Vision of the Department
To educate students with conceptual knowledge and technical skills in the field of Information Technology with moral and ethical values to achieve excellence in academic, industry and research centric environments.

Mission of the Department
1. To inculcate in students a firm foundation in theory and practice of IT skills coupled with the thought process for disruptive innovation and research methodologies, to keep pace with emerging technologies.
2. To provide a conducive environment for all academic, administrative and interdisciplinary research activities using state-of-the-art technologies.
3. To stimulate the growth of graduates and doctorates, who will enter the workforce as productive IT engineers, researchers and entrepreneurs with necessary soft skills, and continue higher professional education with competence in the global market.
4. To enable seamless collaboration with the IT industry and Government for consultancy and sponsored research.
5. To cater to cross-cultural, multinational and demographic diversity of students.
6. To educate the students on the social, ethical, and moral values needed to make significant contributions to society.

1. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):
   I. Demonstrate core competence in basic engineering and mathematics to design, formulate, analyze, and solve hardware/software engineering problems.
   II. Develop insights in foundational areas of Information Technology and related engineering to address real-world problems using digital and cognitive technologies.
   III. Collaborate with industry, academic and research institutions for state-of-the-art product development and research.
   IV. Inculcate a high degree of professionalism, effective communication skills and team spirit to work on multidisciplinary projects in diverse environments.
   V. Practice high ethical values and technical standards.

2. PROGRAMME OUTCOMES (POs):
   After going through the four years of study, our Information Technology Graduates will exhibit ability to:

<table>
<thead>
<tr>
<th>PO#</th>
<th>Graduate Attribute</th>
<th>Programme Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Engineering knowledge</td>
<td>Apply knowledge of mathematics, basic science and engineering science.</td>
</tr>
<tr>
<td>2</td>
<td>Problem analysis</td>
<td>Identify, formulate and solve engineering problems.</td>
</tr>
</tbody>
</table>
3. Design/development of solutions

Design a system or process to improve its performance, satisfying its constraints.

4. Conduct investigations of complex problems

Conduct experiments & collect, analyze and interpret the data.

5. Modern tool usage

Apply various tools and techniques to improve the efficiency of the system.

6. The Engineer and society

Conduct themselves to uphold the professional and social obligations.

7. Environment and sustainability

Design the system with environment consciousness and sustainable development.

8. Ethics

Interact in industry, business and society in a professional and ethical manner.

9. Individual and team work

Function in a multidisciplinary team.

10. Communication

Proficiency in oral and written communication.

11. Project management and finance

Implement cost effective and improved system.

12. Life-long learning

Continue professional development and learning as a life-long activity.

3. PROGRAM SPECIFIC OUTCOMES (PSOs):

I. Ability to apply programming principles and practices for the design of software solutions in an internet-enabled world of business and social activities.

II. Ability to identify the resources to build and manage the IT infrastructure using the current technologies in order to solve real world problems with an understanding of the tradeoffs involved in the design choices.

III. Ability to plan, design and execute projects for the development of intelligent systems with a focus on the future.

4. PEO / PO Mapping:

<table>
<thead>
<tr>
<th>PROGRAMME EDUCATIONAL OBJECTIVES</th>
<th>PROGRAMME OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>I</td>
<td>✓</td>
</tr>
<tr>
<td>II</td>
<td>✓</td>
</tr>
<tr>
<td>III</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td></td>
</tr>
<tr>
<td>V</td>
<td></td>
</tr>
</tbody>
</table>
# Mapping of Course Outcome and Programme Outcome:

<table>
<thead>
<tr>
<th>Course Name</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>Technical English</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engineering Mathematics I</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engineering Physics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engineering Chemistry</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Semester 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>Problem Solving and Python Programming</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basic Sciences Laboratory</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Problem solving and Python Programming</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laboratory</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Semester 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>Professional Communication</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engineering Mathematics II</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Information Technology Essentials</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Basics of Electrical and Electronics</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engineering Graphics</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Semester 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>Information Technology Essentials</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrical and Electronics Engineering</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laboratory</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>YEAR 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>Discrete Mathematics</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Digital Logic and Design</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Semester 4</td>
<td>Electives – Humanities I</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------</td>
<td>-------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Programming and Data Structures</td>
<td></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>Database Management Systems</td>
<td></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>Software Engineering</td>
<td></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>Electives – Humanities I</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Semester 4</th>
<th>Electives – Humanities II</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Environmental Sciences</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Audit Course I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Object Oriented Programming and Advanced Data Structures</td>
</tr>
<tr>
<td>Design and Analysis of Algorithms</td>
</tr>
<tr>
<td>Operating Systems</td>
</tr>
<tr>
<td>Computer Architecture</td>
</tr>
<tr>
<td>Operating Systems Laboratory</td>
</tr>
<tr>
<td>Advanced Data Structures Laboratory</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>YEAR 1 Semester 5</th>
<th>Audit Course II</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Compiler Engineering</td>
</tr>
<tr>
<td></td>
<td>Computer Networks</td>
</tr>
<tr>
<td></td>
<td>Web Technologies</td>
</tr>
<tr>
<td>Semester 6</td>
<td>Professional Elective I</td>
</tr>
<tr>
<td>------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>YEAR 2 Semester 7</td>
<td>Artificial Intelligence</td>
</tr>
</tbody>
</table>

Note: The table above represents the course structure for the mentioned years and semesters. The symbols (✓) indicate the presence of the course.
<table>
<thead>
<tr>
<th>Semester 8</th>
<th>Professional Elective IV</th>
<th>Professional Elective V</th>
<th>Open Elective</th>
<th>Mobile and Security Laboratory</th>
<th>Project I</th>
<th>Professional Elective VI</th>
<th>Professional Elective VII</th>
<th>Project II</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# ANNA UNIVERSITY, CHENNAI
## UNIVERSITY DEPARTMENTS
### B.TECH. INFORMATION TECHNOLOGY
#### REGULATIONS – 2019
##### CHOICE BASED CREDIT SYSTEM
###### CURRICULA AND SYLLABI FOR I - VIII SEMESTER

### SEMESTER I

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>CODE NO.</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>PERIODS PER WEEK</th>
<th>TOTAL CONTACT PERIODS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>PERIODS</td>
<td>CONTACT PERIODS</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L</td>
<td>T</td>
<td>P</td>
</tr>
<tr>
<td>1</td>
<td>HS5151</td>
<td>Technical English</td>
<td>HSMC</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>MA5158</td>
<td>Engineering Mathematics I</td>
<td>BSC</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>PH5151</td>
<td>Engineering Physics</td>
<td>BSC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>CY5151</td>
<td>Engineering Chemistry</td>
<td>BSC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>GE5153</td>
<td>Problem Solving and Python Programming</td>
<td>ESC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BS5161</td>
<td>Basic Sciences Laboratory</td>
<td>BSC</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>GE5161</td>
<td>Problem Solving and Python Programming Laboratory</td>
<td>ESC</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6</td>
<td></td>
<td></td>
<td>16</td>
<td>1</td>
<td>8</td>
</tr>
</tbody>
</table>

### SEMESTER II

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>CODE NO.</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>PERIODS PER WEEK</th>
<th>TOTAL CONTACT PERIODS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>PERIODS</td>
<td>CONTACT PERIODS</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L</td>
<td>T</td>
<td>P</td>
</tr>
<tr>
<td>1</td>
<td>HS5251</td>
<td>Professional Communication</td>
<td>HSMC</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>MA5252</td>
<td>Engineering Mathematics II</td>
<td>BSC</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>IT5201</td>
<td>Information Technology Essentials</td>
<td>ESC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>EE5251</td>
<td>Basics of Electrical and Electronics Engineering</td>
<td>ESC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>GE5151</td>
<td>Engineering Graphics</td>
<td>ESC</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>IT5211</td>
<td>Information Technology Essentials Laboratory</td>
<td>ESC</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>EE5261</td>
<td>Electrical and Electronics Engineering Laboratory</td>
<td>ESC</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6</td>
<td></td>
<td></td>
<td>14</td>
<td>1</td>
<td>12</td>
</tr>
</tbody>
</table>
### SEMESTER III

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>CODE NO.</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>PERIODS PER WEEK</th>
<th>TOTAL CONTACT PERIODS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L</td>
<td>T</td>
<td>P</td>
</tr>
<tr>
<td><strong>THEORY</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>L</strong></td>
<td><strong>T</strong></td>
<td><strong>P</strong></td>
</tr>
<tr>
<td>1</td>
<td>MA5302</td>
<td>Discrete Mathematics</td>
<td>BSC</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>IT5301</td>
<td>Digital Logic and Design</td>
<td>ESC</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>IT5352</td>
<td>Programming and Data Structures</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>IT5351</td>
<td>Database Management Systems</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>IT5302</td>
<td>Software Engineering</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>Electives – Humanities I</td>
<td>HSMC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>PRACTICALS</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>L</strong></td>
<td><strong>T</strong></td>
<td><strong>P</strong></td>
</tr>
<tr>
<td>7</td>
<td>IT5311</td>
<td>Programming and Data Structures Laboratory</td>
<td>PCC</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>8</td>
<td>IT5312</td>
<td>Database Management Systems Laboratory</td>
<td>PCC</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>L</strong></td>
<td><strong>T</strong></td>
<td><strong>P</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>17</td>
<td>1</td>
<td>10</td>
</tr>
</tbody>
</table>

### SEMESTER IV

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>CODE NO.</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>PERIODS PER WEEK</th>
<th>TOTAL CONTACT PERIODS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L</td>
<td>T</td>
<td>P</td>
</tr>
<tr>
<td><strong>THEORY</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>L</strong></td>
<td><strong>T</strong></td>
<td><strong>P</strong></td>
</tr>
<tr>
<td>1.</td>
<td>GE5251</td>
<td>Environmental Sciences</td>
<td>BSC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2.</td>
<td>IT5401</td>
<td>Object Oriented Programming and Advanced Data Structures</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3.</td>
<td>IT5402</td>
<td>Design and Analysis of Algorithms</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4.</td>
<td>IT5403</td>
<td>Operating Systems</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5.</td>
<td>IT5451</td>
<td>Computer Architecture</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6.</td>
<td></td>
<td>Audit Course – I *</td>
<td>AC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7.</td>
<td></td>
<td>Electives – Humanities II</td>
<td>HSMC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>PRACTICALS</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>L</strong></td>
<td><strong>T</strong></td>
<td><strong>P</strong></td>
</tr>
<tr>
<td>8.</td>
<td>IT5411</td>
<td>Operating Systems Laboratory</td>
<td>PCC</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>9.</td>
<td>IT5412</td>
<td>Advanced Data Structures Laboratory</td>
<td>PCC</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>L</strong></td>
<td><strong>T</strong></td>
<td><strong>P</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>21</td>
<td>0</td>
<td>8</td>
</tr>
</tbody>
</table>

*Audit Course is optional*
### Semester V

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Code No.</th>
<th>Course Title</th>
<th>Category</th>
<th>Periods Per Week</th>
<th>Total Contact Periods</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L T P</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>THEORY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>IT5502</td>
<td>Compiler Engineering</td>
<td>PCC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>IT5551</td>
<td>Computer Networks</td>
<td>PCC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>IT5501</td>
<td>Web Technologies</td>
<td>PCC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td>Electives – Humanities I</td>
<td>HSMC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td></td>
<td>Professional Elective I</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td></td>
<td>Audit Course II *</td>
<td>AC</td>
<td>3 0 0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td><strong>PRACTICALS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>IT5511</td>
<td>Computer Networks Laboratory</td>
<td>PCC</td>
<td>0 0 4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>8.</td>
<td>IT5512</td>
<td>Web Technologies Laboratory</td>
<td>PCC</td>
<td>0 0 4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>9.</td>
<td>IT5513</td>
<td>Summer Internship / Summer Project (Minimum 4 Weeks)</td>
<td>EEC</td>
<td>0 0 0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td>18 0 8</td>
<td>26</td>
<td>21</td>
</tr>
</tbody>
</table>

*Audit Course is optional

### Semester VI

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Code No.</th>
<th>Course Title</th>
<th>Category</th>
<th>Periods Per Week</th>
<th>Total Contact Periods</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L T P</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>THEORY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>IT5601</td>
<td>Embedded Systems and Internet of Things</td>
<td>PCC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>IT5602</td>
<td>Data Science and Analytics</td>
<td>PCC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>IT5603</td>
<td>Distributed and Cloud Computing</td>
<td>PCC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Professional Elective II</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Professional Elective III</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>Open Elective I</td>
<td>OEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td><strong>PRACTICALS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>IT5611</td>
<td>Embedded Systems and Internet of Things Laboratory</td>
<td>PCC</td>
<td>0 0 4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>IT5612</td>
<td>Data Analytics and Cloud Computing Laboratory</td>
<td>PCC</td>
<td>0 0 4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>IT5613</td>
<td>Socially Relevant Project Laboratory</td>
<td>EEC</td>
<td>0 0 2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td>18 0 10</td>
<td>28</td>
<td>23</td>
</tr>
</tbody>
</table>
## SEMESTER VII

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>CODE NO.</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>PERIODS PER WEEK</th>
<th>TOTAL CONTACT PERIODS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>THEORY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>IT5701</td>
<td>Artificial Intelligence</td>
<td>PCC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>IT5702</td>
<td>Mobile Computing</td>
<td>PCC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>IT5703</td>
<td>Cryptography and Security</td>
<td>PCC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Professional Elective IV</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Professional Elective V</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>Open Elective II</td>
<td>OEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>PRACTICALS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>IT5711</td>
<td>Mobile and Security Laboratory</td>
<td>PCC</td>
<td>0 0 4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>IT5712</td>
<td>Project I</td>
<td>EEC</td>
<td>0 0 4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>18 0 8</td>
<td>26</td>
<td>22</td>
</tr>
</tbody>
</table>

## SEMESTER VIII

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>CODE NO.</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>PERIODS PER WEEK</th>
<th>TOTAL CONTACT PERIODS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>THEORY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>Professional Elective VI</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Professional Elective VII</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>PRACTICALS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>IT5811</td>
<td>Project II</td>
<td>EEC</td>
<td>0 0 16</td>
<td>16</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6 0 16</td>
<td>22</td>
<td>14</td>
</tr>
</tbody>
</table>

**TOTAL NO. OF CREDITS: 167**
SUMMARY

B.TECH. INFORMATION TECHNOLOGY

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Subject Area</th>
<th>Credits per Semester</th>
<th>Credits Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>I</td>
<td>II</td>
</tr>
<tr>
<td>1</td>
<td>HSMC</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>BSC</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>ESC</td>
<td>5</td>
<td>13</td>
</tr>
<tr>
<td>4</td>
<td>PCC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>PEC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>OEC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>EEC</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Non-Credit / (Audit Course)

DOMAIN WISE GROUPING OF ELECTIVES:
- The electives have been grouped into 5 domains. The students should take electives from a minimum of four domains (to obtain breadth-wise knowledge), and a minimum of three electives from a single domain (to obtain depth-wise knowledge). The semesters in which the electives can be taken is mentioned.
<table>
<thead>
<tr>
<th>Course</th>
<th>Syllabus</th>
<th>Semesters</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>4</strong> Graph Theory**</td>
<td>Semantic Web</td>
<td>Sem: V, VI, VII, VIII</td>
</tr>
<tr>
<td><strong>5</strong> Human Computer Interaction</td>
<td>Information Retrieval</td>
<td>Sem: VI, VII, VIII</td>
</tr>
<tr>
<td><strong>6</strong> Logic and Applications in Computer</td>
<td>IoT Based Smart Systems</td>
<td>Sem: VII, VIII</td>
</tr>
<tr>
<td><strong>7</strong> Infrastructure Management</td>
<td>Machine Learning</td>
<td>Sem: VII, VIII</td>
</tr>
<tr>
<td><strong>8</strong> Quantum Computing</td>
<td>Cognitive Computing</td>
<td>Sem: VII, VIII</td>
</tr>
<tr>
<td><strong>9</strong> Blockchain Technologies</td>
<td>Computational Linguistics</td>
<td>Sem: VII, VIII</td>
</tr>
<tr>
<td><strong>10</strong> Deep Learning</td>
<td>Video Processing and Analytics</td>
<td>Sem: VII, VIII</td>
</tr>
<tr>
<td><strong>11</strong> Probability and Random Processes</td>
<td>Linear Algebra and Numerical Methods</td>
<td>Sem: VII, VIII</td>
</tr>
</tbody>
</table>
# LIST OF PROFESSIONAL ELECTIVES

