional broadening process: collision broadening, broadening due to dephasing collision, amorphous crystal broadening, Doppler broadening in laser and broadening in gases due to isotope shifts. Saturation intensity of laser, condition to attain saturation intensity.

Properties – coherency, intensity, directionality, monochromaticity and focussibility. LASER transition – role of electrons in LASER transition, levels of LASER action: 2 level, 3 level and 4 level laser system.

Unit 3

Types of LASERS


Liquid chemical and dye LASERS. Semiconductor LASER: Principle, characteristics, semiconductor diode LASERS, homo-junction and hetero-junction LASERS, high power semi conductor diode LASERS.

Applications in Communication field:

LASER communications: Principle, construction, types, modes of propagation, degradation of signal, analogue communication system, digital transmission, fiber optic communication.

Applications of LASERS in other fields:


REFERENCES:


### Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
**Course Outcomes**

**CO1:** Understand, Comprehend and acquaint with concepts of NanoPhysics  
**CO2:** To familiarize the material’s property changes with respect to the dimensional confinements.  
**CO3:** Acquire knowledge on the modern preparation process and analysis involved in the nanomaterial’s research  
**CO4:** To learn about the technological advancements of the nano-structural materials and devices in the engineering applications

**CO-PO Mapping**

<table>
<thead>
<tr>
<th>CO1</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

**Syllabus Unit 1**

Introduction

Introduction to nanotechnology, comparison of bulk and nanomaterials – change in band gap and large surface to volume ratio, classification of nanostructured materials. Synthesis of nanomaterials - classification of fabrication methods – top down and bottom up methods.

Concept of quantum confinement and phonon confinement


**Unit 2**

Tools for characterization:


Nanoscale materials – properties and applications:

Carbon nanostructures – structure, electrical, vibration and mechanical properties. Applications of carbon nanotubes

**Unit 3**

Nanoelectronics and nanodevices:

Impact of nanotechnology on conventional electronics. Nanoelectromechanical systems (NEMSs) – fabrication (lithography) and applications. Nanodevices - resonant tunneling diode, quantum cascade lasers, single electron transistors – operating principles and applications.

TEXTBOOKS:


Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
Course Outcomes:

CO1: Understand, comprehend and acquaint with the basics working principles and governing equations of electronic devices like diodes, Bipolar junction transistors, Mosfet and heterojunction transistors.

CO2: Analyze and Solve physics problems pertaining to various process like charge conduction across semiconductor device.

CO3: Apply the knowledge for the development and design of new methods to determine semiconductor parameters and devices.

Syllabus Unit

Unit 1

Introduction: Unit cell, Bravais lattices, crystal systems, crystal planes and Miller indices, symmetry elements. Defects and imperfections – point defects, line defects, surface defects and volume defects.


Unit 2


Theory of p-n junctions – diode and transistor:p-n junction under thermal equilibrium, forward bias, reverse bias, carrier density, current, electric field, barrier potential. V-I characteristics, junction capacitance and voltage breakdown.

Unit 3


Modern semiconducting devices: CCD - introduction to nano devices, fundamentals of tunneling devices, design considerations, physics of tunneling devices.

TEXTBOOKS:


REFERENCES:

**Evaluation Pattern**

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.*
Course Outcomes:

After completion of the course students should be able to

CO1: Get a broad knowledge of scientific and technical methods in astronomy and astrophysics.

CO2: Apply mathematical methods to solve problems in astrophysics.

CO3: Develop critical/logical thinking, scientific reasoning and skills in the area of modern astrophysics.

CO-PO Mapping:

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>CO2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Syllabus Unit**

**Unit 1**


Practical astronomy - telescopes and observations & techniques – constellations, celestial coordinates, ephemeris. Celestial mechanics - Kepler’s laws - and derivations from Newton’s laws.

Sun: Structure and various layers, sunspots, flares, faculae, granules, limb darkening, solar wind and climate.

**Unit 2**


Variable stars: Cepheid, RR Lyrae and Mira type variables - Novae and Super novae. Binary and multiple star system - measurement of relative masses and velocities. Interstellar clouds - Nebulae.

**Unit 3**

Galactic astronomy: Distance measurement - red shifts and Hubble's law – age of the universe, galaxies – morphology - Hubble’s classification - gravitational lens, active galactic nuclei (AGNs), pulsars, quasars.


Cosmology: Comic principles, big bang and big crunch – cosmic background radiation - Nucleo-synthesis - plank length and time, different cosmic models - inflationary, steady state. Variation of G. anthropic principle.

**REFERENCES:**

Publishing Company, 1996

5. ‘Stellar Astronomy’ by K. D Abhayankar.

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
MATHEMATICS

23MAT240 STATISTICAL INFERENCE L-T-P-C: 3-0-0-3

Syllabus

Unit 1

Unit 2

Unit 3
Regression: Introduction, Least Squares Estimators of the Regression Parameters, Distribution of the Estimators, Statistical Inferences about the Regression Parameters, the Coefficient of Determination and the Sample Correlation Coefficient, Analysis of Residuals, transforming to Linearity, Weighted Least Squares, Polynomial Regression, Multiple Linear Regression, Predicting Future Responses, Logistic Regression Models for Binary Output Data.

TEXTBOOK:


REFERENCES:


Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
### Syllabus

#### Unit 1
Elements of Game theory, examples, Strategic Games, 2 Player Strategy Games, payoffs, Minimax, Weak and Strong Domination, Saddle Points, Nash Equilibrium, Prisoner’s Dilemma, Stag Hunt, Matching pennies, BOS, Multi NE, Cooperative and Competitive Games, Strict and Non Strict NE, Best response functions for NE.

#### Unit 2
Combinatorial games, Winning and losing positions, Subtraction Game, 3-Pile and K-Pile Games, Proof of Correctness, Variations of K-Pile Games, Graph Games, Construction, Proof of finiteness, SG theorem for sum of games.

#### Unit 3
Cournot’s Oligopoly, Bertrand’s Oligopoly, Electoral Competition, Median Voter Theorem, Auctions, role of knowledge, Decision making and Utility Theory, Mixed Strategy Equilibrium, Extensive Games with Perfect Information, Stackelberg’s model of Duopoly, Buying Votes, Committee Decision making, Repeated Games, Prisoner’s Dilemma, Supermodular Game and Potential games

### TEXTBOOK:

### REFERENCES:

### Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
23MAT242 NUMERICAL METHODS AND OPTIMIZATION L-T-P-C: 3-0-0-3

Syllabus

09 (a) Roots finding methods:
Roots of Transcendental and Polynomial Equations: Bisection method, Iteration methods based on first degree equation, Rate of convergence, system of nonlinear equations.

09 (b) Interpolations:
Interpolation and Approximation: Lagrange, Newton’s Divided Difference, Newton’s Forward and Backward interpolations.

07 (b) Multivariable optimization (2 Credits)

TEXTBOOK:

REFERENCES:

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
FREE ELECTIVES OFFERED UNDER MANAGEMENT STREAM COMMON TO ALL PROGRAMS

| 23MNG331 | FINANCIAL MANAGEMENT | L-T-P-C: 3-0-0-3 |

Course Objectives

- Understand the overview of financial management
- Inculcate methods and concepts on valuation
- Familiarize with working capital management, financial analysis and planning

Course Outcomes

**CO1**: Understand and apply time value concept of money and use this for investment criteria decisions.
**CO2**: Evaluate the risk and return for various alternatives of investment.
**CO3**: Apply the capital budgeting techniques and evaluate the investment decisions.
**CO4**: Understand working capital management, cash and liquidity management and financial statements. **CO/PO**

Mapping

<table>
<thead>
<tr>
<th>CO/PO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Syllabus Unit


Unit 2


Unit 3


Mergers and Takeovers - International trade.

TEXT BOOKS

REFERENCE BOOKS

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignments, Projects, and Reports
Course Objectives

- Understand the complexity and key issues in supply chain management.
- Describe logistics networks, distribution planning, routing design and scheduling models.
- Familiarize dynamics of supply chain and the role of information in supply chain.
- Understand the issues related to strategic alliances, global supply chain management, procurement and outsourcing strategies.

Course Outcomes

CO1: Analyze the complexity and key issues in supply chain management
CO2: Evaluate single and multiple facility location problems, logistics network configuration, vehicle routing and scheduling models
CO3: Analyze inventory management models and dynamics of the supply chain
CO4: Develop the appropriate supply chain through distribution requirement planning and strategic alliances
CO5: Identify the issues in global supply chain management, procurement and outsourcing strategies

CO/PO Mapping

<table>
<thead>
<tr>
<th>CO/PO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Syllabus

**Unit 1**

Introduction: Introduction to SCM—the complexity and key issues in SCM—Location strategy—facility location decisions—single facility and multiple location models.


**Unit 2**

Inventory: Inventory Management and risk pooling-managing inventory in the SC. Value of Information-bullwhip effect—lead time reduction.


**Unit 3**


TEXT BOOK

REFERENCE BOOKS

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignments, Projects, and Reports
Course Objective

To educate the students to apply concepts and techniques in marketing so that they become acquainted with the duties of a marketing manager with an emphasis to make the students exposed to the development, evaluation, and implementation of marketing management in a variety of business environments.

Course Outcomes

On successful completion of the Course students will be able to:

CO1: Illustrate key marketing concepts, theories and techniques for analysing a variety of marketing situations

CO2: Identify and demonstrate the dynamic nature of the environment in which marketing decisions are taken and appreciate the implication for marketing strategy determination and implementation

CO3: Develop the ability to carry out a research project that explores marketing planning and strategies for a specific marketing situation

CO4: Understand the need and importance of sales promotions and make use of advertising

CO5: Manage a new product development process from concept to commercialization.

CO6: Illustrate the importance of modern trends in retailing and marketing logistics

CO/PO Mapping

<table>
<thead>
<tr>
<th>CO/PO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO6</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Syllabus Unit


Buying Behaviour and Market Segmentation: Major factors influencing buying behaviour, buying decision process, businessbuyingbehaviour. Segmenting consumer and business markets, market targeting.

UNIT 2

Product Pricing and Marketing Research: Objectives, pricing, decisions and pricing methods, pricing management. Introduction, uses, process of marketing research.