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>ELECTIVE DOMAIN</th>
<th>CATEGORY</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>CONTACT PERIODS</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>IT5001</td>
<td>Virtualization (SEMESTER V)</td>
<td>A</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>IT5002</td>
<td>Unix Internals</td>
<td>A</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>IT5003</td>
<td>Heterogeneous Computing</td>
<td>A</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>IT5004</td>
<td>Graph Theory</td>
<td>A</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>IT5005</td>
<td>Human Computer Interaction</td>
<td>A</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>IT5006</td>
<td>Logic and Applications in Computer Science</td>
<td>A</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>7.</td>
<td>IT5007</td>
<td>Advances in Databases</td>
<td>B</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>8.</td>
<td>IT5008</td>
<td>Computer Graphics</td>
<td>C</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>9.</td>
<td>IT5009</td>
<td>Multimedia Technologies</td>
<td>C</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>10.</td>
<td>IT5010</td>
<td>Fundamentals Digital Signal Processing</td>
<td>C</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>11.</td>
<td>IT5011</td>
<td>Multimedia Coding Techniques</td>
<td>C</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>12.</td>
<td>IT5012</td>
<td>Pattern Recognition</td>
<td>C</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>13.</td>
<td>IT5013</td>
<td>Visualization Techniques</td>
<td>C</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>14.</td>
<td>IT5014</td>
<td>C# and .NET Programming</td>
<td>D</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>15.</td>
<td>IT5015</td>
<td>Software Testing</td>
<td>D</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>16.</td>
<td>IT5016</td>
<td>E-Learning Techniques</td>
<td>D</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
<td>Division</td>
<td>Credits</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------</td>
<td>--------------------------------------------------</td>
<td>----------</td>
<td>---------</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. IT5017</td>
<td>Infrastructure Management</td>
<td>A</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. IT5018</td>
<td>Quantum Computing</td>
<td>A</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. IT5019</td>
<td>Soft Computing</td>
<td>B</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20. IT5020</td>
<td>Social Network Analysis</td>
<td>B</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21. IT5021</td>
<td>Semantic Web</td>
<td>B</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22. IT5022</td>
<td>Information Retrieval</td>
<td>B</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23. IT5023</td>
<td>Fundamentals of Digital Image Processing</td>
<td>C</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24. IT5024</td>
<td>Mixed Reality</td>
<td>C</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25. IT5025</td>
<td>Game Programming</td>
<td>C</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26. IT5026</td>
<td>Intellectual Property Rights</td>
<td>D</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27. IT5027</td>
<td>Software Project Management</td>
<td>D</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28. IT5028</td>
<td>Service Oriented Architecture and Microservices</td>
<td>D</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29. IT5029</td>
<td>Software Quality Assurance</td>
<td>D</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30. IT5030</td>
<td>Autonomous Ground Vehicle Systems</td>
<td>D</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31. IT5031</td>
<td>Advanced Networks</td>
<td>E</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32. IT5032</td>
<td>Network Programming and Management</td>
<td>E</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33. IT5033</td>
<td>TCP/IP Design and Implementation</td>
<td>E</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Course Code</td>
<td>Title</td>
<td>Type</td>
<td>Credits</td>
<td>ECTS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td>--------------------------------------</td>
<td>------</td>
<td>---------</td>
<td>------</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IT5034</td>
<td>Blockchain Technologies</td>
<td>A</td>
<td>3 0 0</td>
<td>3 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IT5035</td>
<td>IoT Based Smart Systems</td>
<td>B</td>
<td>3 0 0</td>
<td>3 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IT5036</td>
<td>Machine Learning</td>
<td>B</td>
<td>3 0 0</td>
<td>3 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IT5037</td>
<td>Cognitive Computing</td>
<td>B</td>
<td>3 0 0</td>
<td>3 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IT5038</td>
<td>Computational Linguistics</td>
<td>B</td>
<td>3 0 0</td>
<td>3 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IT5039</td>
<td>Deep Learning</td>
<td>B</td>
<td>3 0 0</td>
<td>3 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MA5002</td>
<td>Probability and Random Processes</td>
<td>B</td>
<td>3 1 0</td>
<td>4 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MA5356</td>
<td>Linear Algebra and Numerical Methods</td>
<td>B</td>
<td>3 1 0</td>
<td>4 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IT5040</td>
<td>Video Processing and Analytics</td>
<td>C</td>
<td>3 0 0</td>
<td>3 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IT5041</td>
<td>Full Stack Software Development</td>
<td>D</td>
<td>3 0 0</td>
<td>3 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IT5042</td>
<td>Wireless Sensor and Mesh Networks</td>
<td>E</td>
<td>3 0 0</td>
<td>3 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IT5043</td>
<td>Ethical Hacking</td>
<td>E</td>
<td>3 0 0</td>
<td>3 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IT5044</td>
<td>Next Generation Networks</td>
<td>E</td>
<td>3 0 0</td>
<td>3 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IT5045</td>
<td>Computer Forensics</td>
<td>E</td>
<td>3 0 0</td>
<td>3 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# HSMC COURSES

<table>
<thead>
<tr>
<th>S.NO</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>CONTACT PERIODS</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>HS5151</td>
<td>Technical English</td>
<td>HSMC</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>HS5251</td>
<td>Professional Communication</td>
<td>HSMC</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

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

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

## HSMC– ELECTIVES – HUMANITIES II (EVEN SEMESTER)

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Periods per week</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lecture</td>
<td>Tutorial</td>
</tr>
<tr>
<td>1.</td>
<td>HU5271</td>
<td>Gender, Culture and Development</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>2.</td>
<td>HU5272</td>
<td>Ethics and Holistic Life</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>3.</td>
<td>HU5273</td>
<td>Law and Engineering</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>4.</td>
<td>HU5274</td>
<td>Film Appreciation</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>5.</td>
<td>HU5275</td>
<td>Fundamentals of Language and Linguistics</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>6.</td>
<td>HU5276</td>
<td>Understanding Society and Culture through Literature</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

## BASIC SCIENCE COURSES

<table>
<thead>
<tr>
<th>S.NO</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>CONTACT PERIODS</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>MA5158</td>
<td>Engineering Mathematics I</td>
<td>BSC</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>PH5151</td>
<td>Engineering Physics</td>
<td>BSC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>S.NO</td>
<td>COURSE CODE</td>
<td>COURSE TITLE</td>
<td>CATEGORY</td>
<td>L</td>
<td>T</td>
<td>P</td>
<td>CONTACT PERIODS</td>
<td>C</td>
</tr>
<tr>
<td>------</td>
<td>-------------</td>
<td>--------------------------------------------------</td>
<td>----------</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>----------------</td>
<td>---</td>
</tr>
<tr>
<td>1.</td>
<td>GE5153</td>
<td>Problem Solving and Python Programming</td>
<td>ESC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>EE5251</td>
<td>Basics of Electrical and Electronics Engineering</td>
<td>ESC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>GE5151</td>
<td>Engineering Graphics</td>
<td>ESC</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>EE5251</td>
<td>Electrical and Electronics Engineering Laboratory</td>
<td>ESC</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>5.</td>
<td>GE5161</td>
<td>Problem Solving and Python Programming Laboratory</td>
<td>ESC</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>6.</td>
<td>EE5261</td>
<td>Electrical and Electronics Engineering Laboratory</td>
<td>ESC</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

**PROFESSIONAL CORE COURSES**

<table>
<thead>
<tr>
<th>S. NO</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>CONTACT PERIODS</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>IT5352</td>
<td>Programming and Data Structures</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>IT5351</td>
<td>Database Management Systems</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>IT5302</td>
<td>Software Engineering</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>IT5311</td>
<td>Programming and Data Structures Laboratory</td>
<td>PCC</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>5.</td>
<td>IT5312</td>
<td>Database Management Systems Laboratory</td>
<td>PCC</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>6.</td>
<td>IT5401</td>
<td>Object Oriented Programming and Advanced Data Structures</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>No.</td>
<td>Course Code</td>
<td>Course Title</td>
<td>Type</td>
<td>Credits</td>
<td>LTP Credits</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----</td>
<td>-------------</td>
<td>---------------------------------------</td>
<td>----------</td>
<td>---------</td>
<td>-------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>IT5402</td>
<td>Design and Analysis of Algorithms</td>
<td>PCC</td>
<td>3</td>
<td>0 0 3 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>IT5403</td>
<td>Operating Systems</td>
<td>PCC</td>
<td>3</td>
<td>0 0 3 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>IT5451</td>
<td>Computer Architecture</td>
<td>PCC</td>
<td>3</td>
<td>0 0 3 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>IT5411</td>
<td>Operating Systems Laboratory</td>
<td>PCC</td>
<td>0</td>
<td>0 4 4 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>IT5412</td>
<td>Advanced Data Structures Laboratory</td>
<td>PCC</td>
<td>0</td>
<td>0 4 4 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>IT5502</td>
<td>Compiler Engineering</td>
<td>PCC</td>
<td>3</td>
<td>0 0 3 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>IT5551</td>
<td>Computer Networks</td>
<td>PCC</td>
<td>3</td>
<td>0 0 3 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>IT5501</td>
<td>Web Technologies</td>
<td>PCC</td>
<td>3</td>
<td>0 0 3 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>IT5511</td>
<td>Computer Networks Laboratory</td>
<td>PCC</td>
<td>0</td>
<td>0 4 4 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16.</td>
<td>IT5512</td>
<td>Web Technologies Laboratory</td>
<td>PCC</td>
<td>0</td>
<td>0 4 4 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17.</td>
<td>IT5611</td>
<td>Embedded Systems and Internet of Things</td>
<td>PCC</td>
<td>3</td>
<td>0 0 3 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18.</td>
<td>IT5612</td>
<td>Data Analytics and Cloud Computing Laboratory</td>
<td>PCC</td>
<td>3</td>
<td>0 0 3 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19.</td>
<td>IT5603</td>
<td>Distributed and Cloud Computing</td>
<td>PCC</td>
<td>3</td>
<td>0 0 3 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20.</td>
<td>IT5611</td>
<td>Embedded Systems and Internet of Things Laboratory</td>
<td>PCC</td>
<td>0</td>
<td>0 4 4 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21.</td>
<td>IT5612</td>
<td>Data Analytics and Cloud Computing Laboratory</td>
<td>PCC</td>
<td>0</td>
<td>0 4 4 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22.</td>
<td>IT5701</td>
<td>Artificial Intelligence</td>
<td>PCC</td>
<td>3</td>
<td>0 0 3 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23.</td>
<td>IT5702</td>
<td>Mobile Computing</td>
<td>PCC</td>
<td>3</td>
<td>0 0 3 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24.</td>
<td>IT5703</td>
<td>Cryptography and Security</td>
<td>PCC</td>
<td>3</td>
<td>0 0 3 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S.NO</td>
<td>COURSE CODE</td>
<td>COURSE TITLE</td>
<td>CATEGORY</td>
<td>L</td>
<td>T</td>
<td>P</td>
<td>CONTACT PERIODS</td>
<td>C</td>
</tr>
<tr>
<td>------</td>
<td>-------------</td>
<td>--------------------------------------------------</td>
<td>----------</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>-----------------</td>
<td>---</td>
</tr>
<tr>
<td>1.</td>
<td>IT5513</td>
<td>Summer Internship / Summer Project</td>
<td>EEC</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Minimum 4 Weeks)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>IT5613</td>
<td>Socially Relevant Project Laboratory</td>
<td>EEC</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>3.</td>
<td>IT5712</td>
<td>Project I</td>
<td>EEC</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>IT5811</td>
<td>Project II</td>
<td>EEC</td>
<td>0</td>
<td>0</td>
<td>16</td>
<td>16</td>
<td>8</td>
</tr>
</tbody>
</table>
AUDIT COURSES (AC)

Registration for any of these courses is optional to students

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Lecture</th>
<th>Tutorial</th>
<th>Practical</th>
<th>Total Contact Periods</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>AD5091</td>
<td>Constitution of India</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>2.</td>
<td>AD5092</td>
<td>Value Education</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>3.</td>
<td>AD5093</td>
<td>Pedagogy Studies</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>4.</td>
<td>AD5094</td>
<td>Stress Management by Yoga</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>5.</td>
<td>AD5095</td>
<td>Personality Development Through Life Enlightenment Skills</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>6.</td>
<td>AD5096</td>
<td>Unnat Bharat Abhiyan</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>7.</td>
<td>AD5097</td>
<td>Essence of Indian Knowledge Tradition</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>8.</td>
<td>AD5098</td>
<td>Sanga Tamil Literature Appreciation</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total Credits:</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>24</strong></td>
<td><strong>0</strong></td>
</tr>
</tbody>
</table>
OBJECTIVES:
- To familiarise first year students of engineering and technology with the fundamental aspects of technical English.
- To develop all the four language skills by giving sufficient practice in the use of the skills in real life contexts.
- To enhance the linguistic and communicative competence of first year engineering and technology students.

UNIT I  INTRODUCING ONESELF  12
Listening: Listening and Filling a Form, Listening to Speeches by Specialists From Various Branches of Engineering and Completing Activities such as Answering Questions, Identifying the Main Ideas of the Listening Text, Style of the Speaker (Tone and Tenor) – Speaking: Introducing Oneself – Introducing Friend/ Family – Reading: Descriptive Passages (From Newspapers / Magazines) – Writing: Writing a Paragraph (Native Place, School Life) – Grammar: Simple Present, Present Continuous – Vocabulary Development: One Word Substitution.

UNIT II  DIALOGUE WRITING  12

UNIT III  FORMAL LETTER WRITING  12

UNIT IV  WRITING COMPLAINT LETTERS  12

UNIT V  WRITING DEFINITIONS AND PRODUCT DESCRIPTION  12

TOTAL : 60 PERIODS
LEARNING OUTCOMES
On completion of the course, the students will able to:
1. Exposure to basic aspects of technical English.
2. Gain confidence to communicate effectively in various academic situations.
3. Learn the use of basic features of Technical English.

TEXTBOOKS:

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

MA5158 ENGINEERING MATHEMATICS – I
(Common to all branches of B.E. / B.Tech. Programmes in I Semester) 3 1 0 4

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

UNIT I MATRICES
12

UNIT II DIFFERENTIAL CALCULUS
12

UNIT III FUNCTIONS OF SEVERAL VARIABLES
12

UNIT IV INTEGRAL CALCULUS
12
Definite and Indefinite Integrals – Substitution Rule – Techniques of Integration – Integration
by Parts, Trigonometric Integrals, Trigonometric Substitutions, Integration of Rational Functions by Partial Fraction, Integration of Irrational Functions – Improper Integrals.

UNIT V MULTIPLE INTEGRALS 12

TOTAL : 60 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Use the matrix algebra methods for solving practical problems.
2. Apply differential calculus tools in solving various application problems.
3. Able to use differential calculus ideas on several variable functions.
4. Apply different methods of integration in solving practical problems.
5. Apply multiple integral ideas in solving areas, volumes and other practical problems.

TEXTBOOKS:

REFERENCES:

PH5151 ENGINEERING PHYSICS (Common to all branches of B.E / B.Tech programmes) 3 0 0 3

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

UNIT II ELECTROMAGNETIC WAVES

UNIT III OSCILLATIONS, OPTICS AND LASERS

UNIT IV BASIC QUANTUM MECHANICS

UNIT V APPLIED QUANTUM MECHANICS

OUTCOMES:
On completion of the course, the students will be able to:
1. Understanding the importance of mechanics.
2. Express the knowledge of electromagnetic waves.
3. Know the basics of oscillations, optics and lasers.
4. Understanding the importance of quantum physics.
5. Apply quantum mechanical principles towards the formation of energy bands in crystalline materials.

TEXT BOOKS

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

UNIT I  POLYMER CHEMISTRY

UNIT II  NANO CHEMISTRY

UNIT III  PHOTOCHEMISTRY AND SPECTROSCOPY

UNIT IV  ENERGY CONVERSIONS AND STORAGE

UNIT V  WATER TECHNOLOGY

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Recognize and apply basic knowledge on different types of polymeric materials, their general preparation methods and applications to futuristic material fabrication needs.
2. Identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.
3. Identify and apply suitable spectroscopic technique for material analysis and study different forms of photochemical reactions.
4. Recognize different forms of energy resources and apply them for suitable applications in energy sectors.
5. Demonstrate the knowledge of water and their quality in using at different industries.

TEXT BOOKS:

REFERENCES:

GE5153 PROBLEM SOLVING AND PYTHON PROGRAMMING L T P C
3 0 0 3

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

UNIT I INTRODUCTION TO COMPUTING AND PROBLEM SOLVING

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

**Suggested Evaluation Methods:**
- Assignments on pseudocodes and flowcharts.
- Tutorials on Python programs.

**UNIT II**  
**CONDITIONALS AND FUNCTIONS**
9

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

**Suggested Evaluation Methods:**
- Tutorials on the above activities.
- Group discussion on external learning.

**UNIT III**  
**SIMPLE DATA STRUCTURES IN PYTHON**
10

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

**Suggested Evaluation Methods:**
- Tutorials on the above activities.
- Group Discussion on external learning component.