UNIT 3

 Advertising Sales Promotion and Distribution: Characteristics, impact, goals, types, and sales promotions- point of
purchase- unique selling proposition. Characteristics, wholesaling, retailing, channel design, logistics, and modern trends in retailing.

**TEXT BOOKS**


**REFERENCE BOOKS**


**Evaluation Pattern**

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignments, Projects, and Reports
Course Objectives

- To discuss the project life cycle and build a successful project from pre-implementation to completion.
- To introduce different project management tools and techniques

Course Outcomes

CO1: Appraise the selection and initiation of individual projects and its portfolios in an enterprise.
CO2: Analyze the project planning activities that will predict project costs, time schedule, and quality.
CO3: Develop processes for successful resource allocation, communication, and risk management.
CO4: Evaluate effective project execution and control techniques that results in successful project completion

CO/PO Mapping

<table>
<thead>
<tr>
<th>CO/PO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Syllabus Unit


2. **Unit 2 Project Presentation:** WBS, Project Network – Activity on Arrow (A-O-A), Activity on Node (A-O-N). **Project Scheduling:** Gantt Chart, Critical Path Method (CPM), Project Evaluation & Review Technique (PERT). **6hrs**

3. **Introduction to project management software:** Primavera/ Microsoft project

4. **Unit 3 Project Execution:** Monitoring control cycle, Earned Value Analysis (EVA), Project Control – Physical control, Human control, financial control.

5. **Organizational and Behavioral Issues:** Organizational Structure, Selection-Project Manager, Leadership Motivation, Communication, Risk Management.

6. **Project Termination:** Extinction, Addition, Integration, Starvation.

TEXT BOOKS

REFERENCE BOOKS


Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignments, Projects, and Reports
Course Objectives

- To impart knowledge on the fundamentals of costing, pricing methods and strategies.
- To give an overview of production operations planning.
- To summarize various quantitative methods of plant location, layout and lean manufacturing.
- To familiarize the concepts of e-commerce, e-purchasing, MRP and ERP in business

Course Outcomes

At the end of the course, the student will be able to:

CO1: Understand the concepts of cost and pricing of goods and appraise project proposals
CO2: Design and analyze manufacturing and service processes and to measure the work performed.
CO3: Understand and analyze the key issues of supply chain Management
CO4: Understand the application of lean manufacturing tools and six sigma concepts
CO5: Select appropriate plant location and their layout methods
CO6: Create capacity plan, aggregate plan, schedule, ERP & MRP systems

CO/PO Mapping

<table>
<thead>
<tr>
<th>CO/PO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>CO6</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Syllabus Unit


Unit 2

Unit 3

TEXT BOOKS

REFERENCE BOOKS

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignments, Projects, and Reports.
Course Objectives

Familiarizing the students with quantitative tools and techniques, which are frequently applied in operational decisions

Course Outcomes

CO1: Formulate operations research models to optimize resources.
CO2: Solve transportation and assignment problems using suitable techniques.
CO3: Apply appropriate technique to analyze a project with an objective to optimize resources.
CO4: Solve operational problems using decision theory approaches.
CO5: Select suitable inventory model for effective utilisation of resources.
CO6: Solve Operations Research problems using software package

CO/PO Mapping

<table>
<thead>
<tr>
<th>CO/PO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO6</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Syllabus

Unit 1
Linear Programming: Formulations - graphical solutions - Simplex Method - Duality, Dual simplex method.
Transportation model: Assignment model – Travelling Salesman Problem.

Unit 2

Unit 3
Sequencing model – 2 machines ‘n’ jobs, ‘m’ machines ‘n’ jobs – n jobs 2 machines.
Simulation –Monte Carlo simulation: simple problems

Lab session: Practicing case problems with excel solver/MatLab/LINGO package

TEXT BOOK

REFERENCE BOOKS

**Evaluation Pattern**

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Periodical 2</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (Theory) (CAT)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (Lab) (CAL)</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>35</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignments, Projects, and Reports
Course Objectives

- To inculcate the concepts of work study and its application to industrial practice
- Impart skills to design, develop, implement, and improve manufacturing/service systems

Course Outcomes

At the end of the course, the student will be able to

**CO1:** Create value to organizations through the analysis, evaluation, and improvement of work systems using work study and method study
**CO2:** Develop work systems through motion economy principles
**CO3:** Apply work measurement techniques to improve productivity, fix wages and incentives
**CO4:** Apply systematic layout planning techniques and work station design principles based on ergonomics and material handling.

CO/PO Mapping

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| CO1   | 2   | 1   | 1   | 1   |     |     |     |     | 1   |     | 3   | 2   |     |      |      |
| CO2   | 2   | 1   | 1   | 1   | 1   |     |     |     |     | 1   |     | 3   | 2   |     |      |
| CO3   | 1   | 2   | 1   | 1   |     |     |     |     |     |     | 1   | 3   | 2   |     |      |
| CO4   | 2   | 2   | 2   | 1   |     |     |     |     |     |     |     | 2   | 3   | 2   |      |

Syllabus Unit

1. Work System: Elements of work, maintenance of machines, interaction, effect of working conditions and environment, physical and mental fatigue.
   Productivity: Productivity, factors affecting production, Measurement of productivity.
   Work Study: Definition and scope of work study; Areas of application of work study in industry; Human aspects of work study.
   Method Study: Information collection, recording techniques, and processing aids; critical examination; development, installation and maintenance of improved methods.

2. Motion Economy and Analysis: Principles of motion economy; Motion analysis; Micromotion and Memomotion study; Therbligs and SIMO charts; Normal work area and design of work places; Basic parameters and principles of work design.
   Work Measurement: Work measurement techniques; Calculation of standard time, work sampling and predetermined Motion time systems.
   Wages and Incentive Schemes: Introduction, wage payment of direct and indirect labour, wage payment plans and incentives, various incentive plans, incentives for indirect labour

   Material Handling: Introduction and functions of material handling equipment, selection of material handling equipment for different requirements, safety requirements.
Recent advances in Industrial Engineering.

**TEXT BOOKS**

**REFERENCE BOOKS**

**Evaluation Pattern**

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continues Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignments, Projects, and Reports
Course Objective

To impart the knowledge of basic statistical tools for analysis and interpretation of qualitative and quantitative data for decision making

Course Outcomes

CO1: Apply basic probability and statistics concepts for various business problems
CO2: Perform test of hypothesis
CO3: Compute and interpret the result of regression and correlation analysis for forecasting
CO4: Solve real time problems by applying different decision making methods.

CO/PO Mapping

<table>
<thead>
<tr>
<th>CO/PO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Syllabus Unit

1 Quantitative methods: Basic terminology in probability, probability rules, conditions of statistical dependence and independence, Bayes Theorem, Discrete Random Variables review of probability distributions, measure of central tendency.
Sampling and sampling distributions: Introduction to sampling, random sampling, design of experiments, introduction to sampling distributions
Estimation: point estimates, interval estimates and confidence intervals, calculating interval estimates of mean from large samples, using t test, sample size estimation.

Unit 2
Testing hypothesis: Introduction, basic concepts, testing hypothesis, testing when population standard deviation is known and not known, two sample tests.
Chi-square and analysis of variance: introduction, goodness of fit, analysis of variance, inferences about a population variation

Unit 3
Regression and correlation: Estimation using regression line, correlation analysis, finding multiple regression equation, modelling techniques,
Non parametric methods and time series and forecasting: Sign test for paired data, rank sum test, rank correlation, Kolmogrov – smirnov test, variations in time series, trend analysis, cyclic variation, seasonal variation and irregular variation. Decision theory: Decision tree analysis

TEXT BOOKS


REFERENCE BOOKS

March 2000 - 2nd Edition  

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignments, Projects, and Reports
Course Objective

To impart knowledge on quality management principles, tools, techniques and quality standards for real life applications

Course Outcomes

CO1: Evaluate the principles of quality management and to explain how these principles can be applied within quality management systems.

CO2: Evaluate the performance measures using various quality and management tools.

CO3: Apply the Quality Function Deployment, Taguchi principles, Total Productive Maintenance and Failure Mode and Effect Analysis concepts to solve industrial problems.

CO4: Practice the various quality system in industry.

CO/PO Mapping

<table>
<thead>
<tr>
<th>CO/PO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Syllabus Unit

1

Unit 2
Customer satisfaction – Customer retention - Employee involvement - Performance appraisal - Continuous process improvement - Supplier partnership - Performance measures. Seven tools of quality. Statistical fundamentals - Control Charts for variables and attributes - Process capability - Concept of six sigma - New seven management tools - Benchmarking.

Unit 3

TEXT BOOK

REFERENCE BOOKS
**Evaluation Pattern**

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignments, Projects, and Reports*
Course Objectives

- Understand Lean manufacturing principles and tools
- Inculcate the concepts of value stream mapping
- Familiarize lean implementation practices

Course Outcomes

CO1: Identify key requirements and concepts in lean manufacturing.
CO2: Initiate a continuous improvement change program in a manufacturing organization
CO3: Analyze and improve a manufacturing system by applying lean manufacturing tools
CO4: Build value stream map for improving the productivity
CO5: Improve productivity through lean practices

CO/PO Mapping

<table>
<thead>
<tr>
<th>CO/PO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

SyllabusUnit

1. Introduction to Lean and Factory Simulation: History of Lean and comparison to other methods - The 7 Wastes, their causes and the effects - An overview of Lean Principles / concepts / tools - Stockless Production.
   Ford production systems – FPS gear model

Unit 2
Value Stream Mapping – Current state: Preparation for building a Current State Value Stream Map – Building a Current State Map (principles, concepts, loops, and methodology) – Application to the factory Simulation scenario.

Unit 3
Value Stream Mapping – Future State: Key issues in building the Future State Map – Process tips in building the map and analysis of the customer loop, supplier loop, manufacturing loop and information loop – Example of completed Future State Maps – Application to factory simulation

TEXT BOOKS


REFERENCES BOOKS

**Evaluation Pattern**

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignments, Projects, and Reports*
Course Objectives

● This course describes the key aspects of a software project.
● It introduces the basic principles of Engineering Software Projects. Most, if not all, students’ complete projects as part of assignments in various courses undertaken. These projects range in size, subject and complexity but there are basic project essentials that need to be understood and practiced for successful team project outcomes.
● The course provides an understanding of the purpose, methods and benefits of process management by exposing the student to the concepts, practices, processes, tools and techniques used in process management for software development.