**UNIT IV**  
**STRINGS, DICTIONARIES, MODULES**
10

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

Suggested Evaluation Methods:
• Tutorials on the above activities.

UNIT V    FILE HANDLING AND EXCEPTION HANDLING
Introduction to Files – File Path – Opening and Closing Files – Reading and Writing Files – File Position – Exception: Errors and Exceptions, Exception Handling, Multiple Exceptions.

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

Suggested Evaluation Methods:
• Tutorials on the above activities.
• Case Studies.

TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>
BS5161  BASIC SCIENCES LABORATORY  L  T  P  C
(Common to all branches of B.E. / B.Tech Programmes)  0 0 4 2

PHYSICS LABORATORY: (Any Seven Experiments)

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

LIST OF EXPERIMENTS:
4. Lee’s disc Determination of thermal conductivity of a bad conductor.
5. Potentiometer – Determination of thermo e.m.f of a thermocouple.
10. Acoustic grating – Determination of velocity of ultrasonic waves in liquids.
11. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids.
15. Michelson Interferometer.
17. Melde’s string experiment.

TOTAL: 30 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Determine various moduli of elasticity and also various thermal and optical properties of materials.
2. Determine the velocity of ultrasonic waves, band gap determination and viscosity of liquids.

BASIC SCIENCE LABORATORY

CHEMISTRY LABORATORY: (Minimum of 8 experiments to be conducted)

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

To demonstrate the analysis of metals and polymers by spectroscopy and viscometry methods.

LIST OF EXPERIMENTS:
1. Estimation of HCl using Na2CO3 as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler’s method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenantherline / thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
12. Pseudo first order kinetics -ester hydrolysis.
14. Phase change in a solid.

TOTAL: 30 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Analyse the quality of water samples with respect to their acidity, alkalinity, hardness and DO.
2. Determine the amount of metal ions through volumetric and spectroscopic techniques.
3. Determine the molecular weight of polymers by viscometric method.
4. Quantitatively analyse the impurities in solution by electroanalytical techniques.
5. Design and analyse the kinetics of reactions and corrosion of metals.

TEXT BOOKS:

GE5161 PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY L T P C 0 0 4 2

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

EXPERIMENTS:
1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same.
2. Python programming using simple statements and expressions.
3. Scientific problems using Conditionals and Iterative loops.
4. Implementing real-time/technical applications using Lists, Tuples.
5. Implementing real-time/technical applications using Sets, Dictionaries.
6. Implementing programs using Functions.
7. Implementing programs using Strings.
9. Implementing real-time/technical applications using File handling.
10. Implementing real-time/technical applications using Exception handling.
12. Developing a game activity using Pygame like bouncing ball, car race etc.

TOTAL: 60 PERIODS

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

CO1: Develop algorithmic solutions to simple computational problems
CO2: Develop and execute simple Python programs.
CO3: Structure simple Python programs for solving problems.
CO4: Decompose a Python program into functions.
CO5: Represent compound data using Python data structures.
CO6: Apply Python features in developing software applications.

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

HS5251        PROFESSIONAL COMMUNICATION        L  T  P  C
4  0  0  4

OBJECTIVES
- To improve the relevant language skills necessary for professional communication.
- To develop linguistic and strategic competence in workplace context.
- To enhance language proficiency and thereby the employability of budding engineers and technologists.

UNIT I     TECHNICAL COMMUNICATION 12
Listening: Listening to Telephone Conversations (Intent of the Speaker and Note Taking Exercises) – Speaking: Role Play Exercises Based on Workplace Contexts, Introducing Oneself – Reading: Reading the Interview of an Achiever and Completing Exercises (Skimming, Scanning and Predicting) – Writing: Writing a Short Biography of an Achiever

UNIT II SUMMARY WRITING

UNIT III PROCESS DESCRIPTION

UNIT IV REPORT WRITING

UNIT V WRITING JOB APPLICATIONS

LEARNING OUTCOMES
On completion of the course, the students will be able to:
1. Read and comprehend technical texts effortlessly.
2. Write reports of a technical kind.
3. Speak with confidence in interviews and thereby gain employability.

TEXTBOOK

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

MA5252 ENGINEERING MATHEMATICS – II
(Common to all branches of B.E. / B.Tech. Programmes in II Semester) L T P C
3 1 0 4

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

UNIT I VECTOR CALCULUS 12

UNIT II ANALYTIC FUNCTION 12
Analytic Functions – Necessary and Sufficient Conditions for Analyticity – Properties – Harmonic Conjugates – Construction of Analytic Function - Conformal Mapping – Mapping by Functions – Bilinear Transformation $w = c + z, \ az, \ 1/z, \ z^2$.

UNIT III COMPLEX INTEGRATION 12

UNIT IV DIFFERENTIAL EQUATIONS 12
Method of Variation of Parameters – Method of Undetermined Coefficients – Homogenous Equations of Euler’s and Legendre’s Type – System of Simultaneous Linear Differential Equations with Constant Coefficients.

UNIT V LAPLACE TRANSFORMS 12

TOTAL : 60 PERIODS

OUTCOMES:
On completion of the course, students will be able to:
1. Calculate grad, div and curl and use Gauss, Stokes and Greens theorems to simplify calculations of integrals.
2. Construct analytic functions and use their conformal mapping property in application problems.
3. Evaluate real and complex integrals using the Cauchy’s integral formula and residue theorem.
4. Apply various methods of solving differential equation which arise in many application problems.
5. Apply Laplace transform methods for solving linear differential equations.

TEXTBOOKS:
REFERENCES:

IT5201 INFORMATION TECHNOLOGY ESSENTIALS

OBJECTIVES:
- To design and develop web pages using HTML and CSS.
- To understand the general concepts of PHP scripting language and MySQL functionalities for the development of simple data-centric applications.
- To provide a basic knowledge of computer hardware and software.
- To familiarize with the basic taxonomy and terminology of computer networking and mobile communications.
- To understand various types of information systems and their complexities.

UNIT I WEB AND SCRIPTING ESSENTIALS
Internet Basics – Browser Fundamentals – Authoring Tools – Introduction to HTML5 – HTML5 Tags – HTML5 Forms – Cascading Style Sheets (CSS3) Fundamentals – Need for Scripting Languages – Introduction to JavaScript/ Angular JS.

Suggested Activities:
- Browse the internet on special topics given by instructor.
- Learn HTML basic tags for web page design.
- Identify different types of form validations in the websites that are commonly used.
- Practical - Design of a small simple website, interlinking set of web pages created using the HTML tags and CSS.

Suggested Evaluation Methods:
- Quizzes on all the topics of the unit.
- Discussion on form validation.
- Peer evaluation of the simple web-sites created.

UNIT II SERVER-SIDE ESSENTIALS (PHP)

Suggested Activities:
- Practical - Simple programs using PHP.
• Design of a dynamic web pages using PHP.
• Practical - Database creation using MySQL and PHP scripts.
• Practical - Creation of session and cookies.

Suggested Evaluation Methods:
• Quizzes on different topics of the unit.
• Demonstration of the implementations.
• Group discussions design of web page.

UNIT III HARDWARE ESSENTIALS

Suggested Activities:
• Understanding Personal Computer and various components.
• Case studies on different types of servers.
• Survey on data centre, cloud server and high-end server.

Suggested Evaluation Methods:
• Quizzes on hardware components.
• Presentations of case studies and survey.

UNIT IV NETWORK ESSENTIALS

Suggested Activities:
• Flipped classroom on generations of cellular networks.
• Explore the web to know more about the networking concepts and recent technologies. Students may present their findings orally or by a written report or through discussion forums.
• Explore the networking devices used in laboratories and homes, and their configurations.

Suggested Evaluation Methods:
• Quizzes on network transmission and communication.
• Report evaluation by peers.
• Discussion on network devices.

UNIT V APPLICATION ESSENTIALS

Suggested Activities:
• Flipped classroom on social networking applications.
• Explore the web to know more about the concepts and technologies used for the design of Information Systems. Students may present their findings orally or by a written report.
• Design a simple web or mobile application.
Explore and analyze some of the visual analytics software.

**Suggested Evaluation Methods:**
- Quizzes on features of social networking applications.
- Presentations on various information systems.
- Demonstration of application.
- Discussions through forums.

**TOTAL : 45 PERIODS**

**OUTCOMES:**
**On completion of the course, the student will be able to:**
- **CO1:** Create dynamic website/web based applications using HTML, PHP, and MYSQL database.
- **CO2:** Design websites that meet specified needs and interests using basic elements to control layout and style.
- **CO3:** Debug the programs by applying concepts and error handling techniques of HTML, JavaScript, PHP and MYSQL.
- **CO4:** Understand the basic concepts of data communications and networking.
- **CO5:** Describe the basic principles of mobile communication systems.
- **CO6:** Identify the fundamental concepts and key issues in the design of commonly used applications.

**TEXT BOOKS:**

**REFERENCES:**

<table>
<thead>
<tr>
<th>CO1</th>
<th>CO2</th>
<th>CO3</th>
<th>CO4</th>
<th>CO5</th>
<th>CO6</th>
<th>CO7</th>
<th>CO8</th>
<th>CO9</th>
<th>CO10</th>
<th>CO11</th>
<th>CO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>
OBJECTIVES:
- To understand the basic concepts of electric circuits, magnetic circuits and wiring.
- To understand the operation of AC and DC machines.
- To understand the working principle of electronic devices and circuits.

UNIT I BASIC CIRCUITS AND DOMESTIC WIRING

UNIT II THREE PHASE CIRCUITS AND MAGNETIC CIRCUITS

UNIT III ELECTRICAL MACHINES

UNIT IV BASICS OF ELECTRONICS

UNIT V CURRENT CONTROLLED AND VOLTAGE CONTROLLED DEVICES
Working Principle and Characteristics – BJT, SCR, JFET, MOSFET.

TOTAL: 45 PERIODS

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

TEXT BOOKS:
REFERENCES:

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

GE5151 ENGINEERING GRAPHICS

COURSE OBJECTIVES:
- To draw free hand sketches of basic geometrical shapes and multiple views of objects.
- To draw orthographic projections of lines and planes.
- To draw orthographic projections of solids.
- To draw the development of surfaces of objects.
- To draw isometric and perspective views of simple solids.

CONCEPTS AND CONVENTIONS (NOT FOR EXAMINATION)

UNIT I PLANES CURVES AND FREE HANDSKETCHING

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES
UNIT III PROJECTION OF SOLIDS 15
Projection of Simple Solids like Prisms, Pyramids, Cylinder, Cone and Truncated Solids When the Axis is Inclined to Both the Principal Planes by Rotating Object Method and Auxiliary Plane Method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 15
Sectioning of Solids in Simple Vertical Position When the Cutting Plane is Inclined to the One of the Principal Planes and Perpendicular to the other – Obtaining True Shape of Section. Development of Lateral Surfaces of Simple and Sectioned Solids – Prisms, Pyramids Cylinders and Cones. Development of Lateral Surfaces Of Solids With Cut-Outs and Holes.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 12

COMPUTER AIDED DRAFTING (DEMONSTRATION ONLY) 3
Introduction to Drafting Packages and Demonstration of Their Use.

TOTAL (L: 15 + P: 60): 75 PERIODS

COURSE OUTCOMES:
On completion of this course, the students will be able to:
1. Draw free hand sketching of basic geometrical shapes and multiple views of objects.
2. Draw orthographic projections of lines and planes
3. Draw orthographic projections of solids
4. Draw development of the surfaces of objects
5. Draw isometric and perspective views of simple solids.

TEXT BOOKS:

REFERENCES:

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

IT5211 INFORMATION TECHNOLOGY ESSENTIALS LABORATORY L T P C
0 0 4 2

OBJECTIVES:
1. To design and develop static web pages using HTML5.
2. To create attractive web pages using CSS (internal & external style sheets).
3. To introduce the JavaScript/Angular JS for client-side validation of the web forms.
4. To understand the concepts of PHP programming.
5. To introduce PHP scripting language and MySQL functionalities for the development of simple data-centric applications.

LABORATORY EXERCISES:
1. Design of static webpage primarily with text and CSS.
2. Apply the inline and block level elements to identify the difference in the layout.
3. Design the HTML forms (text boxes, text areas, radio buttons, check boxes and other elements by understanding the input types and specified needs).
4. Include image/audio and video elements in the web pages.
5. Format and position the text using CSS borders, background and color by understanding the box model.
6. Validate the HTML form elements by creating small client-side validation scripts using JavaScript/Angular JS.
7. Create small PHP scripts to manipulate data using various operators and PHP functions and display the results.
8. Write two different PHP scripts to demonstrate passing variables to a URL.
9. Create Website Registration Form using text box, check box, radio button, select, submit button, and display user inserted value in new PHP page.
10. Write two different PHP scripts to demonstrate passing variables with sessions and cookies.
11. Write PHP script to connect MySQL server from the website incorporating error-handling using exceptions.
12. Create a dynamic web site using PHP and MySQL.

TOTAL: 60 PERIODS

COURSE OUTCOMES:
On completion of the course, the student will be able to:
CO1: Design and develop static web pages by using the markup languages that meet the specified needs and interests.
CO2: Validate HTML forms developed using the JavaScript/Angular JS.
CO3: Create dynamic websites/web based applications using HTML, PHP, and MYSQL database.
CO4: Debug the programs by applying concepts and error handling techniques of HTML, JavaScript, PHP and MYSQL.
CO5: Address/solve the real-time issues by developing data centric applications.
CO6: Develop responsive websites using the programming languages and techniques associated with the World Wide Web.
EE5261  ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY  L T P C  0 0 4 2

OBJECTIVES
- To impart hands on experience in verification of circuit laws and measurement of circuit parameters.
- To train the students in performing various tests on electrical motors.
- To give practical exposure to the usage of CRO, power sources & function generators.

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

TOTAL: 60 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Become familiar with the basic circuit components and know how to connect them to make a real electrical circuit.
2. Perform speed characteristic of different electrical machines.
3. Use logic gates and Flip flops.

MA5302  DISCRETE MATHEMATICS  L T P C  3 1 0 4

OBJECTIVES:
- To introduce Mathematical Logic, Inference Theory and proof methods.
- To provide fundamental principles of combinatorial counting techniques.
To introduce graph models, their representation, connectivity and traversability.
To explain the fundamental algebraic structures, groups and their algebraic properties.
To provide exposure to the development of the algebraic structures, lattices and Boolean algebra and to demonstrate the utility of Boolean laws.

UNIT I LOGIC AND PROOFS 12

UNIT II COMBINATORICS 12

UNIT III GRAPHS 12
Graphs and Graph Models – Graph Terminology and Special Types of Graphs – Matrix Representation of Graphs and Graph Isomorphism – Connectivity – Euler and Hamilton Paths.

UNIT IV ALGEBRAIC STRUCTURES 12

UNIT V LATTICES AND BOOLEAN ALGEBRA 12

TOTAL: 60 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Understand the validity of the logical arguments, mathematical proofs and correctness of the algorithm.
2. Apply combinatorial counting techniques in solving combinatorial related problems.
3. Use graph models and their connectivity, traversability in solving real world problems.
4. Understand the significance of algebraic structural ideas used in coding theory and cryptography.
5. Apply Boolean laws and Boolean functions in combinatorial circuit designs.

TEXTBOOKS:

REFERENCES:
OBJECTIVES:
- To learn Boolean algebra and simplification of Boolean functions.
- To learn to design and analyze different combinational circuits.
- To study the basics of synchronous sequential logic, analyze and design sequential circuits.
- To learn about basic memory devices and programmable logic devices to build simple digital systems.
- To learn to write code in Hardware Definition Language for designing larger digital systems.

UNIT I   BOOLEAN ALGEBRA AND GATES  6

Suggested Activities:
- In-class activity - Number systems, problems in number conversion and complements.
- Flipped classroom and activity on various binary codes.
- Proofs and simplification of basic theorems and properties of Boolean algebra in class.
- External learning - Exclusive OR function.

Suggested Evaluation Methods:
- Verifying the correctness of the activity.
- Checking the understanding of the equivalence among various binary codes for decimal digits.
- Quiz on logic gates.

UNIT II   KARNAUGH MAP AND COMBINATIONAL LOGIC  6
Simplification of Boolean Functions –Karnaugh Map – 2, 3, 4 variables – NAND/NOR Implementations – Combinational Circuits – Arithmetic Circuits – Half and Full Adders – Subtractors – Introduction to HDL.

Suggested Activities:
- Assignments on simplification of Boolean functions using 3 and 4 variable K-map.
- External learning - HDL for simple circuits.

Suggested Evaluation Methods:
- Verifying the correctness and alternate ways of solving the assignment problems.
- Quiz on HDL for simple circuits.
UNIT III  COMBINATIONAL LOGIC  6
Binary Parallel Adder – Carry Look-ahead Adder – BCD Adder – Binary Multiplier –
Mux/Demux – Applications.

Suggested Activities:
- Applications of combinational circuits - activity in class. For example: Identifying the role of the combinational circuits in designing circuits like digital boards.
- External learning - HDL for the combinational circuits.
- Assignments on applications of MUX/DeMUX circuits.

Suggested Evaluation Methods:
- Verifying HDL code for combinational circuits.
- Peer evaluation to check circuits for correctness.
- Verifying the alternate ways used, if any, for solving the assignment problems.

UNIT IV  SEQUENTIAL LOGIC  6

Suggested Activities:
- Assignments on analysis of different sequential circuits.
- External learning - Up-down, ring, decade, modulus and cascaded counters.
- External learning - HDL for sequential circuits.

Suggested Evaluation Methods:
- Verifying the correctness of the analysis of the given circuits.
- Quiz on counters.

UNIT V  SYSTEM DESIGN  6
Memory Systems – RAM – ROM – Memory Decoding – Digital System Design using PLA, PAL and FPGA.

Suggested Activities:
- Assignments on memory decoding, PAL/PLA design.
- Flipped classroom on basic memory types.

Suggested Evaluation Methods:
- Verifying the design for various inputs.
- Quiz on memory types.

PRACTICAL EXERCISES  30
1. Verification of Boolean theorems using logic gates. (2 hrs)
2. Design and implementation of combinational circuits using gates for arbitrary functions. (2 hrs)
3. Implementation of 4-bit binary adder/subtractor circuits and getting started with HDL. (2 hrs)
4. Implementation of combinational circuits using code converters. (2 hrs)
5. Implementation of BCD adder, encoder and decoder circuits. (4 hrs)
6. Implementation of any one of the synchronous counters. (2 hrs)
7. Implementation of a Universal Shift register. (2 hrs)
8. HDL coding for any of the combinational and sequential circuits. (4 hrs)

OUTCOMES:
On completion of the course, the students will be able to:
CO1: Simplify complex Boolean functions.
CO2: Implement digital circuits using combinational logic ICs and PLDs.
CO3: Understand the characteristics of various Flip-Flops.
CO4: Design digital circuits with combinational and sequential components.
CO5: Use HDL to build digital systems.
CO6: Analyze digital system designs.

TOTAL: 60 PERIODS

TEXT BOOK:

REFERENCES:

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

UNIT I C PROGRAMMING FUNDAMENTALS
Suggested Activities:
- Implementing programs using data types, arithmetic operators and basic input/output operations.
- Developing programs using if-else, do-while, while, for, switch, break, continue, enum.
- Write an application to perform operations like finding the maximum, minimum, average values using single dimensional integer and float arrays.
- Develop an application to perform matrix operations using multi-dimensional arrays.
- Create an application that performs operations like concatenation, finding a substring from a given string, etc. using character arrays.
- Develop any application (student’s choice) using User-defined functions and Recursive functions.

Suggested Evaluation Methods:
- Tutorials on conditionals and loops.
- Evaluation of the programs implemented.

UNIT II C PROGRAMMING - ADVANCED FEATURES 9

Suggested Activities:
- Implementing applications using Structures, Unions, Enumerations.
- Demonstration of C programs using pointers to variables, arrays, functions and using address arithmetic.
- Demonstration of programs using dynamic memory.
- Demonstration of real world applications using file operations.

Suggested Evaluation Methods:
- Tutorials on file handling.
- Checking output of programs implemented.

UNIT III LINEAR DATA STRUCTURES 9

Suggested Activities:
- Converting an algorithm from recursive to non-recursive using stack.
- Demonstrating stack for Towers of Hanoi application.
- Developing any application (student’s choice) using all the linear data structures.

Suggested Evaluation Methods:
- Tutorials on applications of linear data structures.
- Checking output of programs implemented.

UNIT IV NON-LINEAR DATA STRUCTURES 9

Suggested Activities:
- Implementing binary tree and tree traversals.
• Solving expressions using expression trees by determining infix, prefix and postfix expressions.
• Implementation of phone directory using hash tables.
• Developing any application using trees.

Suggested Evaluation Methods:
• Tutorials on hashing.
• Check output of programs implemented.
• Quiz on various topics of the unit.

UNIT V SORTING AND SEARCHING TECHNIQUES
Insertion Sort – Quick Sort – Heap Sort – Merge Sort – Linear Search – Binary Search.

Suggested Activities:
• External learning - External sorting implementation.
• Implementation of all sorting techniques in C language.
• Demonstration of searching techniques under best and worst case inputs.

Suggested Evaluation Methods:
• Tutorials on external sorting.
• Checking output of programs implemented.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
CO1: Develop C programs for any real world/technical application.
CO2: Apply advanced features of C in solving problems.
CO3: Write functions to implement linear and non-linear data structure operations.
CO4: Suggest and use appropriate linear/non-linear data structure operations for solving a given problem.
CO5: Appropriately use sort and search algorithms for a given application.
CO6: Apply appropriate hash functions that result in a collision free scenario for data storage and retrieval.

TEXT BOOKS:

REFERENCES:

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
</tr>
</tbody>
</table>
OBJECTIVES:
- To learn the fundamentals of data models, conceptualize and depict a database system using ER diagram.
- To study the principles to be followed to create an effective relational database and write SQL queries to store/retrieve data to/from database systems.
- To know the fundamental concepts of transaction processing, concurrency control techniques and recovery procedure.
- To learn about the internal storage structures using different file and indexing techniques and the basics of query processing and optimization.
- To study the basics of distributed databases, semi-structured and un-structured data models.

UNIT I        RELATIONAL DATABASES

Suggested Activities:
- Creating tables with key constraints, adding and removing constraints with referential integrity using DDL commands.
- Flipped classroom on relational algebra operations (selection, projection, joins etc.).
- Write SQL queries for demonstrating CRUD operations, aggregate functions and various join operations using DML commands.
- Create stored procedures for executing complex SQL transactions.
- Create triggers for alerting user/system while manipulating data.

Suggested Evaluation Methods:
- Tutorials on DDL, DML and DCL queries.
- Quizzes on relational algebra operations.
- Demonstration of created stored procedures and triggers.

UNIT II        DATABASE DESIGN

Suggested Activities:
- Simple database application design using ER diagram.
• Practical - ER modeling using open source tools and realizing database.
• Study of various anomalies and normalizing table (1NF, 2NF, 3NF, BCNF).
• Flipped classroom on topics of database design and normalization.

Suggested Evaluation Methods:
• Tutorials on application specific ER Diagram.
• Tutorials on normalization and database design.

UNIT III TRANSACTION MANAGEMENT

Suggested Activities:
• Checking serializability among transactions.
• Flipped classroom on concurrency control protocols.
• Study of crash recovery algorithm (ARIES).

Suggested Evaluation Methods:
• Tutorials on serializability and crash recovery algorithm
• Quizzes on concurrency control protocols.

UNIT IV IMPLEMENTATION TECHNIQUES

Suggested Student Activities:
• Study of different RAID levels and its uses in different applications.
• Practical - Creation of B+ tree with insertion and deletion operations.
• Assignments on cost estimation of different types of queries.

Suggested Evaluation Methods:
• Report on applications of RAID levels.
• Tutorials on B+ Tree manipulation.
• Quizzes on hashing mechanisms.
• Exercise on cost estimation for various SQL queries.
• Evaluation of the practical assignments.

UNIT V ADVANCED TOPICS

Suggested Student Activities:
• Design of distributed database using fragmentation.
• Creation of XML document based on XML schema.
• Creation of document and column oriented databases and simple manipulation.

Suggested Evaluation Methods:
• Tutorials on fragmenting database tables and writing simple SQL queries.
• Assignments on creation of XML schema and validating XML documents.
• Demonstration of created document and column-oriented databases.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the student will be able to:
CO1: Model an application’s data requirements using conceptual modeling and design
database schemas based on the conceptual model.
CO2: Formulate solutions to a broad range of query problems using relational algebra/SQL.
CO3: Demonstrate an understanding of normalization theory and apply such knowledge to
the normalization of a database.
CO4: Run transactions and estimate the procedures for controlling the consequences of
concurrent data access.
CO5: Explain basic database storage structures, access techniques and query processing.
CO6: Describe distributed, semi-structured and unstructured database systems.

TEXT BOOKS:

REFERENCES:
1. C. J. Date, A. Kannan, S. Swamynathan, “An Introduction to Database Systems”,
4. Carlos Coronel, Steven Morris, Peter Rob, “Database Systems: Design,

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

IT5302 SOFTWARE ENGINEERING L T P C
3 0 0 3

OBJECTIVES:
• To gain knowledge about various software development lifecycle (SDLC) models.
• To learn how to elicit and formulate requirements.
- To be aware of designing a software considering the various perspectives of end user.
- To learn to develop a software component using coding standards and facilitate code reuse.
- To analyze the software using metrics and measurement and predict the complexity and the risk associated.

UNIT I  PRODUCT AND PROCESS


Suggested Activities:
- In-class activity - Application specific product and process view.
- External learning - Impact of unified process models on quality software development methods and JIT software.

Suggested Evaluation Methods:
- Assignments on selection of suitable software process models for a given software specification.
- Tutorials on identification of sample application for each process model and justify the same stating reasons.
- Assignments on selection of appropriate standards for each phase in software development.

UNIT II  REQUIREMENTS ANALYSIS AND SPECIFICATION


Suggested Activities:
- External learning - Using open source tools for requirement engineering to understand the requirements traceability and interdependency among the functionalities provided by the software project.
- External learning - Using open source tools for conceptual data modeling of a sample application, scenario based modeling of a problem statement and class based modeling for given software requirements.

Suggested Evaluation Methods:
- Quiz on requirements elicitation mechanisms and selection of an appropriate strategy.
- Assignments on requirement categorization (considering contradicting, omission, commission of requirements) in a software project; Data Modeling of Sample application; Designing use case diagram and activity diagram to analyze the requirements obtained from the customer and segregate them as use cases and determine the possible set of activities from the end user; Determining the flow of data/events among the processes in the application under consideration.

UNIT III  ANALYSIS AND DESIGN


Suggested Activities:
- External learning - Use open source tools to perform different modeling approaches.
- Model the object classes that might be used in the system implementation to represent a mailbox and an e-mail message.
- Develop a software design for any socially relevant project.

Suggested Evaluation Methods:
- Quizzes on different modeling approaches and design methodologies
- Identification of the data and flow of the software design.
- Creation of UML diagrams using a tool such as StarUML.

UNIT IV  SOFTWARE TESTING 9

Suggested Activities:
- External learning - Understanding the requirements (SRS) and designing a suitable test suite; Determining valid interfaces for integration testing and designing necessary stub and driver modules; Software test documentation.
- External learning - Testing a simple online application on selected test cases.
- Tutorials on automation software for testing.
- In-class activity - Equivalence class partitioning, boundary value analysis.

Suggested Evaluation Methods:
- Quiz and discussion on testing strategies, types of testing and their methods.
- Assignments on testing of sample application using any OSS on software test automation.
- Assignments on testing sample application using Black Box approaches and understanding the differences in selecting of test cases from the test suite.

UNIT V  SOFTWARE PROJECT MANAGEMENT 9

Suggested Activities:
- External learning - Tools for estimating software cost.
- Flipped classroom on software project management, risk management & mitigation, configuration management, software documentation standards

Suggested Evaluation Methods:
- Tutorials on identification of potential risks for a software project during development/ maintenance and tabulate.
- Assignments on using a software configuration management template for a software project.
- Quizzes on various metrics of project management.
OUTCOMES:
On completion of the course, the students will be able to:
CO1: Obtain an insight into the concepts of software engineering.
CO2: Analyze and resolve information technology problems through the application of systematic approaches and diagnostic tools for end to end solutions.
CO3: Elicit the requirements for real-time problems.
CO4: Estimate the cost of software, risks of handling, do software planning and configuration management.
CO5: Have knowledge about the role of software tester and be aware of testing methodologies and tools.
CO6: Maintain documentation for software engineering process.

TEXT BOOK:

REFERENCES:

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

IT5311 PROGRAMMING AND DATA STRUCTURES LABORATORY L T P C
0 0 4 2

OBJECTIVES:
- To introduce the concepts of structured programming language and writing ADTs.
- To familiarize with the advanced features of C language.
- To introduce the concepts of primitive data structures.
- To introduce the concepts of hashing and sorting.
- To understand the searching process in linear and non-linear data structures.

LIST OF EXERCISES:
1. Practice of C Programming on real world/technical applications using statements, expressions, decision making constructs.
2. Practice of C Programming on real world/technical applications using iterative and branching constructs, Structures, arrays, functions, pointers and File handling.
3. Implementation of Linked List.
4. Implementation of Stack using Arrays and Linked List.
5. Implementation of Queue using Arrays and Linked List.
6. Implementation of Stack and Queue applications.
7. Implementation of Binary Search Tree.
8. Implementation of Priority Queue.
10. Implementation of Quick Sort, Merge Sort.
11. Implementation any application using Linear Search.

TOTAL: 60 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
CO1: Develop C programs for any real world/technical situations.
CO2: Apply advanced features of C in solving problems.
CO3: Implement data structures using C language.
CO4: Write code using linear and non-linear data structure operations.
CO5: Implement various sorting and searching techniques.
CO6: Analyze and implement hashing techniques that solve in linear time.

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

IT5312 DATABASE MANAGEMENT SYSTEMS LABORATORY L T P C 0 0 4 2

OBJECTIVES:
- To learn and implement important commands in SQL.
- To learn the usage of nested and joint queries.
- To understand functions, procedures and procedural extensions of databases.
- To understand design and implementation of typical database applications.
- To be familiar with the use of a front end tool for GUI based application development.
LABORATORY EXERCISES:
1. Create a database table, add constraints (primary key, unique, check, Not null), insert rows, update and delete rows using SQL DDL and DML commands.
2. Create set of tables, add foreign key constraints and incorporate referential integrity.
3. Query the database tables using different ‘where’ clause conditions and also implement aggregate functions.
4. Query the database tables and explore sub queries and simple clause join operations.
5. Query the database tables and explore natural, equi and outer joins.
6. Write user defined functions and stored procedures in SQL.
7. Execute complex transactions and realize DCL and TCL commands.
8. Write SQL Triggers for insert, delete, and update operations in database table.
9. Create View and index for database tables with large number of records.
10. Create a XML database and validate it using XML schema.
12. Develop a simple GUI based database application and incorporate all the above-mentioned features.

TOTAL: 60 PERIODS

OUTCOMES:
On completion of the course, the student will be able to:
CO1: Create databases with different types of key constraints.
CO2: Write simple and complex SQL queries using DML and DCL commands.
CO3: Realize database design using 3NF and BCNF.
CO4: Use advanced features such as stored procedures and triggers and incorporate in GUI based application development.
CO5: Create XML database and validate with meta-data (XML schema).
CO6: Create and manipulate data using NOSQL database.

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

GE5251  ENVIRONMENTAL SCIENCES  L T P C
3 0 0 3

OBJECTIVES:
- To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize on the biodiversity of India and its conservation.
- To impart knowledge on the causes, effects and control or prevention measures of environmental pollution and natural disasters.
- To facilitate the understanding of global and Indian scenario of renewable and non-renewable resources, causes of their degradation and measures to preserve them.
- To familiarize the influence of societal use of resources on the environment and introduce the legal provisions, National and International laws and conventions for environmental protection.
- To inculcate the effect of population dynamics on human and environmental health and inform about human right, value education and role of technology in monitoring human and environmental issues.

UNIT I  ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY

UNIT II  ENVIRONMENTAL POLLUTION
Definition – Causes, Effects and Control Measures of: (A) Air Pollution (B) Water Pollution (C) Soil Pollution (D) Marine Pollution (E) Noise Pollution (F) Thermal Pollution (G) Nuclear Hazards – Soil Waste Management: Causes, Effects and Control Measures of Municipal Solid Wastes – Role of an Individual in Prevention of Pollution – Pollution Case Studies – Disaster Management: Floods, Earthquake, Cyclone and Landslides. Field Study of Local Polluted Site – Urban / Rural / Industrial / Agricultural.