Course Outcomes

CO 1: To understand the basic concepts, terminologies and issues of software project management.
CO 2: To apply appropriate methods and models for the development of solutions.
CO 3: To analyze the cost-benefits of calculations so as to optimize the selection strategy
CO 4: To evaluate methods, models and technologies towards achieving project success
CO 5: To design and evaluate network planning models with criticality

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td></td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Syllabus Unit

1

Unit 2

Unit 3
Monitoring and control – Visualizing Progress, Earned value analysis, managing people and organizing teams- organizational structures- Planning for small projects. Case Study: PMBOK, Agile Development

TEXT BOOK(S)

REFERENCE(S)

**Evaluation Pattern**

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>External</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td><em>Continuous Assessment (CA)</em></td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.*
Pre-Requisite(s): 19MAT112 Linear Algebra, 19MAT205 Probability and Random Processes

Course Objectives

- This course serves as an introduction to financial engineering including cash flows, financial decision making etc.
- It gives a thorough yet highly accessible mathematical coverage of standard and recent topics of introductory investments: fixed-income securities, modern portfolio theory, optimal portfolio growth and valuation of multi-period risky investments.

Course Outcomes

- **CO1:** Apply basic concepts to understand and evaluate cash flows
- **CO2:** Evaluate and arrive at a financial investment decision employing the underlying knowledge of stocks and derivatives
- **CO3:** Analyse and design Portfolio selection methods
- **CO4:** Understand capital market theory for stock performance evaluation

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>CO1</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Syllabus Unit


TEXT BOOK(S)

REFERENCE(S)

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>External</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
Course Objectives

- Prepare engineering students to analyze and understand the business, impact of economic environment on business decisions

Course Outcomes

CO1: Understand and evaluate the economic theories, cost concepts and pricing policies and draw inferences for the investment decisions for appraisal and profitability

CO2: Appraise the dynamics of the market and market structures and portray implication for profit and revenue maximization

CO3: Employ operations research and allied techniques in managerial economics for an enhanced analysis and decision making

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO1</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Syllabus

Unit 1

Unit 2

Unit 3

TEXT BOOK(S)

REFERENCE(S)
**Evaluation Pattern**

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>External</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.*
Course Objectives

- This course is to expose the students to the managerial issues relating to information systems and also understand the role of Business Process Reengineering technique in an organization.
- The course also focus on the management of information technology to provide efficiency and effectiveness or strategy decision making.

Course Outcomes

CO1: Understand the fundamental concepts of Information Systems in business.
CO2: Understand and analyse the strategic role played by Information Systems in e-commerce.
CO3: Analyse management challenges in Global Businesses predominantly dependent on IS functions.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO CO1</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

Syllabus Unit

Unit 1

Unit 2

Unit 3

TEXT BOOK(S)

**REFERENCE(S)**
Laudon K, Laudon JP. Management Information Systems; 2010

**Evaluation Pattern**

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>External</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
FREE ELECTIVES OFFERED UNDER HUMANITIES / SOCIAL SCIENCE STREAMS COMMON TO ALL PROGRAMS

23CUL230 ACHIEVING EXCELLENCE IN LIFE -AN INDIAN PERSPECTIVE L-T-P-C: 2-0-0-2

Course Objectives:
The course offers to explore the seminal thoughts that influenced the Indian Mind on the study of human possibilities for manifesting excellence in life. This course presents to the students, an opportunity to study the Indian perspective of Personality Enrichment through pragmatic approach of self analysis and application.

Syllabus

Unit 1
Goals of Life – Purusharthas
What are Purusharthas (Dharma, Artha, Kama, Moksha); Their relevance to Personal life; Family life; Social life & Professional life; Followed by a Goal setting workshop;
Yogic way of Achieving Life Goals – (Stress Free & Focused Life)
Introduction to Yoga and main schools of Yoga; Yogic style of Life & Time Management (Work Shop); Experiencing life through its Various Stages
Ashrama Dharma; Attitude towards life through its various stages (Teachings of Amma);

Unit 2
Personality Development
What is Personality – Five Dimensions – Pancha Kosas (Physical / Energy / Mental / Intellectual / Bliss); Stress Management & Personality; Self Control & personality; Fundamental Indian Values & Personality;
Learning Skills (Teachings of Amma)
Art of Relaxed Learning; Art of Listening; Developing ‘Shraddha’ – a basic qualification for obtaining Knowledge; Communication Skills - An Indian Perspective;

Unit 3
Developing Positive Attitude & Friendliness - (Vedic Perspective);
Achieving Work Excellence (Karma Yoga by Swami Vivekananda & teachings based on Amma);
Leadership Qualities – (A few Indian Role models & Indian Philosophy of Leadership);

REFERENCE BOOKS:
1. Awaken Children (Dialogues with Sri Mata Amritanandamayi) Volumes 1 to 9
2. Complete works of Swami Vivekananda (Volumes 1 to 9)
3. Mahabharata by M. N Dutt published by Parimal publications – New Delhi (Volumes 1 to 9)
4. Universal message of Bhagavad-Gita (An exposition of Gita in the light of modern thought and Modern needs) by Swami Ranganathananda. (Vols.1 to 3)
7. Art of Man Making - Swami Chinmayananda published by Chinmaya Mission, Bombay
10. Yoga In Daily Life - Swami Sivananda – published by Divine Life Society
12. All about Hinduism – Swami Sivananda - Published by Divine Life Society
15. Valmiki Ramayana – Four volumes- published by Parimal Publications, Delhi

17. Mind Sound Resonance Technique (MSRT) Published by Swami Vivekananda Yoga Prakashana, Bangalore.

18. Yoga & Memory - Dr H R Nagendra & Dr. Shirley Telles, published by Swami Vivekananda Yoga Prakashana, Bangalore.

**Evaluation Pattern**

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.*
Syllabus

Unit 1
1. The anatomy of ‘Excellence’. What is ‘excellence’? Is it judged by external factors like wealth?
2. The Great Flaw. The subject-object relationship between individual and world. Promote subject enhance excellence.
3. To work towards excellence, one must know where he is. Our present state... An introspective analysis. Our faculties within.

Unit 2
4. The play of the mind. Emotions – convert weakness into strength.
5. The indispensable role of the intellect. How to achieve and apply clear thinking?
7. Increase Productivity, reduce stress.. work patterning.

Unit 3
8. The art of right contact with the world. assessment, expectations.
9. Myths and Realities on key issues like richness, wisdom, spirituality.
10. Collect yourself, there is no time to waste. The blue-print of perfect action.

REFERENCES:
The Bhaja Govindam and the Bhagavad Gita.

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
OBJECTIVES:

This course offers a journey of exploration through the early developments in India of astronomy, mathematics, technologies and perspectives of the physical world. With the help of many case studies, the students will be equipped to understand concepts as well as actual techniques.

Syllabus

Unit 1
1. General introduction: principles followed and sources;
2. Astronomy & mathematics from the Neolithic to the Indus civilization;
3. Astronomy & mathematics in Vedic literature;
4. Vedanga Jyotisha and the first Indian calendars;
5. Shulba Sutras and the foundations of Indian geometry;

Unit 2
1. Astronomy & mathematics in Jain and Buddhist literature;
2. The transition to the Siddhantic period; Aryabhata and his time;
3. The Aryabhatiya: concepts, content, commentaries;
4. Brahmagupta and his advances;
5. Other great Siddhantic savants;
6. Bhaskara II and his advances;

Unit 3
1. The Kerala school of mathematics;
2. The Kerala school of astronomy;
3. Did Indian science die out?;
4. Overview of recent Indian scientists, from S. Ramanujan onward;
5. Conclusion: assessment and discussion;

TEXTBOOK:

Indian Mathematics and Astronomy: Some Landmarks, by S. Balachandra Rao

REFERENCE:

IFIH’s interactive multimedia DVD on Science & Technology in Ancient India.

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
OBJECTIVES:
This course offers the foundation necessary to understand Eastern approaches to psychology and spirituality. The course includes experiential components centering on meditation and spiritual practice.

Syllabus

Unit 1
Introduction
Introduction to Modern Psychology
A short history of Modern Psychology - Major Schools of Modern Psychology - The three major forces in Western Psychology - Freudian Psychoanalysis; Behaviourism; Humanistic Psychology.

Introduction to Indian Psychology
What is Yoga? - Rise of Yoga Psychology tradition - Various schools of Yoga Psychology - Universal Goal of all Yoga-schools.

Patanjali Yoga Sutra – 1

Patanjali Yoga Sutra – 2

Unit 2
Patanjali Yoga Sutra – 3
Two formulae - Necessity of Abhyasah and Vairagyah - Foundation of Abhyasah - Foundation of Vairagyah.

Patanjali Yoga Sutra – 4

Patanjali Yoga Sutra – 5
Main obstacles in the path of Yoga - other obstructions - removal of obstacles by one – pointedness; by controlling Prana - by observing sense experience - by inner illumination - by detachment from matter - by knowledge of dream and sleep - by meditation as desired.

Patanjali Yoga Sutra – 6

Patanjali Yoga Sutra – 7

Unit 3
Patanjali Yoga Sutra – 8

Patanjali Yoga Sutra – 9
Patanjali Yoga Sutra – 10
Asanam – Pranayamah – various kinds of Pranayamah - Pratyaharah - Mastery over the senses.

REFERENCES:
1. The course book will be “The four chapters of Freedom” written by Swami Satyananda Saraswati of Bihar School of Yoga, Munger, India.
3. Eight Upanishads with the commentary of Sankaracharya, Translated by Swami Gambhirananda, Published by Advaita Ashram, Uttarajal.
4. ‘Hatha Yoga Pradipika’ Swami Muktibodhananda, Yoga Publications Trust, Munger, Bihar, India

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
OBJECTIVES:

To introduce business vocabulary; to introduce business style in writing and speaking; to expose students to the cross-cultural aspects in a globalised world; to introduce the students to the art of persuasion and negotiation in business contexts.