UNIT III  NATURAL RESOURCES

UNIT IV  SOCIAL ISSUES AND THE ENVIRONMENT
Enforcement Machinery Involved in Environmental Legislation - Central and State Pollution Control Boards – Public Awareness.

UNIT V  HUMAN POPULATION AND THE ENVIRONMENT  6

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Recognize and understand the functions of environment, ecosystems and biodiversity and their conservation.
2. Identify the causes, effects and environmental pollution and natural disasters and contribute to the preventive measures in the immediate society.
3. Identify and apply the understanding of renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.
4. Recognize different forms of energy and apply them for suitable applications in for technological advancement and societal development.
5. Demonstrate the knowledge of societal activity on the long and short term environmental issues and abide by the legal provisions, National and International laws and conventions in professional and personal activities and to identify and analyse effect of population dynamics on human value education, consumerism and role of technology in environmental issues.

TEXT BOOKS:

REFERENCE BOOKS:

IT5401  OBJECT ORIENTED PROGRAMMING AND ADVANCED DATA STRUCTURES  L T P C  3 0 0 3

OBJECTIVES:
- To introduce basic concepts and advanced features of Object Oriented Programming.
- To learn and implement different data structures using object oriented concepts.
- To learn about non-linear data structures.
• To familiarize with graph and graph-related algorithms.
• To learn about the applications of graphs for real world problem solving.

UNIT I OBJECT ORIENTED PROGRAMMING FUNDAMENTALS

Suggested Activities:
• Flipped Classroom - Features of OOP, Pointers.
• External learning - Dynamic memory allocation operators and its usage.
• Exploration of examples on static functions and usage of ‘this’ pointer.
• Exploration of the usage of reference variables, pointer to reference and reference to a pointer.
• Application development using Friend functions and function overloading.

Suggested Evaluation Methods:
• Assignments on the usage of dynamic memory allocation operators, Friend functions and reference variables.
• Quizzes on pointers and usage of pointers.
• Demonstration of the application development.

UNIT II OBJECT ORIENTED PROGRAMMING - ADVANCED FEATURES

Suggested Activities:
• Flipped Classroom on basics of exception handling.
• External learning - STL Containers and Iterators.
• Practical - Solve a given problem (such as Vector Manipulation, List Updation) by choosing appropriate functions from STL.
• Exploration on the usage of Virtual Functions and Abstract Classes.
• Application development using exception handling.

Suggested Evaluation Methods:
• Assignments on problem solving using STL.
• Quizzes on exception handling, abstract classes.
• Demonstration for application development.

UNIT III ADVANCED NON-LINEAR DATA STRUCTURES

Suggested Activities:
• Flipped classroom on binary search trees and binary heap concepts.
• External learning - Fibonacci Heap, Tries.
• Exploration of application of trees where trees can be applied for real time problems.
• Practical - Design and Implementation of a suitable tree/heap structure for solving a given real time problem such as implementation of syntax trees in compilers/implementation of Binary Space Partition in video games/order statistics problem.
Suggested Evaluation Methods:
- Assignments on Fibonacci Heaps, Tries, Real time problem solving using Trees/Heaps.
- Quizzes on BST, Binary Heap.
- Demonstration of practical learning component.

UNIT IV ELEMENTARY GRAPH ALGORITHMS 9

Suggested Activities:
- Flipped Classroom on basics of graphs.
- External learning - Applications of graphs.
- Exploration of other single source shortest path problems.
- Practical - To choose and apply a suitable graph algorithm for solving a real time problem/scenario such as Network Routing/Finding relations in Networks/Finding shortest path in Maps.

Suggested Evaluation Methods:
- Assignments on representation of graphs for a given problem and solving real time problems by applying suitable graph structures.
- Quizzes on basics of graphs.

UNIT V ADVANCED GRAPH ALGORITHMS 9

Suggested Activities:
- Flipped Classroom on BFS and its applications.
- External learning - Inline memory data structures.
- Exploration of more applications of DFS and its usage in real time scenario.
- Simulation of All Pair Shortest Path with various graphs.

Suggested Evaluation Methods:
- Assignments on inline memory data structures and application of a DFS algorithm to solve a real time problem.
- Quizzes on BFS and few more applications of DFS.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
CO1: Understand the problem specifications as per the requirements.
CO2: Design practical applications using OOP concepts.
CO3: Solve the given problem using object oriented programming concepts.
CO4: Implement advanced data structures through ADTs using OOP.
CO5: Apply graph data structures for a real world problem.
CO6: Understand and apply the advanced data structures for solving real world applications.

TEXT BOOKS:

REFERENCES:

<table>
<thead>
<tr>
<th>Course outcomes</th>
<th>Programme outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
</tr>
<tr>
<td>CO6</td>
<td>✓</td>
</tr>
</tbody>
</table>

IT5402 DESIGN AND ANALYSIS OF ALGORITHMS

OBJECTIVES:
- To learn about the process of problem solving.
- To be conversant with algorithms for common problems.
- To analyse the algorithms for time/space complexity.
- To learn to write algorithms for a given problem using different design paradigms.
- To understand computational complexity of problems.

UNIT I FUNDAMENTALS

Suggested Activities:
- Discussion on role of algorithms in computer science.
- External learning - Design of simple problems, sample problems in Hackerrank, like, diagonal difference in matrices, staircase construction.
- Computation of step count and operation count for merge sort and Quicksort.
- Design of induction proofs for algorithm verification for recursive algorithms.
• Practical - Implementation of time complexity in Python.

Suggested Evaluation Methods:
• Tutorials on operation count and step count for iterative algorithms such as linear search and array sum.
• Assignments on recursive algorithm analysis and Master Theorem.
• Quizzes on algorithm writing.

UNIT II DESIGN TECHNIQUES

Suggested Activities:
• External learning - Divide and conquer based algorithms, Hackerrank divide and conquer algorithms.
• External learning - Dynamic programming based algorithms like coin change.
• Computation of step count and operation count.
• Design of Induction Proofs for algorithm verification.
• Practical - Implementation of Merge sort and Longest Common Sequence like Spell Checker, Hackerrank problems like coin change.

Suggested Evaluation Methods:
• Tutorials on matrix chain multiplication and longest common sequence.
• Assignments on string edit and string basics.
• Quizzes on algorithm design.

UNIT III GREEDY APPROACH AND MATRIX OPERATIONS

Suggested Activities:
• Flipped classroom on algorithm design.
• External learning - Greedy approach based algorithms like set cover and vertex cover – Hackerrank problems like Password cracker.
• Computation of step count and operation count of Huffman code.
• Design of greedy based proofs for set cover problems.
• Practical - Implementation of matrix inverse using Gaussian Elimination problem.

Suggested Evaluation Methods:
• Tutorial on Huffman code and task scheduling.
• Assignments on LUP Decomposition and Matrix Inverse using matrix decomposition.
• Quizzes on greedy approach.

UNIT IV LINEAR PROGRAMMING

Suggested Activities:
• Flipped classroom on Linear Algebra, Linear Programming basics
• External learning - Problems like Diet Problem in Hackerrank.
• Formulation of Duality for simple Linear Programming problems like Diet Problem.
• Practical - Implementation of Simplex algorithm.

**Suggested Evaluation Methods:**
• Tutorials on linear programming.
• Assignments in duality and linear programming problem formulations.
• Quizzes on linear programming.

**UNIT V  COMPUTATIONAL COMPLEXITY**

Cook’s Theorem – NP-Completeness Proofs – Probabilistic Analysis and Randomized
Algorithms – Quicksort – Approximation Algorithms – Set Cover and Vertex Cover.

**Suggested Activities:**
• Flipped classroom on computational complexity.
• External learning - NP complexity, Turing machines.
• Computation and derivation of exponential complexity for set cover and vertex cover
  problems.
• Design of approximation bounds for randomized quicksort.
• Practical - Implementation of approximation algorithm for set cover problem.

**Suggested Evaluation Methods:**
• Tutorials on NP-complete proofs such as SAT problem.
• Assignments on set cover and vertex cover approximation problems.
• Quizzes on computational complexity.

**OUTCOMES:**
On completion of the course, the student will be able to:
CO1: Articulate the process of problem solving and writing algorithms.
CO2: Understand different algorithmic design strategies.
CO3: Design and implement any problem using design techniques.
CO4: Critically analyse the complexity of the given algorithm.
CO5: Solve a problem in polynomial time or prove that to be an NP-Complete problem.
CO6: Obtain knowledge of advanced topics such as approximation algorithms, linear
programming and randomized algorithms.

**TEXT BOOKS:**

**REFERENCES:**

<table>
<thead>
<tr>
<th>COURSE OUTCOMES</th>
<th>PROGRAMME OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>PO1</td>
<td>PO2</td>
</tr>
</tbody>
</table>

TOTAL: 45 PERIODS
OBJECTIVES:
- To learn the basic concepts and functions of operating systems (OS).
- To learn the mechanisms of OS to handle processes and threads and their communication.
- To study the basic components of scheduling mechanism.
- To learn memory management strategies in contemporary OS.
- To appreciate the emerging trends in operating systems.

UNIT I INTRODUCTION TO OPERATING SYSTEMS AND PROCESSES
9

Suggested Activities:
- Introduction to Linux and shell programming.
- External learning - Introduction to xv6: download, build, boot (in virtual machine if needed).
- Implement a user program in xv6 to print "Hello World!!".
- Study and use of system calls in xv6: getpid, fork, clone, exit, wait.
- Study of the following files in xv6:
  - main.c[Bootstrap processor running, other CPU setup, starting running processes], syscall.h[system call numbers], syscall.c[system call handler]
  - sysproc.c[system call definitions], proc.c[set up first user process, create new process, allocating process, exit of process, process states and scheduling], swtch.S[context switch], proc.h [per-CPU state and per-process state], vectors.S[trap handler], trapasm.S[build trap frame], trap.c[Interrupt Descriptor Table], traps.h[Interrupt constants]
- Exercises on Virtualization like the following may be given:
  Given two C code snippets that compile and execute without any errors, queries like the following may be asked: If the given code snippets are run on
a machine with a single CPU and a main memory of size 1 GB, what are the hardware resources that are being virtualized - Only CPU OR only memory OR both?

- Writing a user program to check and print the state of a process (current/all/specified) in xv6.
- Give two C code snippets (assuming that these compile successfully and APIs like fork(), exec(), and wait() never fails) and questions like the following may be given:
  (a) After program 1 is executed, how many processes are created?
  (b) After program 2 is executed, how many processes are created?
- External learning - Mobile OS structure.

Suggested Evaluation Methods:
- Quiz on understanding of Linux and shell programming.
- Implementation evaluation of “Hello World!” user program.
- Quizzes on xv6 system calls, study files and other topics of the unit.
- Assignments to be appropriately evaluated.
- Assignments and implementation evaluation.

UNIT II PROCESS SYNCHRONIZATION AND SCHEDULING 12

Suggested Activities:
- Add a new system call with parameters in xv6 and invoke it in user program.
- Create thread and implement multi threading using pthread library in any language.
- Implement at least one form of producer consumer problem in any language.
- Implement process synchronization using lock variable method in any language.
- Implement Dekker’s algorithms using thread in any language.
- Implement semaphores in any language.
- Computation of the response time and turnaround time when running three jobs of length 200 with the SJF, FIFO and RR (time-slice of 1) schedulers.
- Study of the following files in xv6: main.c [Starting running processes], vm.c [allocating space for scheduler processes], proc.h [process context and state], proc.c [scheduling], swtch.S [context switch]
- Study of the scheduling algorithm in xv6 and making appropriate changes in the Round Robin scheduler in xv6 to print the process id and process name during scheduling.
- Assignments on scheduling mechanisms.

Suggested Evaluation Methods:
- Implementation evaluation of system call in xv6 using the implemented user program.
- Implementation evaluation of multi-threading.
- Quiz on xv6 study files and other topics of the unit.
- Quiz to check the understanding of the scheduling concepts in xv6.
- Assignments to be appropriately evaluated.

UNIT III FILE SYSTEM 6
Suggested Activities:
- Demonstration of various combined actions using system calls and file such as the followings: Is it possible to use file names only without using file descriptor (fd) or, given an fd, is it possible to get the corresponding file name or can multiple directories “contain” the same file?
- Create a file in xv6 and perform read and write operations.
- Study the following files in xv6: file.c, sysfile.c [file creation, reading and writing].
- Change the existing xv6 file system to add high-performance support for small files. The basic idea is as follows: If one has a small file that can be indexed with only 13 direct data pointers, we use the 13th pointer as reserved for indirect data block as a direct data pointer, thus speeding up access to the small file, as well as saving some disk space.

Suggested Evaluation Methods:
- Checking the understanding of the file concepts in xv6.
- Quiz on xv6 study files and other topics of the unit.
- Assignment on xv6 to be appropriately evaluated.
- Implementation evaluation of small file problem in xv6.

UNIT IV   MEMORY MANAGEMENT

Suggested Activities:
- Study files in xv6: umalloc.c and kalloc.c (kvalloc() [allocating space for kernel process], allocuvm() [allocating page tables and physical memory], deallocuvm() [deallocating physical memory], freevm() [free physical memory page table].
- Practical - Implementation and use of functions malloc() and free() in xv6.
- Practical - Implementation of at least one of the page replacement policies.
- Assignments on computing page faults for LRU, FIFO and Optimal Page Replacement algorithms.
- Practical - Implementation of the program in any programming language to select free holes from given memory partitions using first-fit, best-fit, and worst-fit dynamic storage allocation strategies.

Suggested Evaluation Methods:
- Quiz on xv6 study files and other topics of the unit.
- Implementation evaluation of assignment in xv6 and other programs.

UNIT V   I/O SYSTEMS AND STORAGE MANAGEMENT

Suggested Activities:
- Use I/O (open, read, write, ioctl) system calls in xv6.
- External learning - Learn the differences between solid state drives and hard disk drive.
- External learning - Understand the concepts of blocking and non-blocking I/O.
- Practical - Write a chat program using blocking I/O (read/write) and non-blocking I/O using any language.
- Practical - Write a program to perform contiguous, linked and indexed allocation strategies using any language.

**Suggested Evaluation Methods:**
- Quizzes on I/O and other concepts in xv6 and other topics of the unit.
- Implementation evaluation of the practical assignments.

**TOTAL: 45 PERIODS**

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

CO1: Articulate the main concepts, key ideas, strengths and limitations of operating systems.

CO2: Analyze the structure and basic architectural components of OS.

CO3: Design various scheduling algorithms.

CO4: Understand various file management systems.

CO5: Design and implement memory management schemes.

Acquire a detailed understanding of various aspects of I/O management.

**TEXT BOOK:**

**WEBLINKS:**

**REFERENCES:**

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

**IT5451** COMPUTER ARCHITECTURE

**OBJECTIVES:**
- To identify the functional units in a digital computer system.
- To distinguish between the various ISA styles.
• To trace the execution sequence of an instruction through the processor.
• To evaluate different computer systems based on performance metrics.
• To understand the fundamentals of memory and I/O systems and their interface with the processor.

UNIT I  FUNDAMENTALS OF COMPUTER SYSTEMS

Suggested Activities:
• In-class activity on performance evaluation.
• Flipped classroom – Evolution and types of computer systems, identification of benchmarks.
• Use a Simulator for RISC and CISC. Analyze the ISA supported by the architectural simulator by running simple programs on the simulator.
• Mapping and correlating a C code with its machine code.
• Practical – Opening up a computer system and studying the components.

Suggested Evaluation Methods:
• Mock test on problems for computer performance.
• Group discussion on activity four with assembly instruction, identifying the instruction type and encoding used in machine code.
• Quizzes on ISA.

UNIT II  ARITHMETIC FOR COMPUTERS

Suggested Activities:
• Flipped classroom – Unsigned binary operations(+,−,*,/).
• Simulation of the floating point operations.
• External learning – Arithmetic algorithms for faster multiplication and division.
• Tutorials on multiplication and division (Booths algorithm, restoring and non-restoring).

Suggested Evaluation Methods:
• Mock test on multiplication and division.
• Quizzes on floating point single precision and double precision representation.

UNIT III  PROCESSOR

Suggested Activities:
• Flipped Classroom for analyzing data path in Intel and ARM core.
• Practical – Analyzing the data path on the standard simulator.
• Practical – Study of the pipelined implementation and analysis of various hazards on a standard simulator.
Suggested Evaluation Methods:
- Assignment on data path design.
- Group discussion on pipeline depth and stages.
- Quiz on class or automatic quizzes on the flipped classroom content.

UNIT IV MEMORY AND I/O

Suggested Activities:
- Flipped classroom on memory hierarchy in Intel i7 and ARM Cortex.
- Practical – Implement a simple functional model for memory mapping in cache using C/C++.
- Study hit/miss rates for various access patterns. Experiment with different replacement policies.

Suggested Evaluation Methods:
- Mock test for problems on memory mapping.
- Quizzes on memory management in ARM and Intel processor.

UNIT V PARALLEL PROCESSING

Suggested Activities:
- Flipped classroom on evolution of GPU.
- External learning – Speculative dynamic scheduling.
- Survey on multicore and draw a mind map on trends of multicore processors.

Suggested Evaluation Methods:
- Quizzes on dynamic scheduling.
- Group discussion on how to reduce CPI to less than one clock cycle.

OUTCOMES:
On completion of the course, the students will be able to:
CO1: Interpret assembly language instructions.
CO2: Design and analyze ALU circuits.
CO3: Implement a control unit as per the functional specification.
CO4: Design and analyze memory, I/O devices and cache structures for processor.
CO5: Evaluate the performance of computer systems.
CO6: Point out the hazards present in a pipeline and suggest remedies.

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:

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

IT5411 OPERATING SYSTEMS LABORATORY

OBJECTIVES:
- To learn about the basic commands of operating systems.
- To implement process synchronization mechanisms in operating systems.
- To learn various process management schemes in operating systems.
- To practice with the important memory management mechanisms.
- To implement the file allocation techniques.

LIST OF EXERCISES:
1. Basic Unix file system commands such as ls, cd, mkdir, rmdir, cp, rm, mv, more, lpr, man, grep, sed, etc.
2. Shell script.
3. Process control system calls - demonstration of fork, exec and wait
4. Thread management.
5. Thread synchronization.
7. Program to simulate preemptive and non-preemptive process scheduling algorithms.
8. Program to simulate file allocation strategies.
9. Interprocess communication using pipes.
10. Interprocess communication using FIFOs.
11. Interprocess communication using signals.

TOTAL: 60 PERIODS

OUTCOMES:
On completion of this course, the student will be able to:
CO1: Understand and implement basic services and functionalities of the operating system using system calls.
CO2: Use modern OS system calls and synchronization libraries in software/hardware interfaces.
CO3: Understand the benefits of thread over process and implement synchronized programs using multithreading concepts.
CO4: Analyze various IPC techniques in the operating system
CO5: Implement memory management schemes and page replacement schemes.
CO6: Simulate file allocation and organization techniques.

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

IT5412 ADVANCED DATA STRUCTURES LABORATORY L T P C
0 0 4 2

OBJECTIVES:
- To understand the concepts of Object Oriented Programming.
- To use standard template library in the implementation of standard data structures.
- To learn advanced data structures using Object Oriented Programming (OOP) language.
- To explore graph structures and traversals using OOP concepts.
- To understand various graph algorithms using OOP concepts.

LIST OF EXPERIMENTS:
Implement the following exercises using C++:
1. Implementation of an Application (such as Library Management System) using Classes, Objects, Constructors, Destructors and String Handling.
2. Implementation of Programs using Function Overloading and Operator Overloading.
3. Implementation of an Application such as Student Information System using Inheritance, Virtual Functions and Abstract Classes.
4. Implementation of Programs using Function Templates and Class Templates.
5. Implementation of Stack, Queue and List Data Structures using STL Concepts.
7. Implementation of Splay Tree using Templates.
8. Implementation of a Heap tree using Templates.
10. Implementation of Graph Traversals Algorithms: Breadth-First Search, Depth-First Search.
OUTCOMES:
On completion of the course, the students will be able to:
CO1: Implement the basic and advanced concepts of object-oriented programming.
CO2: Solve the given problem using object oriented concepts.
CO3: Implement basic and advanced data structures through ADTs using OOP.
CO4: Analyze and apply the graph data structures for a real world problem.
CO5: Design and develop real time applications by applying suitable data structures and associated operations.
CO6: Design and develop efficient algorithms with data representations on their own based on the requirements.

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

IT5502 COMPILER ENGINEERING

OBJECTIVES:
- To learn about automata theory and regular expressions.
- To learn the concepts in the design of compilers.
- To learn about the runtime store organization.
- To know the data structures used to implement symbol tables.
- To be familiar with garbage collection.

UNIT I INTRODUCTION TO AUTOMATA THEORY AND REGULAR EXPRESSIONS

Suggested Activities:
- Flipped classroom on Finite Automata and Regular Expressions.
- External learning - Automata, Basics of Finite Automata, NFA, DFA ,Finite state machines - Regular expressions.
- Practical - Study of Lexical analysis tools and lexer generators.

Suggested Evaluation Methods:
- Tutorials on minimization of automata.
- Assignments on regular expressions.
• Quizzes on automata.

UNIT II  LEXICAL ANALYSIS

Suggested Activities:
• Flipped classroom on Compilers and Interpreters, The compilation process and the anatomy of a compiler, Bootstrapping.
• External learning - The role of the lexical analyzer, Finite state machines - Regular expressions.
• Practical - Perform lexical analysis and use lexical analyzer generators, Implementation of lexers using FLEX.

Suggested Evaluation Methods:
• Tutorials on structure of the compiler.
• Assignments on lexical analysis.
• Quizzes on lexical generators.

UNIT III  SYNTAX ANALYSIS

Suggested Activities:
• Flipped classroom on languages, writing grammars for programming languages, transformations on grammars.
• External learning - Parser generators.
• Practical - Read and write grammars for programming language constructs, Perform top-down parsing, bottom-up parsing and use parser generators, Implementation of Parsers using YACC in Unix Environment.

Suggested Evaluation Methods:
• Tutorials on context-free grammar.
• Assignments on various parsers.
• Quizzes on parsers.

UNIT IV  INTERMEDIATE CODE GENERATION

Suggested Activities:
• Flipped classroom on attributes grammars.
• External learning - Type checking, intermediate code and abstract machines.
• Practical - Perform semantic analysis including static checking, intermediate representations and attribute grammars, implementation of semantic analyzers using YACC.

Suggested Evaluation Methods:
• Tutorials on syntax directed definitions.
UNIT V CODE GENERATION AND OPTIMIZATION


Suggested Activities:
- Flipped classroom on Target machine.
- Practical - Perform code generation.

Suggested Evaluation Methods:
- Tutorials on code generation.
- Assignment problems flow graph.
- Quizzes on code optimization.

OUTCOMES:
On completion of the course, the students will be able to:
CO1: Understand the concept of lexical analysis and construction of deterministic and non-deterministic automata.
CO3: Study programming language design, target machine design and run time environment of compilers.
CO4: Study about the compiler construction tools.
CO5: Obtain knowledge to construct a prototype compiler for a subset of a programming language.

TEXT BOOKS:

REFERENCES:

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
OBJECTIVES:
- To understand the concept of layering in networks.
- To know the functions of protocols of each layer of TCP/IP protocol suite.
- To visualize the end-to-end flow of information.
- To understand the components required to build different types of networks.
- To learn concepts related to network addressing and routing.

UNIT I  INTRODUCTION AND APPLICATION LAYER  9

Suggested Activities:
- In-class activity - Solving problems on performance metrics.
- In-class activity - HTTP problems.
- Accessing HTTP and SMTP server through Telnet.
- External learning - HTTP/DNS format using a tool like Wireshark.
- External learning - POP3 and IMAP protocols of email application.

Suggested Evaluation Methods:
- Quiz on Wireshark.
- Quiz on POP3 and IMAP.
- Assignment problems different protocols.

UNIT II  TRANSPORT LAYER  9

Suggested Activities:
- Flipped Classroom on UDP Applications.
- External learning - Wireshark for UDP, TCP packet formats.
- External learning - Transport for Real Time Applications.
- External learning - Understanding RFCs.
- Assignments on flow control analysis in class.

Suggested Evaluation Methods:
- Quiz on UDP applications.
- Quiz on real time transport protocols.
- Discussion/assignment on RFC.
• Interpreting Wireshark output.

UNIT III NETWORK LAYER

Suggested Activities:
• In-class activity - IP addressing.
• External learning - IPV4 Packet Format using Wireshark.
• In-class activity - Subnetting for different scenarios.
• Flipped classroom on CIDR.
• External learning - Ping and trace-route commands.
• Mini-project on the implementation of a protocol based on an RFC.

Suggested Evaluation Methods:
• Quiz on CIDR.
• Check ability to use commands.

UNIT IV ROUTING

Suggested Activities:
• In-class activity - Distance Vector Routing, Link State Routing.
• External learning - RIP, OSPF packet formats.
• Assignment on Link state routing for different network graphs.
• In-class activity - Error Detection and Correction.
• Flipped classroom on IPV6.
• External learning - Study on global IP address assignment.

Suggested Evaluation Methods:
• Quizzes on RIP, OSPF packet format.
• Quiz on IPv6.

UNIT V DATA LINK AND PHYSICAL LAYERS

Suggested Activities:
• In-class activity - Problems on encoding techniques.
• External learning - Virtual LAN, Wireless LAN (802.11) formats.
• Flipped Classroom on recent developments in transmission media.
• Design a protocol for some application.
• Trace the end-to-end flow of packets through the network.

Suggested Evaluation Methods:
• Quizzes on VLAN and 802.11 formats.
• Presentation/Implementation of design.
• Demonstration of RFC implementation project.

TOTAL : 45 PERIODS
OUTCOMES:
On the completion of the course, the student will be able to:

CO1: Highlight the significance of the functions of each layer in the network.
CO2: Identify the devices and protocols to design a network and implement it.
CO3: Build network applications using the right set of protocols and estimate their performances.
CO4: Trace packet flows and interpret packet formats.
CO5: Apply addressing principles such as subnetting and VLSM for efficient routing.
CO6: Explain media access and communication techniques.

TEXT BOOKS:

REFERENCES:

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

IT5501 WEB TECHNOLOGIES L T P C 3 0 0 3

OBJECTIVES:
- To learn the basic object oriented concepts using Java language.
- To understand the advanced features of Java language.
- To understand the essential client side technologies for web programming.
- To develop applications using database connectivity and server side programming in Java environment.
- To develop smart device based web application and deploy in different platforms.

UNIT I JAVA BASICS
Suggested Activities:
- Simple Java programming using control statements, strings, arrays, ArrayList, passing and returning object with exception handling.
- Exploring class hierarchy using inheritance and implementing Interface based run-time polymorphism.
- String manipulation and regular expression based examples.

Suggested Evaluation Methods:
- Grading system to evaluate simple java exercises.
- Tutorials on program writing skills.
- Simple application development using all the above mentioned features.

UNIT II        JAVA GUI, FILE STREAM AND CONCURRENCY


Suggested Activities:
- Applet and frame based application development using Swing.
- File stream and object serialization on text and binary data.
- Thread priorities and synchronization based application development.
- Simple networking programs like chat application.

Suggested Evaluation Methods:
- Grading system to evaluate simple java exercises.
- Tutorials on various GUI control based applet and frame applications with event handling.
- Application development based on I/O stream and thread manipulation.

UNIT III        CLIENT SIDE ESSENTIALS


Suggested Activities:
- Programming exercises on HTML forms with Java script and JQuery objects.
- XML and JSON based AJAX enabled rich Internet application.
- Tutorials on web speech API.

Suggested Evaluation Methods:
- Case studies on simple web site with HTML, Java script and JQuery objects.
- AJAX enabled web site realization.
- Java script based speech API implementation.

UNIT IV        SERVER SIDE ESSENTIALS

Suggested Student Activities:
- Servlet programming with database connectivity and session tracking.
- JSF applications with database connectivity and session management.

Suggested Evaluation Methods:
- Demonstration of simple web application using Servlet and JSF.
- Session management demos using Servlet and JSF.

UNIT V        SERVERLESS AND MOBILE BASED WEB DEVELOPMENT

Node Programming Fundamentals – Asynchronous Programming Techniques – Sequencing
–Mobile Web Application Frameworks – Simple Android Based Development – Cloud Based
Applications Deployment.

Suggested Student Activities:
- Asynchronous web application development.
- Android based mobile application development.
- Practical - Application deployment in web servers.

Suggested Evaluation Methods:
- Evaluating asynchronous application development.
- Evaluation of online web hosting.
- Modular design factors like cohesion and coupling used to evaluate proper modules
  breakup.

OUTCOMES:
On completion of the course, the student will be able to:
CO1: Implement object oriented concepts using Java language.
CO2: Develop GUI application by including I/O streams and threads.
CO3: Create web pages with proper client–side features.
CO4: Design dynamic web pages with server–side and other technologies.
CO5: Develop simple android based mobile application.
CO6: Deploy web applications in a cloud based environment.

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
2. Harvey Deitel, Abbey Deitel, “Internet and World Wide Web How To Program”, 5th
3. Reto Meier, “Professional Android 4 Application Development”, Wiley India Pvt Ltd,
   2012.
4. Mike Cantelon, Marc Harter, TJ Holowaychuk and Nathan Rajlich, “Node.js in
OBJECTIVES:
- To explore various network commands in different operating systems.
- To understand and practice the configuration of various network devices.
- To implement functionalities using raw sockets.
- To understand and implement the network programming concepts using APIs.
- To explore the various network simulators for analysing network behaviour.

EXERCISES:
1. Practice different network commands available in Windows and Linux Operating Systems and troubleshoot the network.
2. Configure the network devices such as Router, Switch, Hub, Bridge and Repeater.
3. Write socket programs to simulate the operation of the following application layer protocols:
   a) HTTP
   b) FTP
   c) DNS
   d) SMTP and POP3
4. Simulate ECHO and CHAT applications using the following transport layer protocols:
   e) TCP
   f) UDP
5. Implement the functionality of Ping and traceroute commands using raw sockets.
6. Analysing the Network traffic using Packet Analyser (Wireshark) and understanding the various protocol headers.
7. Configure IPv4 and IPv6 addressing for a network using static and dynamic approaches (SLAAC and DHCP).
8. Configure Dynamic Routing mechanism using RIP and OSPF protocols.
9. Simulate TCP congestion control mechanism using NS2/NS3/OPNET.
10. Performance analysis of Network using NS2/NS3/OPNET (Delay, Bandwidth etc.)

TOTAL: 60 PERIODS

OUTCOMES:
On completion of the course, the student will be able to:
CO1: Configure various networking devices.
CO2: Understand the nuances of various network programming APIs and protocols of application layer protocols.
CO3: Program with raw sockets for network protocol implementation.
CO4: Configure IP addressing and routing for a network.
CO5: Understand the behaviour of TCP for congestion via simulation.
CO6: Work with network simulators.
OBJECTIVES:
- To develop simple Java programs using object orientation concepts.
- To program using files and threads for concurrent operations.
- To design attractive GUI using framework.
- To create dynamic web pages using CSS, JavaScript and AJAX.
- To develop mobile based web applications in cloud environment.

LIST OF EXPERIMENTS:
1. Simple Java programs using arrays and lists.
2. Object orientation program using inheritance and polymorphism.
4. Simple GUI application development using applet and SWING.
5. Implement multithreaded program for concurrent operations.
6. Develop program to set priority and synchronize java threads.
7. Input and Output manipulation on files (Read/Write).
8. Java programs on generic and collections.
10. Dynamic web page creation using Javascript, JQuery and AJAX.
11. Develop servlet and JSF application with JDBC access.
12. Manage sessions in JSP using cookies.
14. Android application for location based service.
15. Develop Cloud based web application.

TOTAL: 60 PERIODS

OUTCOMES:
On completion of the course, the student will be able to
CO1: Implement object oriented concepts using Java language.
CO2: Develop GUI application by including I/O streams and threads.
CO3: Create web pages with proper client-side features.
CO4: Design dynamic web pages with server-side and other technologies.
CO5: Develop simple android based mobile application.
CO6: Deploy web applications in a cloud based environment.
OBJECTIVES:
- To learn the internal architecture and programming of an embedded processor.
- To introduce interfacing I/O devices to the processor.
- To introduce the evolution of Internet of Things (IoT).
- To build a small low-cost embedded and IoT system using Arduino/Raspberry Pi/ open platform.
- To apply the concept of Internet of Things in real world scenario.

UNIT I 8-BIT EMBEDDED PROCESSOR 9

Suggested Activities:
- Flipped classroom activity on different types of microcontrollers.
- Assignment on writing simple assembly codes.
- Practical - Developing simple application using assembly code.

Suggested Evaluation Methods:
- Tutorials on instruction set and programming.
- Assignments on programming using machine code.
- Quizzes on instruction set and programming.