Course Outcomes

CO1: Familiarize and use appropriate business vocabulary and etiquettes in verbal communication in the professional context
CO2: Understand organizational structures, pay structures and performance assessments
CO3: Apply language skills in drafting various business documents and other necessary communications in the business context
CO4: Understand and address cross cultural differences in the corporate environment
CO5: Participate in planned and extempore enactments of various business situations

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>CO2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>CO3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>

Syllabus

Unit 1

Unit 2
Writing: Style and vocabulary - Business Memorandum, letters, Press Releases, reports – proposals – Speaking: Conversational practice, telephonic conversations, addressing a gathering, conducting meetings.

Unit 3
Active Listening: Pronunciation – information gathering and reporting - Speaking: Cross-Cultural Issues, Group Dynamics, negotiation & persuasion techniques.

Activities
Case studies & role-plays.

BOOKS RECOMMENDED:


Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
OBJECTIVES:
To expose the students to the greatness of Indian Thought in English; to develop a sense of appreciation for the lofty Indian Thought; to develop an understanding of the eclectic Indian psyche; to develop an understanding about the societal changes in the recent past.

Syllabus

Unit 1
Poems
Rabindranath Tagore’s Gitanjali (1-10); Nizzim Ezekiel’s Enterprise; A.K. Ramanujam’s Small-Scale Reflections on a Great House.

Unit 2
Prose
Khushwant Singh’s The Portrait of a Lady; Jhumpa Lahiri’s Short Story - Interpreter of Maladies.

Unit 3
Drama and Speech
Vijay Tendulkar’s Silence, the Court is in Session; Motivational speeches by Jawaharlal Nehru/ S. Radhakrishnan / A. P. J. Abdul Kalam’s My Vision for India etc. (any speech).

REFERENCES:

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
OBJECTIVES:
To expose the students to different genres of Literature; to hone reading skills; to provide deeper critical and literary insights; to enhance creative thinking; to promote aesthetic sense.

Syllabus

Unit 1
Poems

Unit 2
Short Stories

Unit 3
Prose

Practicals:
Role plays: The Proposal, Chekov / Remember Caesar, Gordon Daviot / Final Solutions, Mahesh Dattani, Book reviews, Movie reviews.

SUGGESTED READING:
The Old Man and the Sea, Hemingway / Any one of the novels of R. K. Narayan, etc.

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
OBJECTIVES:
To introduce the students to the elements of technical style; to introduce the basic elements of formal correspondence; to introduce technical paper writing skills and methods of documentation; to improve oral presentation skills in formal contexts.

Course Outcomes:
After the completion of the course the student will be able to:

CO1: Understand and use the basic elements of formal correspondence and methods of documentation
CO2: Learn to edit technical content for grammatical accuracy and appropriate tone and style
CO3: Use the library and internet resources for research purposes
CO4: Demonstrate the ability to communicate effectively through group mock-technical presentations and other activities

Mapping of course outcomes with program outcomes:

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>CO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

Syllabus:

Unit 1

Unit 2
Different kinds of written documents: Definitions – descriptions – instructions – recommendations - manuals -reports – proposals; Formal Correspondence: Letter Writing including job applications with Resume.

Unit 3

Practice in oral communication and Technical presentations

REFERENCES:
**Evaluation Pattern**

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
OBJECTIVES:
To help the students learn the fine art of story writing; to help them learn the techniques of story telling; to help them study fiction relating it to the socio-cultural aspects of the age; to familiarize them with different strategies of reading short stories; to make them familiar with the morals and values held in high esteem by the ideals of Indianness.

Syllabus
Unit 1

Unit 2

Unit 3
Masti Venkatesha Iyengar: The Curds-Seller; Manohar Malgonkar: Upper Division Love; Romila Thapar: The Spell; Premchand: The Voice of God.

TEXT:

REFERENCE:

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
23FRE230  PROFICIENCY IN FRENCH LANGUAGE (LOWER)  L-T-P-C: 2-0-0-2

Syllabus

Unit 1

Population - Identity
How to introduce yourself (name, age, address, profession, nationality); Numbers; How to ask questions; Grammar – Pronouns - subjects; Regular verbs of 1st group (er) in the present; Être (to be) and avoir (to have) in the present; Interrogative sentence; Gender of adjectives.

Unit 2

The suburbs - At the train station
Introduce someone; Buy a train ticket or a cinema ticket; Ask for information; Official time; Ask for a price; The city (church, town hall, post office…)
Grammar – Pronouns - subjects (continuation); Gender of adjectives (continuation); Plural of nouns and adjectives; Definite and indefinite articles; Interrogative adjectives; I would like (Je voudrais).

Unit 3

Paris and the districts - Looking for a room
Locate a room and indicate the way; Make an appointment; Give a price; Ordinal numbers; Usual time; Ask for the time.
Grammar - Imperative mode; Contracted articles (au, du, des); negation.

TEXTBOOK:
Metro St Michel - Publisher: CLE international

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
Syllabus

Unit 1

The first room of a student
A party to celebrate the 1st room; Description of a room; furniture; Locate objects: prepositions (devant, derrière, dans…), Read advertisement; Appreciation (I like, I prefer,).

Grammar - Perfect past tense with avoir; Possessive adjectives (mon, ton, son…); Demonstrative adjectives (ce, cet, cette); Yes (oui, si).

Unit 2 Small jobs
Conversation on the phone; Give Time indications; Answer a job offer; Describe a job; Suggest a meeting time.
Grammar - Perfect past tense with être and avoir (continuation); Possessive adjectives (notre, votre, leur); Prepositions (à, pour, avec…); Pronoun as direct object (le, la, l’, les).

Unit 3

University Restaurant
Inquiry; Express an opinion; Ask questions (continuation); Food, meals, taste, preferences; Nutrition, diet, choose a menu or diet, Expression of quantities (beaucoup, peu).

Grammar - Partitif (expressing quantity) (du, de la, pas de…); Comparison (plus…que, moins…que, autant …que); Interrogation (continuation), inversion, Est-ce que, qu’est-ce que?!

TEXTBOOK:
Metro St Michel - Publisher: CLE International

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
23GER230  GERMAN FOR BEGINNERS I  L-T-P-C: 2-0-0-2

Syllabus

Unit 1
Greetings; Introducing one-self (formal and informal context), saying their name, origin, living place, occupation. Numbers 1-100; Saying the telephone number. Countries and Languages. Grammar: Structure – W - Questions and Yes/No questions and statements, personal pronouns, verb conjugations. Articles. Vocabulary: Professions.

Unit 2
Giving the personal details. Name, age, marital status, year of birth, place of birth, etc. Numbers till 1000. Saying a year. Alphabets – spelling a word. Filling up an application form; In the restaurant – making an order. Grammar: Definite, indefinite and negative article in nominative. Accusative: indefinite and negative Article Vocabulary: Food items

Unit 3

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
**Syllabus**

**Unit 1**
Shopping and orientation in supermarket; Conversation between the customer and salesman; Where one finds what in supermarket; Asking for requests and suggestions.

Grammar: Dative of personal pronouns. Imperative form. Vocabulary: Consumables and measurements;

**Unit 2**
Appointments; Work and leisure time activities; Time, weekdays, months and seasons; saying the date; fixing upon appointment.

Grammar: Model verbs; Prepositions with time and place; Ordinal numbers. Vocabulary: Leisure activities, weekdays, months and seasons.

**Unit 3**
Family and household; Family and relations; household and daily routine. Grammar: Possessive articles; Divisible and indivisible verbs.
Vocabulary: Family circle; Household articles.

**Evaluation Pattern**

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
Syllabus

To have an elementary exposure to German language; specifically

1. to have some ability to understand simple spoken German, and to be able to speak it so as to be able to carry on life in Germany without much difficulty (to be able to do shopping, etc.);
2. to be able to understand simple texts, and simple forms of written communication;
3. to have a basic knowledge of German grammar;
4. to acquire a basic vocabulary of 500 words;
5. to be able to translate simple letters with the use of a dictionary; and
6. to have some familiarity with the German life and culture.

(This will not be covered as part of the regular classroom teaching; this is to be acquired by self-study.) Some useful websites will be given.

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
Syllabus

The basic vocabulary and grammar learned in the earlier course is mostly still passive knowledge. The endeavour of this course is to activate this knowledge and develop the skill of communication.

Topics are: Airport, railway station, travelling; shopping; invitations, meals, meeting people; around the house; the human body; colours; professions.

Past and future tenses will be introduced. Applying genitive, dative and accusative. Some German culture. Films.

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
OBJECTIVES:

To teach Hindi for effective communication in different spheres of life - Social context, Education, governance, Media, Business, Profession and Mass communication.

Course Outcomes:

After the completion of the course the student will be able to:

CO1: Gain knowledge about the nature and culture of Hindi language
CO2: Understand the structural aspects of Hindi language
CO3: Apply the knowledge of the grammatical structures to communicate in Hindi
CO4: Analyse the social significance of modern literature.
CO5: Develop the ability to translate a given text to Hindi

CO-PO Mapping:

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>

Syllabus Unit 1

Introduction to Hindi Language, National Language, Official Language, link Language etc. Introduction to Hindi language, Devanagari script and Hindi alphabet.


Unit 2

Common errors and error corrections in Parts of Speech with emphasis on use of pronouns, Adjective and verb in different tenses – Special usage of adverbs, changing voice and conjunctions in sentences, gender & number - General vocabulary for conversations in given context –understanding proper pronunciation - Conversations, Interviews, Short speeches.

Unit 3

Poems – Kabir 1st 8 Dohas, Surdas 1st 1 Pada; Tulsidas 1st 1 Pada; Meera 1st 1 Pada

Unit 4


Unit 5

Kahani – Premchand: Kafan, Abhilasha, Vidroh, Poos ki rath, Juloos.
BOOKS:
1. *Prem Chand Ki Srvashrestha Kahaniyam*: Prem Chand; Diamond Pub Ltd. New Delhi
2. *Vyavaharik Hindi Vyakaran ,Anuvad thaha Rachana*: Dr. H. Parameswaran, Radhakrishna publishing House, New Delhi

**Evaluation Pattern**

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td><em>Continuous Assessment (CA)</em></td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.*
OBJECTIVES:
Appreciation and assimilation of Hindi Literature both drisya & shravya using the best specimens provided as anthology.