UNIT II EMBEDDED C PROGRAMMING 9

Suggested Activities:
- Flipped classroom on different types of RTOS.
- Practical - Writing simple embedded C codes.
- Practical - Developing simple application using embedded C code.
Suggested Evaluation Methods:
- Tutorials on embedded C programming.
- Assignment on scheduling policies.
- Practical - Developing applications using embedded C.
- Quizzes on Embedded C and RTOS.

UNIT III  IOT AND ARDUINO PROGRAMMING


Suggested Activities:
- Flipped classroom on ARM processors and its applications.
- Practical - Developing simple application using Arduino.
- Case study of different sensors used in IoTs.

Suggested Evaluation Methods:
- Tutorials on Arduino programming.
- Assignment problems on interfacing I/O based applications with Arduino board.
- Quizzes on IoT devices.

UNIT IV  IOT COMMUNICATION AND OPEN PLATFORMS


Suggested Activities:
- Flipped classroom on Bluetooth, WiFi, ZigBee, GPS, GSM etc. standards.
- Practical - Developing simple application using open platform (like Raspberry Pi).
- Case study of different existing IoT related standards.

Suggested Evaluation Methods:
- Tutorials on programming with open platforms for IoT.
- Assignment on interfacing different sensors/actuators with open platform.
- Quizzes on IoT communications.

UNIT V  APPLICATIONS DEVELOPMENT


Suggested Activities:
- Flipped classroom activity on different existing IoT applications.
- Designing simple applications.
- Case study on IoT based home automation solutions.

Suggested Evaluation Methods:
- Tutorials on design and development of IoT applications.
- Assignment on different IoT based smart solutions.
- Demonstrating real-time applications using embedded and IOT processors.
Quizzes on Design of embedded systems and IoT applications.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the student will be able to:
CO1: Understand and compare various embedded processors.
CO2: Design and deploy timers and interrupts.
CO3: Write embedded C programs.
CO4: Design simple embedded applications.
CO5: Design portable IoT using Arduino/Raspberry Pi/open platform.
CO6: Analyze applications of IoT in real time scenario.

TEXT BOOKS:

REFERENCES:

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

IT5602 DATA SCIENCE AND ANALYTICS L T P C
3 0 0 3

OBJECTIVES:
- To learn the fundamentals of data science and big data.
- To gain in-depth knowledge on descriptive data analytical techniques.
- To gain knowledge to implement simple to complex analytical. Algorithms in big data frameworks.
- To develop programming skills using required libraries and packages to perform data analysis in Python.
- To understand and perform data visualization, web scraping, machine learning and natural language processing using various Data Science tools.

UNIT I  INTRODUCTION TO DATA SCIENCE AND BIG DATA

Suggested Activities:
- Case studies on big data application domain.
- Real world domain specific problems involving big data and listing out the challenges.
- Demonstration on data analytics tools.

Suggested Evaluation Methods:
- Student assignment on case studies related to healthcare, climate change, e-commerce, retail business, manufacturing etc.
- Group presentation on big data applications with societal need.
- Quizzes on topics like big data terminologies, big data applications, etc.

UNIT II  DESCRIPTIVE ANALYTICS USING STATISTICS

Suggested Activities:
- Solving numerical problems based on statistics and probability.
- Demonstration of descriptive analysis using Python.
- Demonstrate PCA using Iris data set in Python.

Suggested Evaluation Methods:
- Assignment on data understanding using open source tools.
- Student Presentation of real world applications and the required descriptive analysis.
- Quiz on all topics in descriptive analytics using statistics.

UNIT III  PREDICTIVE MODELING AND MACHINE LEARNING

Suggested Activities:
- Solve numerical problem solving using linear regression models.
- Demonstrate data cleaning using WEKA tool.
- Demonstration of data preprocessing and machine learning features in Python.
Suggested Evaluation Methods:
- Simple lab based activities for machine learning in Python using small benchmark datasets.
- Tool based assignments on linear, polynomial and multivariate regression using real world case studies.
- Assignment on comparative analysis of two or more data sets using their features.

UNIT IV DATA ANALYTICAL FRAMEWORKS

Suggested Activities:
- Case studies on applications involving usage of data analytical frameworks.
- Demonstration of Installation and configuring Hadoop and MapReduce.
- Design and develop algorithms to be executed in Map Reduce involving numerical methods for analytics.
- Installation of MongoDB and simple data management.

Suggested Evaluation Methods:
- Mini Project (Group) – Real time data collection, saving in Hive, implement analytical techniques using Map-Reduce Tasks and Result Projection.
- Practical – Programming assignments in MongoDB.
- Quiz on Hive query language.

UNIT V DATA SCIENCE USING PYTHON

Suggested Activities:
- Demonstration of simple Python scripts using NumPy and SciPy Package.
- Demonstration on NumPy arrays and matrix operations.
- Simple lab activities on dimensionality reduction and feature selection using Python.
- Demonstration of experiments on data visualization using matplotlib functions.

Suggested Evaluation Methods:
- Mini Project using Python for data analytics with benchmark datasets.
- Quiz on data visualization functions.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the student will be able to:
- CO1: Identify the real world business problems and model with analytical solutions.
- CO2: Solve analytical problem with relevant mathematics background knowledge.
- CO3: Convert any real world decision making problem to hypothesis and apply suitable statistical testing.
- CO4: Write and demonstrate simple applications involving analytics using Hadoop and MapReduce.
CO5: Use open source frameworks for modeling and storing data.
CO6: Perform data analytics and visualization using Python.

**TEXT BOOKS:**

**REFERENCES:**

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

**IT5603 DISTRIBUTED AND CLOUD COMPUTING**

**OBJECTIVES:**
- To learn about the concepts of distributed systems.
- To understand distributed resource management.
- To study the basics of cloud computing.
- To study about virtualization and cloud resource management.
- To be aware of different cloud platforms.

**UNIT I INTRODUCTION TO DISTRIBUTED SYSTEM CONCEPTS**

**Suggested Activities:**
- Implement RPC and Bankers algorithm.
- Create and Distribute a Torrent file to share a file in LAN Environment.

**Suggested Evaluation Methods:**
- Demonstration and assessment of the working of the implemented algorithm.
UNIT II  INTRODUCTION TO CLOUD COMPUTING

Suggested Activities:
- Use Google Collaboration Tools: Create Google Docs, Sheets, and Slides and share it with others.
- Explore public cloud services like Amazon, Google, Sales force, and Digital Ocean etc.

Suggested Evaluation Methods:
- Quiz on different architectural styles of cloud.
- Report Submission - Comparison of various services provided by different Cloud Service Providers (Configuration of VM, Cost, Network Bandwidth etc.).

UNIT III  CLOUD ENABLING TECHNOLOGIES

Suggested Activities:
- Create a simple web service using Python Flask /Java /any language [Web service: Client-server model should be implemented using socket/http].
- Install Oracle Virtual Box/VMware Workstation and Create a chat application [Note: Launch two Virtual Machines for chat application].

Suggested Evaluation Methods:
- Review the web service implementation - Proper Connection should be established between the client and server to make use of the service offered by the Server.
- Review the working of Application in virtual environment.

UNIT IV  CLOUD MANAGEMENT, STORAGE AND SECURITY

Suggested Activities:
- Use security tools like ACUNETIX, ETTERCAP to scan web applications on the cloud, cloud networks for finding vulnerabilities, verifying leakage of information to an unauthorized third party.

Suggested Evaluation Methods:
- Report Submission - Generate a detailed report describing vulnerabilities along with the suitable action that can be taken to remedy the loopholes.

UNIT V  CLOUD SOFTWARE AND COMPUTING PLATFORMS
HDFS – Map Reduce – Google App Engine (GAE) – Programming Environment for GAE – Architecture of GFS – Case Studies: Openstack, Heroku, and Docker Containers –Amazon EC2, AWS, Microsoft Azure, Google Compute Engine.
Suggested Activities:
- Install and configure OpenStack all-in-one using Devstack/Packstack and Launch VMs in OpenStack through dashboard.

Suggested Evaluation Methods:
- OpenStack Dashboard should be accessed through web browser. Verify the working of instance by logging into it / pinging the instance.

TOTAL: 45 PERIODS

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

CO1: Appreciate distributed computing, distributed resource management.

CO2: Articulate the main concepts, key technologies, strengths and limitations of cloud computing.

CO3: Develop the ability to understand and use the architecture of compute and storage cloud, service and delivery models.

CO4: Explain the core issues of cloud computing such as resource management and security.

CO5: Choose the appropriate technologies, algorithms and approaches for implementation and use of cloud.

CO6: Establish own cloud environment using Openstack and work on it.

TEXTBOOKS:

REFERENCES:

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

PO1: PO10, PO12
OBJECTIVES:
- To learn tools relevant to Embedded System and IoT development.
- To write simple assembly programs that use various features of the processor.
- To explore Embedded C Programs for different embedded processors.
- To develop simple applications using Arduino/Raspberry Pi/open platform.
- To design and develop IOT application for real world scenario.

LIST OF EXERCISES:
1. Write 8051 Assembly Language experiments using simulator.
2. Test data transfer between registers and memory.
3. Perform ALU operations.
4. Using interrupts generate waveforms and test Timers.
5. Write assembly language experiments using Kit to test interfaces and interrupts using Traffic Generator, DAC, ADC, Stepper Motor (2).
6. Write Basic and arithmetic Programs Using Embedded C.
7. Write Embedded C program to test interrupt and timers.
8. Develop Real time applications – clock generation, waveform generation, counter – using embedded C.
9. Explore ARM/PIC based controllers using Embedded C.
10. Explore different communication methods with IoT devices.
13. Deploy IOT applications using platforms such as Bluemix.

TOTAL: 60 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
CO1: Write and implement simple assembly programs that use various features of the processor.
CO2: Write an Embedded C Program, debug and interpret the results.
CO3: Develop micro controller based application.
CO4: Test and experiment different sensors for application development.
CO5: Develop IOT applications using Arduino/Raspberry Pi/open platform.
CO6: Explore deployment platforms for IoT applications.
OBJECTIVES:
- To provide hands-on experience to cloud and data analytics frameworks and tools.
- To use the Python packages for performing analytics.
- To learn using analytical tools for real world problems.
- To familiarize the usage of distributed frameworks for handling voluminous data.
- To write and deploy analytical algorithms as MapReduce tasks.

LIST OF EXERCISES:

Analytics Using Python:
1. Download, install and explore the features of NumPy, SciPy, Jupyter, Statsmodels and Pandas packages.
   (i) Reading data from text file, Excel and the web.
   (ii) Exploring various commands for doing descriptive analytics on Iris data set.
2. Use the diabetes data set from UCI and Pima Indians Diabetes data set for performing the following:
   (i) Univariate analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis.
   (ii) Bivariate analysis: Linear and logistic regression modeling.
   (iii) Multiple Regression analysis
   Also compare the results of the above analysis for the two data sets.
3. Apply Bayesian and SVM techniques on Iris and Diabetes data set.
4. Apply and explore various plotting functions on UCI data sets.

Cloud Computing:
5. Installation of OpenStack.
6. Creation of VMs and installing applications and executing simple programs in OpenStack.
7. Simple applications for communication across VMs.

Hadoop, MapReduce, HDFS, Hive:
8. Install and configure Hadoop in its two operating modes: Pseudo distributed and fully distributed.
9. Implement the following file management tasks in Hadoop: Adding files and directories, retrieving files and deleting files.
10. Create a retail data base with the following tables: Product, Customer, Manufacturer, Shipping and Time using MongoDB and perform data replication using sharding techniques.
11. Install HIVE and implement the above retail schema definition and perform CRUD operations.

TOTAL:45 PERIODS

OUTCOME:
On completion of the course, the students will be able to:
CO1: Install analytical tools and configure distributed file system.
CO2: Have skills in developing and executing analytical procedures in various distributed frameworks and databases.
CO3: Develop, implement and deploy simple applications on very large datasets.
CO4: Implement simple to complex data modeling in NoSQL databases.
CO5: Develop and deploy simple applications in OpenStack cloud.
CO6: Implement real world applications by using suitable analytical framework and tools.
OBJECTIVES:
- To identify socially relevant problems.
- To design solutions for socially relevant problems.
- To develop projects based on software design process.
- To implement solutions for societal valued projects using relevant state of the art technologies.
- To test the implemented project based on user needs and usefulness.

Students are expected to take up problems that would directly benefit the society and design and implement an IT based solution for the problem, based on the courses undertaken up to that semester. The domains of the problems may reach out to sectors like but not limited to Energy, Education, Material, Environment, Telecommunications, Defense, Healthcare, Entertainment and Agriculture. The societal value of the project is to be evaluated based on the need of the hour and request from stakeholders. The evaluation of the project would be based on the usefulness of the problem statement, formulation of the problem, stakeholders need, and the usage statistics of the solution and the technical merit of the solution.

The project design, development and testing phases can be as shown below:

REQUIREMENTS ENGINEERING PHASE:
- Problem identification.
- Feasibility study of domain.
- Requirement elicitation and analysis.

DESIGN PHASE:
- Architectural design.
- UI design.
- Component Design.
- Database design.

IMPLEMENTATION PHASE:
- Coding in a suitable language using necessary platforms and tools.

TESTING AND VALIDATION PHASE:
- Component Testing
- System Testing
- Acceptance Testing

TOTAL : 30 PERIODS
OUTCOMES:
On completion of the course, the students will be able to:
CO1: Analyze social problems and provide technical solutions.
CO2: Benefit the society by providing IT based solutions for social problems.
CO3: Design, develop and implement solutions for social problems.
CO4: Develop innovative technical solutions of social relevance.
CO5: Design, develop and implement standard solutions to social problems applying CO6: Software engineering methodologies.
CO6: Evaluate the solution based on usefulness, effectiveness and user satisfaction.

REFERENCES:

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

IT5701 ARTIFICIAL INTELLIGENCE L T P C 3 0 0 3

OBJECTIVES:
- To know the underlying structure behind intelligence mathematically.
- To know the logical implications in computational intelligence.
- To know the automated learning techniques.
- To study the techniques of knowledge representation.
- To explore the adaption of artificial intelligence techniques in real-time scenarios.

UNIT I INTELLIGENT AGENTS AND SEARCH TECHNIQUES 12

Suggested Activities:
- Flipped classroom on structure of agents.
- Uninformed search - Searching with costs.
- Solve puzzles with uninformed and informed searches.
- Practical - Implementation of search through Python/other languages.

Suggested Evaluation Methods:
- Tutorials on various topics of the unit.
• Assignments on puzzles with uninformed and informed searches.
• Quizzes on agents, environments and search
• Evaluation of the programming exercises.

UNIT II REASONING WITH LOWER ORDER LOGICS

Suggested Activities:
• Reasoning methods through puzzles and real life scenarios.
• Practical - Inference through Prolog/Python.
• Practical - Programming through Prolog/Python for various topics such as reasoning through resolution.

Suggested Evaluation Methods:
• Tutorials on reasoning methods.
• Assignment problems on different topics of the unit.
• Quizzes on inference techniques in logic.
• Evaluation of the programming exercises.

UNIT III KNOWLEDGE REPRESENTATION

Suggested Activities:
• Examples of knowledge representation through different methods and reasoning.
• Practical - Ontology creation using a tool like Protégé.

Suggested Evaluation Methods:
• Tutorials on different topics of the unit.
• Assignments on knowledge representation through different methods and reasoning.
• Quizzes on different methods of knowledge representation.
• Evaluation of the programming exercise.

UNIT IV AI PLANNING AND NATURAL LANGUAGE PROCESSING

Suggested Activities:
• Flipped classroom on planning types and the background of plan.
• Out of class activity – Classical Planning, Boolean satisfiability.
• In class – Graph plan.
• Practical - Programming through PDDL/Python to develop a plan for block world, cargo world etc.

Suggested Evaluation Methods:
• Tutorials on planning types and the background of plan.
• Assignments on graph plan.
• Quizzes on planning and natural language processing basics.
• Evaluation of the programming exercise.

Suggested Activities:
- Flipped classroom on knowledge in learning.
- Assignments on problem solving in learning techniques.
- Practical Programming exercises using Python/other programming languages such as: Programming for HMM.
- Explore the available Chatbot models such as Watson and adapt to a specific domain such as Education or Customer relations.

Suggested Evaluation Methods:
- Tutorials on knowledge in learning.
- Evaluation of the programming exercise.
- Quizzes on knowledge in learning.

OUTCOMES:
On completion of the course, the student will be able to:
CO1: Understand the search techniques.
CO2: Apply the search techniques to real-time problems.
CO3: Apply the reasoning techniques to real world problems.
CO4: Understand the representation of knowledge.
CO5: Understand the learning techniques.
CO6: Apply AI techniques in developing real world applications.