Course Outcomes:
After the completion of the course the student will be able to:

CO1: Understand the grammatical structures of Hindi
CO2: Understand the post modern trends of literature
CO3: Enhance critical thinking and writing skills
CO4: Identify and analyse different literary and audio-visual material
CO5: Apply fundamental knowledge of Hindi in formal and informal writing

CO-PO Mapping:

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO1</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Syllabus:

Unit 1
Kavya Tarang; Dhumil ke Anthim Kavitha [Poet-Dhumil]; Dhabba [Poet-Kedarnath Singh]; Proxy [Poet-Venugopal]; Vakth [Poet-Arun Kamal]; Maachis [Poet-Suneeta Jain].

Unit 2
Communicative Hindi - Moukhik Abhivyakthi

Unit 3
Audio-Visual Media in Hindi – Movies like Tare Zameen par, Paa, Black etc., appreciation and evaluation. Newsreading and presentations in Radio and TV channels in Hindi.

Unit 4
Gadya Manjusha – Budhapa, Kheesa, Sadachar ka Thavis

Unit 5

BOOKS:
2. *Gadya Manjusha: Editor: Govind, Jawahar Pustakalay, Mathura*

**Evaluation Pattern**

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.*
Syllabus

Unit 1
Emotional Intelligence: Concept of Emotional Intelligence, Understanding the history and origin of Emotional Intelligence, Contributors to Emotional Intelligence, Science of Emotional Intelligence, EQ and IQ, Scope of Emotional Intelligence.

Unit 2

Unit 3

REFERENCES:

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
Syllabus Unit 1

Introduction

General Introduction; ‘His + Story’ or ‘History’ ; The concepts of ‘nation’, ‘national identity’ and ‘nationalism’; Texts and Textualities: Comparative Perspectives.

Unit 2

Selected writings / selections from the complete works of the following authors will be taken up for study in a chronological order:

Raja Ram Mohan Roy; Dayananda Saraswati; Bal Gangadhar Tilak; Rabindranath Tagore;

Unit 3

Selected writings / selections from the complete works of the following authors will be taken up for study in a chronological order:

Swami Vivekananda; Sri Aurobindo; Ananda K. Coomaraswamy; Sister Nivedita; Mahatma Gandhi; Jawaharlal Nehru; B.R. Ambedkar; Sri Chandrasekharendra Saraswati, the Paramacharya of Kanchi; Dharampal; Raja Rao; V.S. Naipaul.

Conclusion.

REFERENCES:

1. Tilak, Bal Gangadhar. The Orion / Arctic Home in the Vedas.
2. Tagore, Rabindranath. The History of Bharatavarsha / On Nationalism / Greater India.

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
Syllabus

Unit 1
Introduction
A peep into India’s glorious past
Ancient India – the vedas, the vedic society and the Sanatana Dharma – rajamandala and the Cakravartins – Ramarajya – Yudhisthira’s ramarajya; Sarasvati - Sindhu Civilization and the myth of the Aryan Invasion; Classical India – Dharma as the bedrock of Indian society – Vaidika Brahmanya Dharma and the rise of Jainism and Buddhism – the sixteen Mahajanapadas and the beginning of Magadhan paramountcy - Kautilya and his Arthasastra – Chandragupta Maurya and the rise of the Mauryan empire – Gupta dynasty Indian art and architecture – classical sanskrit literature – Harsavardhana; Trade and commerce in classical and medieval India and the story of Indian supremacy in the Indian ocean region; The coming of Islam – dismantling of the traditional Indian polity – the Mughal empire – Vijayanagara samrajya and days of Maratha supremacy.

Unit 2
India’s contribution to the world: spirituality, philosophy and sciences
Indian Philosophy – the orthodox (Vaidika) and the heterodox (atheistic) schools; Ramayana and Mahabharata; Bhagavad Gita; Saints and sages of India; Ancient Indian medicine: towards an unbiased perspective; Ancient Indian mathematics; Ancient Indian astronomy; Ancient Indian science and technology.

The arrival of Europeans, British paramountcy and colonization
What attracted the rest of the world to India?; India on the eve of the arrival of European merchants; The story of colonization and the havoc it wreaked on Indian culture and civilization; Macaulay and the start of the distortion of Indian education and history; Indian economy – before and after colonization: a brief survey; The emergence of modern India.

Unit 3
Women in Indian society
The role and position of women in Hindu civilization; Gleanings from the Vedas, Brihadarnyaka Upanishad, Saptasati Devi Mahatmyam, Ramayana, Mahabharata, Manusmriti, Kautilya’s Arthasastra and Mrichchhakatikam of Sudraka; The role and position of Indian women vis-a-vis Islam and European cultures; The great women of India.

Modern India
The national movement for freedom and social emancipation; Swami Vivekananda, Sri Aurobindo, Rabindranath Tagore; Understanding Mahatma Gandhi; A new nation is born as a republic – the pangs of birth and growth; India since Independence – the saga of socio-political movements; Problems facing the nation today; Globalization and Indian Economy; Bharatavarsha today and the way ahead: Regeneration of Indian National Resources.

Conclusion
The Wonder that was India; The ‘politics’ and ‘purpose’ of studying India.

REFERENCES:
17. Aurobindo, Sri. The Indian Renaissance / India’s Rebirth / On Nationalism.
25. Danino, Michel. The Invasion That Never Was.
34. Dharampal. Archival Compilations (unpublished)

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
Syllabus

Unit 1
Introduction
General Introduction; Primitive man and his modes of exchange – barter system; Prehistoric and proto-historic polity and social organization.
Ancient India – up to 600 B.C.
Early India – the vedic society – the varnashramadharma – socio-political structure of the various institutions based on the four purusarthas; The structure of ancient Indian polity – Rajamandala and Cakravartins – Prajamandala; Socio-economic elements from the two great Epics – Ramayana and Mahabharata – the concept of the ideal King (Sri Rama) and the ideal state (Ramaraja) – Yudhisthira’s ramaraja; Sarasvati - Sindhu civilization and India’s trade links with other ancient civilizations; Towards chiefdoms and kingdoms – transformation of the polity: kingship – from gopati to bhupati; The mahajanapadas and the emergence of the srenis – states and cities of the Indo-Gangetic plain.

Unit 2
Classical India: 600B.C. – 1200 A.D.
The rise of Magadha, emergence of new religions – Buddhism and Jainism – and the resultant socio-economic impact; The emergence of the empire – the Mauryan Economy and Kautilya’s Arthasastra; of Politics and trade – the rise of the Mercantile Community; Elements from the age of the Kushanas and the Great Guptas; India’s maritime trade; Dharma at the bedrock of Indian polity – the concept of Digvijaya: dharma-vijaya, lobha-vijaya and asura-vijaya; Glimpses into the south Indian economies: political economies of the peninsula – Chalukyas, Rashtrakutas and Cholas

Medieval India: 1200 A.D. – 1720 A.D.
Advent of Islam – changes in the social institutions; Medieval India – agrarian economy, non-agricultural production and urban economy, currency system; Vijayanagara samrajya and maritime trade – the story of Indian supremacy in the Indian Ocean region; Aspects of Mughal administration and economy; The Maratha and other provincial economies.

Unit 3
Modern India: 1720 - 1947
the Indian market and economy before the arrival of the European traders; Colonisation and British supremacy (dismantling of everything that was ‘traditional’ or ‘Indian’) – British attitude towards Indian trade, commerce and economy and the resultant ruining of Indian economy and business – man-made famines – the signs of renaissance: banking and other business undertakings by the natives (the members of the early Tagore family, the merchants of Surat and Porbander, businessmen of Bombay, etc. may be referred to here) – the evolution of the modern banking system; Glimpses into British administration of India and administrative models; The National movement and nationalist undertakings in business and industry: the Tatas and the Birlas; Modern India: the growth of large-scale industry – irrigation and railways – money and credit – foreign trade; Towards partition – birth of two new nations – division of property; The writing of the Indian Constitution – India becomes a democratic republic – a new polity is in place.

Independent India – from 1947
India since Independence – the saga of socio-political movements; Indian economy since Independence – the fiscal system – the five year plans – liberalisation – the GATT and after; Globalisation and Indian economy; Impact of science and (new/emerging) technology on Indian economy; Histories of select Indian business houses and business entrepreneurship.

Conclusion

REFERENCES:
1. The Cultural Heritage of India. Kolkata: Ramakrishna Mission Institute of Culture.

**Evaluation Pattern**

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.*
Syllabus

Unit 1

Introduction to Health
Health is wealth; Role of lifestyle habits on health; Importance of adolescence; Stages, Characteristics and changes during adolescence; Nutritional needs during adolescence why healthy lifestyle is important for adolescence. Eating Habits - eating disorders, skipping breakfast, junk food consumption.

Practicals - Therapeutic Diets

Unit 2

Food and Nutritional Requirements during Adolescence
Fluid intake; nutrition related problems; lifestyle related problems, Role of physical activity; resting pattern and postures, Personal habits – alcoholism, and other tobacco products, electronic addiction etc

Practicals - Ethnic Foods

Unit 3

Need for a Positive Life Style Change
Peer pressure & procrastination, Stress, depression, suicidal tendency, Mini project review and viva, Whole portions revision.

Practical - Cooking without Fire or Wire-healthy Snacks

TEXTBOOKS:

REFERENCE BOOKS:
2. WHO Report on Adolescent Health: 2010

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
Syllabus

Unit 1
Introductory study of the Bhagavad Gita and the Upanishads.

Unit 2
The relevance of these classics in a modern age.

Unit 3
Goals of human life - existential problems and their solutions in the light of these classics etc.

REFERENCE:
The Bhagavad Gita, Commentary by Swami Chinmayananda

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
PREAMBLE:

This paper will introduce the students to the multiple dimensions of the contribution of India to the fields of philosophy, art, literature, physical and social sciences. The paper intends to give an insight to the students about the far-reaching contributions of India to world culture and thought during the course of its long journey from the hoary antiquity to the present times. Every nation takes pride in its achievements and it is this sense of pride and reverence towards the achievements that lays the foundation for its all-round progress.

Syllabus

Unit 1

A brief outline of Indian history from prehistoric times to the present times.

Contributions of India to world culture and civilization: Indian Philosophy and Religion; Art and Literature; Physical and Social Sciences.

Unit 2

Modern India: Challenges and Possibilities.

Scientific and technological progress in post-independence era; Socio-cultural and political movements after independence; Challenges before the nation today - unemployment – corruption – degradation of cultural and moral values - creation of a new system of education; Creation of a modern and vibrant society rooted in traditional values.

Unit 3

Modern Indian Writing in English: Trends in Contemporary Indian Literature in English.

TEXTBOOK:

Material given by the Faculty

BACKGROUND LITERATURE:

1. Selections from The Cultural Heritage of India, 6 volumes, Ramakrishna Mission Institute of Culture (Kolkata) publication.
2. Selections from the Complete Works of Swami Vivekananda, Advaita Ashrama publication.
3. Invitations to Indian Philosophy, T. M. P. Mahadevan, University of Madras, Chennai.
4. Outlines of Indian Philosophy, M. Hiriyanna, MLBD.
5. An Advanced History of India, R. C. Majumdar et al, Macmillan.
6. India Since 1526, V. D. Mahajan, S. Chand & Company
7. The Indian Renaissance, Sri Aurobindo.
8. India’s Rebirth, Sri Aurobindo.
13. Awaken Children: Conversations with Mata Amritanandamayi
15. Indian Philosophy of Beauty, T. P. Ramachandran, University of Madras, Chennai.
16. Web of Indian Thought, Sister Nivedita
17. Essays on Indian Nationalism, Anand Kumarasvamy
18. Comparative Aesthetics, Volume 2, Kanit Chandra Pandey, Chowkhamba, Varanasi
19. The Invasion That Never Was, Michel Danino
20. Samskara, U. R. Ananthamurthy, OUP.
21. Hayavadana, Girish Karnard, OUP.
22. Naga-Mandala, Girish Karnard, OUP.

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
OBJECTIVES:
To familiarize students with Sanskrit language; to introduce students to various knowledge traditions in Sanskrit; to help students appreciate and imbibe India’s ancient culture and values.

Syllabus

Unit 1
Sanskrit Language – Vakya Vyavahara

Unit 2
Language Studies - Role of Sanskrit in Indian & World Languages.

Unit 3

Unit 4

Unit 5
Indology Studies – Perspectives and Innovations.

TEXTBOOKS AND REFERENCE BOOKS:
1. Vakya Vyavahara- Prof. Vempaty Kutumba Sastri, Rashtriya Sanskrit Sansthan, New Delhi
2. The Wonder that is Sanskrit - Dr. Sampadananda Mishra, New Delhi

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
Syllabus

Unit 1
Introduction to Basic Concepts of NSS: History, philosophy, aims and objectives of NSS, Emblem, flag, motto, song, badge etc., Organisational structure, roles and responsibilities of various NSS functionaries.
NSS Programmes and Activities: Concept of regular activities, special campaigning, Day Camps, Basis of adoption of village/slums, methodology of conducting survey, financial pattern of the scheme, other youth programme/schemes of GOI, Coordination with different agencies, Maintenance of the Diary.

Unit 2
Volunteerism and Shramdan: Indian Tradition of volunteerism, Needs and importance of volunteerism, Motivation and Constraints of volunteerism, Shramdan as part of volunteerism, Amalabharatam Campaign, Swatch Bharath.

Unit 3
Understanding youth: Definition, profile and categories of youth, Issues, challenges and opportunities for youth, Youth as an agent of social change.
Youth and Yoga: History, philosophy and concept of Yoga, Myths and misconceptions about Yoga, Different Yoga traditions and their impacts, Yoga as a preventive and curative method, Yoga as a tool for healthy life style

Unit 4
Youth Development Programmes in India: National Youth Policy, Youth development programmes at the national level, state level and voluntary sector, youth-focused and youth-led organizations.

Unit 5
Environmental Issues: Environment conservation, enrichment and sustainability, climate change, waste management, rain water harvesting, energy conservation, waste land development.

Project Work / Practical

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
Course Objectives

1. To help students acquire the basic knowledge of behavior and effective living
2. To create an awareness of the hazards of health compromising behaviours
3. To develop and strengthen the tools required to handle the adversities of life

Course Outcome

CO 1: Understand the basic concepts of Behavioral Psychology
CO 2: Demonstrate self reflective skills through activities
CO 3: Apply the knowledge of psychology to relieve stress
CO 4: Analyse the adverse effects of health compromising behaviours.
CO 5: Evaluate and use guided techniques to overcome and cope with stress related problems.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO CO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>CO2</td>
<td></td>
<td></td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td></td>
<td>2</td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Syllabus

Unit 1

Self-Awareness & Self-Motivation
Self analysis through SWOT, Johari Window, Maslow’s hierarchy of motivation, importance of self esteem and enhancement of self esteem.

Unit 2

The Nature and Coping of Stress

Unit 3

Application of Health Psychology
Health compromising behaviours, substance abuse and addiction.

TEXTBOOKS:

1. V. D. Swaminathan & K. V. Kaliappan “Psychology for effective living - An introduction to Health Psychology.
REFERENCE BOOKS:

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
Course Objectives:

1. To strengthen the fundamental knowledge of human behavior
2. To strengthen the ability to understand the basic nature and behavior of humans in organizations as a whole
3. To connect the concepts of psychology to personal and professional life

Course Outcome

CO 1: Understand the fundamental processes underlying human behavior such as learning, motivation, individual differences, intelligence and personality.
CO 2: Apply the principles of psychology in day-to-day life for a better understanding of oneself and others.
CO 3: Apply the knowledge of Psychology to improve study skills and learning methods
CO 4: Apply the concepts of defense mechanisms to safeguard against abusive relationships and to nurture healthy relationships.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO</th>
<th>CO1</th>
<th>CO2</th>
<th>CO3</th>
<th>CO4</th>
</tr>
</thead>
<tbody>
<tr>
<td>PO1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>PO2</td>
<td></td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>PO3</td>
<td></td>
<td></td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>PO4</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>PO5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PO6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PO7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PO8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PO9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PO10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PO11</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PO12</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Syllabus

Unit 1
Psychology of Adolescents: Adolescence and its characteristics.

Unit 2
Learning, Memory & Study Skills: Definitions, types, principles of reinforcement, techniques for improving study skills, Mnemonics.

Unit 3
Attention & Perception: Definition, types of attention, perception.

TEXTBOOKS:

REFERENCE BOOKS:
Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
Syllabus

Unit 1
Introduction
Western and Indian views of science and technology
Introduction; Francis Bacon: the first philosopher of modern science; The Indian tradition in science and technology: an overview.

Unit 2
Indian sciences
Introduction; Ancient Indian medicine: towards an unbiased perspective; Indian approach to logic; The methodology of Indian mathematics; Revision of the traditional Indian planetary model by Nilakantha Somasutvan in circa 1500 AD

Science and technology under the British rule
Introduction; Indian agriculture before modernization; The story of modern forestry in India; The building of New Delhi

Unit 3
Science and technology in Independent India
Introduction; An assessment of traditional and modern energy resources; Green revolution: a historical perspective; Impact of modernisation on milk and oilseeds economy; Planning without the spirit and the determination.

Building upon the Indian tradition
Introduction; Regeneration of Indian national resources; Annamahatmyam and Annam Bahu Kurvita: recollecting the classical Indian discipline of growing and sharing food in plenty and regeneration of Indian agriculture to ensure food for all in plenty.

Conclusion

REFERENCES:
18. The Cultural Heritage of India. Kolkata: Ramakrishna Mission Institute of Culture.

* The syllabus and the study material in use herein has been developed out of a ‘summer programme’ offered by the Centre for Policy Studies (CPS), Chennai at the Indian Institute of Advanced Study (IIAS), Rashtrapati Nivas, Shimla, sometime ago. The same has been very kindly made available to us by Professors Dr M.D. Srinivas (Chairman) and Dr J.K. Bajaj (Director) of the CPS.

**Evaluation Pattern**

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td><em>Continuous Assessment (CA)</em></td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.*
Syllabus

Unit 1
Introduction: Relevance of Bhagavad Gita today – Background of Mahabharatha. Arjuna Vishada

Yoga: Arjuna’s Anguish and Confusion – Symbolism of Arjuna’s Chariot.


Unit 2
Karma Yoga: Yoga of Action – Living in the Present – Dedicated Action without Anxiety over Results - Concept of Swadharma.

Dhyana Yoga: Tuning the Mind – Quantity, Quality and Direction of Thoughts – Reaching Inner Silence.

Unit 3


TEXTBOOKS / REFERENCES:

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
OBJECTIVES:
To give students an introduction to the basic ideas contained in the Upanishads; and explores how their message can be applied in daily life for achieving excellence.

Syllabus

Unit 1
An Introduction to the Principal Upanishads and the Bhagavad Gita - Inquiry into the mystery of nature - Sruti versus Smrti - Sanatana Dharma: its uniqueness - The Upanishads and Indian Culture - Upanishads and Modern Science.

Unit 2
The challenge of human experience & problems discussed in the Upanishads – the True nature of Man – the Moving power of the Spirit – The Message of Fearlessness – Universal Man - The central problems of the Upanishads – Ultimate reality – the nature of Atman - the different manifestations of consciousness.

Unit 3
Upanishad Personalities - episodes from their lives and essential teachings: Yajnavalkya, Aruni, Uddalaka, Pippalada, Satyakama Jabala, Svetaketu, Nachiketas, Upakosala, Chakrayana Ushasti, Raikva, Kapila and Janaka. Important verses from Upanishads - Discussion of Sage Pippalada’s answers to the six questions in Prasnopanishad.

REFERENCES:
1. The Message of the Upanishads by Swami Ranganathananda, Bharatiya Vidya Bhavan
2. Eight Upanishads with the commentary of Sankaracharya, Advaita Ashrama
3. Indian Philosophy by Dr. S. Radhakrishnan, Oxford University Press
4. Essentials of Upanishads by R L Kashyap, SAKSI, Bangalore
5. Upanishads in Daily Life, Sri Ramakrishna Math, Mylapore.
7. Upanishad Ganga series – Chinmaya Creations

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
Course Objectives:
- To introduce the significance of food, nutrients, locally available food resources, synergic food combinations, good cooking methods and importance of diversity in foods
- To understand nutritional imbalances and chronic diseases associated with the quality of food.
- To gain awareness about the quality of food - Organic food, genetically modified food, adulterated food, allergic food, food poisoning and food safety.
- To understand food preservation processing, packaging and the use of additives.

Course Outcome:
CO1: Acquire knowledge about the various food and food groups
CO2: Understand nutritional imbalances and chronic diseases prevailing among different age groups.
CO3: Understand the significance of safe food and apply the food safety standards
CO4: Demonstrate skills of food processing, preservation and packaging methods with or without additives.
CO5: Evaluate the quality of food based on the theoretical knowledge of Food and Nutrition

CO-PO Mapping:

<table>
<thead>
<tr>
<th>PO CO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO 1</td>
<td>1</td>
<td>1</td>
<td></td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>CO 2</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>CO 3</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>CO 4</td>
<td>1</td>
<td>1</td>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>CO 5</td>
<td>1</td>
<td>1</td>
<td></td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

Syllabus Unit 1

**Food and Food Groups**
Introduction to foods, food groups, locally available foods, Nutrients, Cooking methods, Synergy between foods, Science behind foods, Food allergies, food poisoning, food safety standards.

*Cookery Practicals - Balanced Diet*

Unit 2

**Nutrients and Nutrition**
Nutrition through life cycle, RDA, Nutrition in disease, Adulteration of foods & Food additives, Packaging and labeling of foods.

*Practicals - Traditional Foods*

Unit 3

**Introduction to Food Biotechnology**
Future foods - Organic foods and genetically modified foods, Fortification of foods, value addition of foods, functional foods, Nutraceuticals, supplementary foods, Processing and preservation of foods, applications of food.
technology in daily life, and your prospects associated with food industry – Nanoparticles, biosensors, advanced research.

Practicals - Value added foods

TEXTBOOKS:

REFERENCE BOOKS:

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
Syllabus

This paper will introduce the basics of Japanese language. Students will be taught the language through various activities like writing, reading, singing songs, showing Japanese movies etc. Moreover this paper intends to give a thorough knowledge on Japanese scripts that is Hiragana and Katakana. Classes will be conducted throughout in Japanese class only. Students will be able to make conversations with each other in Japanese. Students can make self-introduction and will be able to write letters in Japanese. All the students will be given a text on Japanese verbs and tenses.

Students can know about the Japanese culture and the lifestyle. Calligraphy is also a part of this paper. Informal sessions will be conducted occasionally, in which students can sing Japanese songs, watch Japanese movies, do Origami – pattern making using paper.

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
Syllabus

Students will be taught the third and the most commonly used Japanese script, Kanji. Students will be taught to write as well as speak.

Students will be given detailed lectures on Calligraphy.

This version of the course includes a new project where the students should make a short movie in Japanese language selecting their own topics.

By the end of the semester they will master the subject in all means. They will be able to speak Japanese as fluently as they speak English. Students will be encouraged to write stories and songs in Japanese language themselves.

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
OBJECTIVES:

To enable the students to acquire basic skills in functional language; to develop independent reading skills and reading for appreciating literary works; to analyse language in context to gain an understanding of vocabulary, spelling, punctuation and speech.

Syllabus

Unit 1
Adalitha Kannada: bhashe, swaroopa, belavaniyeya kiru parichaya Paaribhaashika padagalu
Vocabulary Building

Unit 2
Prabhandha – Vyaaghra Geethe - A. N. Murthy Rao

Unit 3
Mochi – Bharateepriya
Mosarina Mangamma – Maasti Venkatesh iyengar Kamalaapurada Hotelnalli – Panje Mangesh Rao Kaanike – B. M. Shree
Geleyanobbanige bareda Kaagada – Dr. G. S. Shivarudrappa Moodala Mane – Da. Ra. Bendre
Swathantryada Hanate – K. S. Nissaar Ahmed

Unit 4
Letter W riting - Personal: Congratulation, thanks giving, invitation, condolence

Unit 5
Reading Comprehension; nudigattu, gaadegalu Speaking Skills: Prepared speech, pick and speak

REFERENCES:

1. H. S. Krishna Swami Iyangar – Adalitha Kannada – Chetana Publication, Mysuru
2. N. Murthy Rao – Aleyuva Mana – Kuvempu Kannada Adyayana Samste
3. Nemi Chandra – Badhuku Badalisabahudu – Navakarnataka Publication
4. Sanna Kathegalu - Prasaranga, Mysuru University, Mysuru
5. B. M. Shree – Kannadada Bavuta – Kannada Sahitya Parishattu
6. K. S. Nissar Ahmed – 75 Bhaavageetegalu – Sapna Book House (P) Ltd.
7. Dr. G. S. Shivarudrappa – Samagra Kavya – Kamadhenu Pustaka Bhavana

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
OBJECTIVES:

To enable the students to acquire basic skills in functional language; to develop independent reading skills and reading for appreciating literary works; to develop functional and creative skills in language; to enable the students to plan, draft, edit & present a piece of writing.

Syllabus

Unit 1
Official Correspondence: Adhikrutha patra, prakatane, manavi patra, vanijya patra

Unit 2
Nanna Hanate - Dr. G. S. Shivarudrappa
Ella Marethiruvaga - K. S. Nissaar Ahmed Saviraru Nadigalu – S Siddalingayya

Unit 3

Unit 4
Sarva Sollegala turtu Maha Samelana - Beechi Swarthakkaagi Tyaga - Beechi

Unit 5
Essay writing: Argumentative & Analytical Précis writing

REFERENCES:

1. H. S. Krishnaswami Iyangar – Adalitha Kannada – Chetan Publication, Mysuru
2. Dr. G. S. Shivarudrappa – Samagra Kavya. - Kamadhenu Pustaka Bhavana
4. K. S. Nissar Ahmed – 75 Bhaavageetegalu – Sapna book house
5. Dr. Da. Ra. Bendre – Saayo Aata – Shri Maata Publication

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
Course Objectives:
To appreciate the aesthetics & cultural implications; to enhance creative thinking in mother tongue; to learn our culture & values; to equip students read & write correct Malayalam; to correct the mistakes in pronunciation; to create awareness that good language is the sign of complete personality.

Course Outcome:
After the completion of the course the student will be able to:

CO1: Understand and inculcate philosophical thoughts and practices
CO2: Understand and appreciate the post modern trends of literature.
CO3: Analyse the literary texts and comprehend the cultural diversity of Kerala
CO4: Distinguish the different genres in Malayalam literature
CO5: Demonstrate the ability to effectively communicate in Malayalam

CO-PO Mapping:

<table>
<thead>
<tr>
<th>PO</th>
<th>CO1</th>
<th>CO2</th>
<th>CO3</th>
<th>CO4</th>
<th>CO5</th>
</tr>
</thead>
<tbody>
<tr>
<td>PO1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PO2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PO3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PO4</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PO5</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PO6</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PO7</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PO8</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PO9</td>
<td>2</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>PO10</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>PO11</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>PO12</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Syllabus

Unit 1
Ancient poet trio: Adhyatmaramayanam, Lakshmana Swanthanam (valsa soumitre… mungikidakayal), Ezhuthachan - Medieval period classics –Jnanappana (kalaminnu… vilasangalingane), Poonthanam

Unit 2

Unit 3
Short stories from period 1/2/3, Poovanpazham - Vaikaom Muhammed Basheer - Literary & Cultural figures of Kerala and about their literary contributions.

Unit 4
Literary Criticism: Ithihasa studies - Bharatha Paryadanam - Vyasante Chiri - Kuttikrishna Mararu - Outline of literary Criticism in Malayalam Literature - Introduction to Kutti Krishna Mararu & his outlook towards literature & life.

Unit 5
Error-free Malayalam: 1. Language; 2. Clarity of expression; 3. Punctuation – Thettillatha Malayalam
Writing - a. Expansion of ideas; b. Precis Writing; c. Essay Writing; d. Letter writing; e. Radio Speech; f. Script / Feature / Script Writing; g. News Editing; h. Advertising; i. Editing; j. Editorial Writing; k. Critical appreciation of literary works (Any one or two as an assignment).

REFERENCES:

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
OBJECTIVES:
To appreciate the aesthetics & cultural implications; to enhance creative thinking in mother-tongue; to learn our culture & values; to equip students read & write correct Malayalam; to correct the mistakes in pronunciation; to create awareness that good language is the sign of complete personality.

Course Outcome:
After the completion of the course the student will be able to:

CO1: Understand the different cultural influences in linguistic translation
CO2: Identify and appreciate the Romantic elements of modern literature
CO3: Analyze the genre of autobiographical writing
CO4: Critically evaluate the significance of historical, political and socio cultural aspects in literature
CO5: Demonstrate good writing skills in Malayalam

CO-PO Mapping:

<table>
<thead>
<tr>
<th>PO CO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>3</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>3</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>3</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO4</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO5</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Syllabus
Unit 1

Unit 2

Unit 3
Anthology of short stories from period 3/4/5: Ninte Ormmayku, M. T. Vasudevan Nair - literary contributions of his time

Unit 4
Part of an autobiography / travelogue: Kannerum Kinavum, V. T. Bhattathirippadu - Socio-cultural literature - historical importance.

Unit 5
Error-free Malayalam - 1. Language; 2. Clarity of expression; 3. Punctuation - Thettillatha Malayalam
Writing - a. Expansion of ideas; b. Précis Writing; c. Essay Writing; d. Letter writing; e. Radio Speech; f. Script / Feature Script Writing; g. News Editing; h. Advertising; i. Editing; j. Editorial Writing; k. Critical appreciation of literary works (Any one or two as an assignment).

REFERENCES:
1. Narayana Pillai, P. K. Sahitya Panchanan, Vimarsanathrayam, Kerala Sahitya Academy, 2000

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
OBJECTIVES:

To familiarize students with Sanskrit language and literature; to enable them to read and understand Sanskrit verses and sentences; to help them acquire expertise for self-study of Sanskrit texts and communication in Sanskrit; to help the students imbibe values of life and Indian culture as propounded in scriptures.

Syllabus

Unit 1
Introduction to Sanskrit language, Devanagari script - Vowels and consonants, pronunciation, classification of consonants, conjunct consonants, words – nouns and verbs, cases – introduction, numbers, Pronouns, communicating time in Sanskrit. Practical classes in spoken Sanskrit

Unit 2
Verbs- Singular, Dual and plural – First person, Second person, Third person. Tenses – Past, Present and Future – Atmanepadi and Parasmaipadi-karthariprayoga

Unit 3
Words for communication, slokas, moral stories, subhashithas, riddles (from the books prescribed)

Unit 4
Selected slokas from Valmiki Ramayana, Kalidasa’s works and Bhagavad Gita. Ramayana – chapter VIII - verse 5, Mahabharata - chapter 174, verse -16, Bhagavad Gita – chapter - IV verse 8, Kalidasa’s Sakuntalam Act IV – verse 4

Unit 5
Translation of simple sentences from Sanskrit to English and vice versa.

ESSENTIAL READING:

1. Praveshaha; Publisher: Samskrita bharati, Aksharam, 8th cross, 2nd phase, girinagar, Bangalore - 560 085
2. Sanskrit Reader I, II and III, R. S. Vadhyar and Sons, Kalpathi, Palakkad
3. Prakriya Bhashyam written and published by Fr. John Kunnappally
4. Sanskrit Primer by Edward Delavan Perry, published by Ginn and Company Boston
5. Sabdamanjari, R. S. Vadyar and Sons, Kalpathi, Palakkad
6. Namalingamsasanam by Amarasintha published by Travancore Sanskrit series
7. Subhashita Ratna Bhandakara by Kashinath Sharma, published by Nrnayasagar press

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
OBJECTIVES:
To familiarize students with Sanskrit language and literature; to enable them to read and understand Sanskrit verses and sentences; to help them acquire expertise for self-study of Sanskrit texts and communication in Sanskrit; to help the students imbibe values of life and Indian culture as propounded in scriptures.

Syllabus
Unit 1
Seven cases, indeclinables, sentence making with indeclinables, Saptha karakas.

Unit 2

Unit 3
Words and sentences for advanced communication. Slokas, moral stories (Pancatantra) Subhashitas, riddles.

Unit 4
Introduction to classical literature, classification of Kavyas, classification of Dramas - The five Mahakavyas, selected slokas from devotional kavyas - Bhagavad Gita – chapter - II verse 47, chapter - IV verse 7, chapter -VI verse 5, chapter - VIII verse 6, chapter - XVI verse 21, Kalidasa’s Sakuntala act IV – verse 4, Isavasyopanishat 1st Mantra, Mahabharata chapter 149 verses 14 - 120, Neetisara chapter - III

Unit 5
Translation of paragraphs from Sanskrit to English and vice versa.

ESSENTIAL READING:
1. Praveshaha; Publisher: Samskrita bharati, Aksharam, 8th cross, 2nd phase, girinagar, Bangalore -560 085
2. Sanskrit Reader I, II and III, R.S. Vadhyar and Sons, Kalpathi, Palakkad
3. Prakriya Bhashyam written and published by Fr. John Kunnappally
4. Sanskrit Primer by Edward Delavan Perry, published by Ginn and Company Boston
5. Sabdamanjari, R. S. Vadyar and Sons, Kalpathi, Palakkad
6. Namalingamusasanam by Amarasimha published by Travancore Sanskrit series

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td>50</td>
<td></td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
Syllabus

Unit 1
Understanding CSR - Evolution, importance, relevance and justification. CSR in the Indian context, corporate strategy. CSR and Indian corporate. Structure of CSR - In the Companies Act 2013 (Section 135); Rules under Section 13; CSR activities, CSR committees, CSR policy, CSR expenditure CSR reporting.

Unit 2
CSR Practices & Policies - CSR practices in domestic and international area; Role and contributions of voluntary organizations to CSR initiatives. Policies; Preparation of CSR policy and process of policy formulation; Government expectations, roles and responsibilities. Role of implementation agency in Section 135 of the Companies Act, 2013. Effective CSR implementation.

Unit 3
Project Management in CSR initiatives - Project and programme; Monitoring and evaluation of CSR Interventions. Reporting - CSR Documentation and report writing. Reporting framework, format and procedure.

REFERENCES:

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
Syllabus

Unit 1

Unit 2

Unit 3
Strategies of Help and Care: Positive impact of work on health, Characteristics of mentally healthy workplace, Employee and employer obligations, Promoting mental health and well being- corporate social responsibility (CSR), an inclusive work environment, Training and awareness raising, managing performance, inclusive recruitment, Supporting individuals - talking about mental health, making reasonable adjustments, Resources and support for employees - Employee Assistance Programme / Provider (EAP), in house counsellor, medical practitioners, online resources and telephone support, 24 hour crisis support, assistance for colleagues and care givers, Legislations. Case Study, Activity.

REFERENCES:
3. Canadian Mental Health Association, Ontario “Workplace mental health promotion, A how to guide”www.cmhaontario.ca/
6. Mental Health Act 1987 (India) www.tnhealth.org/mha.htm
7. Persons with disabilities Act 1995 (India) socialjustice.nic.in
8. The Factories Act 1948 (India) www.caaa.in/Image/19ulabourlawshb.pdf

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
Course Objectives:

- To introduce the students to different literature - Sangam literature, Epics, Bhakthi literature and modern literature.
- To improve their ability to communicate with creative concepts, and also to introduce them to the usefulness of basic grammatical components in Tamil.

Course Outcomes

CO 1: To understand the Sangam literature
CO 2: To understand the creative literature
CO 3: To understand the literary work on religious scriptures
CO 4: To improve the communication and memory skills
CO 5: To understand the basic grammar components of Tamil language and their usage and applications
CO 6: Understand creative writing aspects and apply them.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>CO2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>CO3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>CO4</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>CO5</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>CO6</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>-</td>
</tr>
</tbody>
</table>

Syllabus

Unit 1
The history of Tamil literature: Nāṭṭupūṟap pāṭalkaḷ, kataikkal, palamolikkaḷ - ciṟukataikaḷ tōṟṟamum vaḷarcciyum, ciṟṟilakkiyaṅkāḷ: Kaliṅkattup paraṇi (pōrpāṭiyatu) - mukkūṭar paḷḷu 35.
Kāppiyaṅkāḷ: Cilappatikāram – manimēkalai naṭaiyiyal āyvu maṟṟum aimerum – aĩciṟuṅ kāppiyaṅkāḷ toṭarpāṅa ceytiкал.

Unit 2
tiṇai ilakkiyamum nīṭiyilakkiyamum - patiņenkiḷkuṇaṅkku nūlkaḷ toṭarpāṅa piṟa ceytiкал - tirukkuṟṟal (aṟṟu, paṇpu, kalvi, oḻukkam, natpu, vāymai, kēḷvi, ceyนาṉri, periyāratiṟṇaḻkkōṭal, viljippuṇarvu peŋṟa atikārattil uḷḷa ceytiкал.
Aṟanūlkaḷ: Ulakanīti (1-5) – ēḷāti (1,3,6). - Cittarkal: Kaṭuveḷi cittiṟ pāṭalkaḷ (aŋnantak kalippu –1, 4, 6, 7, 8), maṟṟum akappēy citter pāṭalkaḷ (1-5).

Unit 3
tamiḻ ilakkanam: Vākkiya vakaikal – taṉviṉai piṟavini – nērkkūṟu ayarkūṟu

Unit 4
Unit 5

Textbooks:
5. n. Vaanamalai, “tamilar nattupatalkal” niyu ceicuri puttaka veliyitakkam 1964, 2006
6. pongo manimana “atong tamil ilkakaam “atong paplisin kurup, vauciyur,

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.
Course Objectives

- To learn the history of Tamil literature.
- To analyze different styles of Tamil Language.
- To strengthen the creativity in communication, Tamil basic grammar and use of computer on Tamil Language.

Course Outcomes

CO 1: Understand the history of Tamil literature.
CO 2: Apply practical and comparative analyses on literature.
CO 3: Understand thinai literature, literature on justice, Pathinenkeelkanaku literature.
CO 4: Understand the tamil scholars’ service to Tamil language and society.
CO 5: Understand components of Tamil grammar and its usage.
CO 6: Understand creative writing aspects and apply them.

CO-PO Mapping

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO1</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>CO2</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>CO3</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>CO4</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>CO5</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>CO6</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td>2</td>
<td>-</td>
</tr>
</tbody>
</table>

Syllabus

Unit 1

The history of Tamil literature:
Nāṭṭupuṟap pāṭalkaḷ, kataikkal, pāḻamoḻikaḷ - ciṟukataikaḷ tōṟṟamum vaḷarcciyum, ciṟṟilakkiyaṅkaḷ: Kalinkattup paraṇi (pōrpāṭiyatu) - mukkūṭar paḷḷu 35.
Kāppiyaṅkaḷ: Cilappatikāram - maṇimēkalai āyvu maṟṟum aimperum - aṅciṟuṅ kāppiyaṅkaḷ toṭarpāṉa ceytikaḷ.

Unit 2

tiṇai ilakkiyamum nītiyilakkiyamum - pāṭeņkāḻkaṇṇakku nūlkaḷ toṭarpāṉa piḷa ceytikaḷ - tirukkuṟṟa (புṟு, புன, கல்வி, டின்ஸ், பொய்யல், பாதுகை, வில்லூடு, பிள்ளை), maṟṟum pāṭalkaḷ (1-5).

Unit 3

tamiḻ ilakkaṇam: Vākkiya vakaikaḷ – taṇṭhānai piṟaviṇai – nērkkūṟṟu ayarkūṟṟu

Unit 4

Unit 5

Text Books / References
Mu.Varatarācaṉ “tamiḻ ilakkiya varalāṟu” cāhitya aكاţemi paplıḱēṣaṇs, 2012
nā.Vāṇamāmalai, “tamiḻar nāṭṭuppāṭalkaḷ” niyū ceṅcuri puttaka veliyiṭṭakam 1964,2006 poṅ maṉimāṟaṅ “aṭōṅ tamiḻ ilakkaṇam ”aṭōṅ papḷiṣiṅ kurūp, vaṅcyū

Evaluation Pattern

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Internal</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodical 1 (P1)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Periodical 2 (P2)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>*Continuous Assessment (CA)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>End Semester</td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

*CA – Can be Quizzes, Assignment, Projects, and Reports.