TEXT BOOKS:

REFERENCES:

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

- To learn the basics of wireless communication and cellular networks.
- To study the popular cellular networking technologies.
- To explore various protocols that support mobility at network layer and transport layer.
- To understand the intricacies of UI required by mobile applications and the design aspects of mobile application.
- To study various mobile app development platforms and learn developing mobile applications.

UNIT I  WIRELESS COMMUNICATION AND CELLULAR NETWORKS  9

Suggested Activities:

- External learning - Performing a survey of popular mobile phones and exploring their configuration (performance in terms of processor core, clock speed, RAM), display (technology, screen size and resolution), camera features and battery features, LTESim and Players in 5G networks and exploring the structure and operation of a cell phone tower.
- Exploring frequency reuse and reuse factor in cellular network deployment.
- Flipped classroom on CDMA2000, WCDMA, HSPA, HSDPA, HSUPA and HSPA+.

Suggested Evaluation Methods:

- Assignments on features of modern mobile phones and structure and operation of a cell phone tower.
- Solving frequency reuse relayed problems.
- Quiz and discussion on CDMA and its variants and HSPA and its variants.

UNIT II  3G AND 4G WIRELESS MOBILE NETWORKS  9
Suggested Activities:
- External learning - Explore 5G networks.
- Flipped classroom on IP multimedia subsystem.
- Analysis and requirements of cellular networks.

Suggested Evaluation Methods:
- Assignments on 5G networks.
- Quiz and discussion on IP multimedia subsystem.
- Design a cellular network for the given case study.

UNIT III MOBILITY SUPPORT IN IP AND TCP
Mobile IP – Mobile Agent, Foreign Agent, Care of Address, Registration, Advertisement and Discovery, Tunneling, IP within IP – Mobility Support in IPv6 – Mobility Header, Mobility Options, Dynamic Home Agent Address Discovery, Cache Management, Bidirectional Tunneling – TCP Over Wireless Networks – Indirect TCP – Snoop TCP – Mobile TCP.

Suggested Activities:
- External learning - Performing a survey of popular wireless routers and exploring their configuration (Built in radio interfaces in terms of IEEE 802.11 and its variants, support for MU - MIMO technology, external antennas, clock speed of the processor, data rate supported).
- Exploring the task list required to configure mobile IP and getting familiar with the networking operating system commands required to configure mobile IP.
- Flipped classroom on mobility support in IPv6.

Suggested Evaluation Methods:
- Assignments on features of wireless routers and their configuration.
- Configuring mobile IP using network operating system commands.
- Quiz and discussion on mobility support in IPv6.

UNIT IV APPLICATION DESIGN

Suggested Activities:
- External learning - Exploring XForms processing model and location based services.
- Flipped classroom on GUI features supported in WAP, J2ME, BREW and Microsoft platforms.
- Analyzing problems in designing mobile applications where location and energy are the constraints.

Suggested Evaluation Methods:
- Assignments on XForms and location based services.
- Quiz and discussion on GUI features supported in WAP, J2ME, BREW and MS platforms.
- Designing and implementing location and energy constrained mobile applications.

UNIT V APPLICATION DEVELOPMENT

**Suggested Activities:**
- Flipped classroom on Android emulator, DDMS, Debug-bridge, SQLite quick-start guides.
- External learning - Performing a comparative study of Android TV vs. Google Chromecast.
- Developing mobile apps using Android web APIs, location based services APIs.
- Flipped classroom on targeting different device configurations and languages.

**Suggested Evaluation Methods:**
- Quiz and discussion on Android emulator, DDMS, Debug-bridge and SQLite.
- Assignments on Android TV and Google chromecast.
- Developing and testing simple mobile apps in Android and Apple iOS.
- Quiz and discussion on device configurations and languages.

**TOTAL: 45 PERIODS**

**OUTCOMES:**
On completion of the course, the students will be able to:
1. Have knowledge on the architecture and protocols of 2G, 3G, and 4G cellular system.
2. Deploy various protocols that support mobility at network layer and transport layer.
3. Design and implement the user interfaces for mobile applications.
4. Design the mobile applications that are aware of the resource constraints of mobile devices.
5. Develop advanced mobile applications that access the databases and the web.
6. Understand the intricacies in deploying cellular networks and developing mobile applications based on resilient programming practices.

**TEXT BOOKS:**

**REFERENCES:**

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

- To understand the fundamentals of cryptography and number theory.
- To use the standard security algorithms to provide confidentiality, integrity and authentication for any applications.
- To make use of application protocols to design and manage a secure system.
- To learn the configuration and manage Firewall and WLAN Security.
- To understand the importance of system security and its vulnerabilities.

UNIT I
INTRODUCTION TO SECURITY AND NUMBER THEORY

Suggested Activities:

- In-class activity - Practice cryptanalysis of classical cryptography and break the classical algorithms using cryptographic attack.
- In-class activity - Solve modular exponentiation and multiplicative inverse using Fermat and Euler theorem.
- Practical - Classical cryptography algorithms using Cryptool.

Suggested Evaluation Methods:

- Assignments on cryptanalysis of classical cryptography, additive Inverse, Multiplicative Inverse and modular exponentiation using the theorem.
- Quiz on classical cryptography and number theory.
- Demonstration of the classical cryptography algorithms using Cryptool.

UNIT II
SYMMETRIC CRYPTOGRAPHY

Suggested Activities:

- Explain the importance of key size and explore some examples with brute force attack to break the key.
- Demonstrate the working of DES and AES algorithms using Cryptool.
- Demonstrate various cryptographic attacks on DES and AES.
Suggested Evaluation Methods:
- Assignments on key generation, linear and differential cryptanalysis of symmetric cryptography.
- Quiz on modes of operation and internal structure of DES and AES.

UNIT III ASYMMETRIC KEY CRYPTOGRAPHY

Suggested Activities:
- Highlight the mathematics behind RSA, Diffie-Hellman Key exchange and Elliptic Curve Cryptography.
- Demonstrate the Hash code generation using MD5 and SHA 256 algorithm.
- Practical - Verify the Message Integrity using Hashing Techniques such as MD5 and SHA256.
- Case studies on Quantum and Threshold Cryptography.

Suggested Evaluation Methods:
- Assignments on RSA and ECC generation for encryption and decryption process.
- Quiz on mathematics behind the public key algorithms, Quantum and Threshold Cryptography.

UNIT IV SECURITY APPLICATIONS

Suggested Activities:
- Case studies on understand the components of X.509 Certificate and Blockchain.
- Demonstrate IP security and configure VPN connection.
- Implement the SSL/TLS in Web Server for a Web Application.

Suggested Evaluation Methods:
- Assignment on configuration of IP security and VPN connection in networks and Blockchain.
- Quizzes on Key Management, SSL, TLS and Blockchain.

UNIT V FIREWALL & WIRELESS SECURITY

Suggested Activities:
- Teaching with case studies: access control and cloud security.
- Configure the Access Control List and using firewall, mitigate DoS attack.
- Understand the safety measures during the implementation of security in WLAN.
- Simulate the importance of various security standards in WLAN.

Suggested Evaluation Methods:
- Assignments on buffer overflow, malicious software and types of IDS.
- Quizzes on firewall generation, WLAN security and cloud security.

**TOTAL: 45 PERIODS**

**OUTCOMES:**
On completion of the course, the students will be able to:
1. Apply the basic security algorithms and policies required for a computing system.
2. Predict the vulnerabilities across any computing system and hence be able to design security solution for any computing system.
3. To identify any network security issues and resolve the issues.
4. To manage the firewall and WLAN security.
5. Evaluate the system related vulnerabilities and mitigation.
6. To design secured web applications in real-time.

**TEXT BOOKS:**

**REFERENCES:**

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

**IT5711**

**MOBILE AND SECURITY LABORATORY**

**OBJECTIVES:**
- To do several hands-on exercises to reinforce the students’ knowledge and understanding of the various security aspects.
- To explore the sequence of cryptographic algorithms by implementing using a programming language.
- To understand vulnerabilities and security flaws in the various applications.
- To develop simple and location specific applications in android environment.
- To analyse the performance of mobile networks using Network simulator.
LIST OF EXERCISES:
The following exercises are based on the cryptographic algorithms. They can be implemented using any Programming Language.

1. Write a program to perform encryption and decryption using the following algorithms:
   a. Caesar cipher
   b. Affine Cipher
   c. Hill Cipher
   d. Transposition Cipher.
2. Perform cryptographic attack on the cipher-text generated using any of the algorithms implemented in exercise 1.
3. Write a program to demonstrate symmetric key encryption process using DES and AES algorithm.
4. Write a program to implement RSA algorithm and demonstrate the key generation and encryption process.
5. Write a program to generate message digest for the given message using the SHA/MD5 algorithm and verify the integrity of message.
6. Write a program to sign and verify a document using DSA algorithm.
7. Perform Penetration testing on a web application to gather information about the system, then initiate XSS and SQL injection attacks using tools like kali Linux.
8. Develop a Mobile application for event handling and push notification in Android.
9. Create animations and graphical primitives in Android environment.
10. Develop a Location based services such as tracking, geofencing, and activity recognition using Google play services.
11. Develop a Mobile application for recognizing and authorizing using camera and sensors.
12. Performance analysis of various node deployment strategies in mobile environment using network simulators such as NS2/NS3/OPNET/GloMoSim/NetSim.

OUTCOMES:
On completion of the course, the students will be able to:
1. Attain knowledge to program both symmetric and asymmetric key cryptography.
2. Implement specific encryption/decryption algorithms.
3. Analyse the vulnerabilities in any application using penetration testing.
4. Develop basic mobile applications in Android environment.
5. Use both hardware and sensors to develop applications.

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<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></td>
</tr>
</tbody>
</table>
OBJECTIVES:
- To understand the concept of virtualization.
- To understand the various issues in virtualization.
- To be familiar with the virtualization of various components/functionalities.
- To compare and analyze various virtual machines products.
- To work with virtualization platforms.

UNIT I   INTRODUCTION TO VIRTUALIZATION   9

Suggested Activities:
- Install Oracle Virtual Box/VMware workstation and create a blackboard application [Hint: One VM should act as a master and other VMs acts as a listeners, when any content is written by the master VM, the content should be displayed in all the Listener VMs]

Suggested Evaluation Methods:
- Quizzes on process virtual machines and system virtual machines.
- Assignments on types of virtualization tools and products.
- Report submission virtualization tools and products.

UNIT II  SERVER VIRTUALIZATION   8

Suggested Activities:
- Install any one server virtualization tool (e.g., VMware ESX, Xen, KVM) and run and create two VMs and configure one VM as Web Server and another as File Server.

Suggested Evaluation Methods:
- Review the working of installed server virtualization tools (access the service offered by remote virtual machine via web browser).

UNIT III  NETWORK VIRTUALIZATION   10

Suggested Activities:
- Create and configure a VLAN using Cisco packet tracer.
- Connect the created VLANs using router in Cisco packet tracer.
Suggested Evaluation Methods:
- Demonstration - Inter VLAN Communication.

UNIT IV  STORAGE VIRTUALIZATION

Suggested Activities:
- Setup iSCSI Target and initiator in Linux.

Suggested Evaluation Methods:
- Assessing if the created storage LUNs are accessible from target/remote system.

UNIT V  APPLYING VIRTUALIZATION

Suggested Activities:
- Mini Project - Use Virtualization Tools.

Suggested Evaluation Methods:
- Demonstration of the mini project.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Create a virtual machine and extend it to a virtual network.
2. Discuss various virtual machine products.
3. Perform server virtualization.
4. Explain the concept of network virtualization.
5. Discuss various tasks in storage virtualization.
6. Compile all types of virtualization techniques and utilize them in design of virtual machines.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To learn about the design of the Unix operating system.
- To become familiar with the various data structures used and learn the various low-level algorithms used in Unix.
- To understand the Unix file system and its system calls.
- To study about process management and scheduling in Unix.
- To learn about memory management and I/O systems.

UNIT I  OVERVIEW

Suggested Activities:
- Flipped classroom on operating system services.
- Practical:
  - Implement the system call ‘cat’ using command line arguments and generate the executable version of the program and invoke the executable file using exec system calls (fork, wait etc).
  - Implement a scenario resulting to an incorrect linked list because of context switch.
  - Implement the five scenarios in the getblk algorithm by using first in first out scheme.
  - Simulate the function of bread(), breada(), bwrite and brelse.

Suggested Evaluation Methods:
- Quiz on operating system services.
- Evaluation of the functions implemented.

UNIT II  FILE SUBSYSTEM
Internal Representation of Files: inodes – Structure of a Regular File – Directories – Conversion of a Path Name to an Inode – Super Block – Inode Assignment to a New File – Allocation of Disk Blocks.
Suggested Activities:
- Flipped classroom on files and directory structure.
- Practical:
  - Implement the five scenarios in the iget algorithm by using least recently used scheme.
  - Implement the bmap algorithm and find the block number and the byte offset in file system for the given offset. Assume the disk block contain 1024 bytes.
    - 96000
    - 9999999
  - Simulate the function of `iput`, `ialloc`, `ifree`, `alloc` and `ifree`.
  - Write a program to display the directory entries (i.e., byte offset, inode number and the file name).

Suggested Evaluation Methods:
- Quiz on files and directory structure.
- Evaluation of the functions implemented.

UNIT III  SYSTEM CALLS FOR THE FILE SYSTEM


Suggested Activities:
- Flipped classroom on file system and system calls.
- Practical:
  - How does the command `mkdir` work? (Hint: When `mkdir` completes, what are the inode numbers for `.` and `..`?)
  - Simulate the function of `chown`, `chmod`, `stat` and `fstat`.
  - Set the whole-file lock with `fcntl()` and `lockf()`.
  - Write a program to print the mount table whenever an external device is connected to the Unix system.

Suggested Evaluation Methods:
- Quiz on file system calls.
- Checking the functions implemented.

UNIT IV  PROCESSES


Suggested Activities:
- Flipped classroom on context switching
- Practical:
  - Implement the algorithm for allocating and freeing memory pages and page tables. Which data structures would allow best performance?
  - Design an algorithm that translates virtual address to physical addresses, given the virtual address and the address of the region entry.
  - Implement an algorithm that exchange messages over pipe (use of pipe and `dup` and `fork`).
o  Write a program to communicate between two process using signals.

**Suggested Evaluation Methods:**
- Quiz on context switching.
- Evaluation of the functions implemented.

**UNIT V MEMORY MANAGEMENT AND I/O**  

**Suggested Activities:**
- Flipped classroom on virtual memory concepts
- Practical -
  - Write a program that tracks the allocation of space on a swap device.
  - Write a program that verifies that the file systems on a disk do not overlap. The program should take two arguments: a device file that represents a disk volume and a descriptor file that gives section numbers and section lengths for the disk type. The program should read the super blocks to make sure that file systems do not overlap.
  - Implement sty command: with no parameters, it retrieves the values of terminal settings and report them to the user.
  - Encode a line disciple that writes the machine name at the beginning of each line of output.

**Suggested Evaluation Methods:**
- Quiz on virtual memory concepts.
- Evaluation of the functions implemented.

**OUTCOMES:**
On completion of the course, the students will be able to:
1. Understand UNIX architecture and describe the component of operating system.
2. Explain how they interact with computer hardware.
3. Gain a deeper understanding of system calls in Unix operating system.
4. Apply the concepts of operating systems design to practical problems.
5. Design and implement the subsystems of an operating system.
6. Critically analyze different data structures and algorithms used in the building of a kernel.

**TEXT BOOK:**

**REFERENCES:**

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

**TOTAL: 45 PERIODS**
OBJECTIVES:
● To understand the development of parallel and massively parallel systems.
● To understand the challenges in heterogeneous processing systems.
● To use shared programming models for parallel programs.
● To learn to program heterogeneous systems.
● To learn to provide effective parallel solutions for GPGPU architectures.

UNIT I PARALLEL COMPUTING BASICS

Suggested Activities:
● Identify parallelism in day-to-day activities.
● Study the configuration of the multi-core processors and GPUs used in laptops, PCs and smart phones.
● Review the configuration of top 500 super computers over the last 10 years.
● Problems on cache coherence in class.
● Flipped classroom on GPGPUs.

Suggested Evaluation Methods:
● Pair-wise/group discussion on the studies conducted.
● Assignment on various topics of the unit.
● Quiz on speedup and scalability calculation.
● Quiz on GPGPUs.

UNIT II SHARED MEMORY PROGRAMMING WITH OPENMP

Suggested Activities:
● Write simple OpenMP programs.
● Interpret given OpenMP program and identify bugs.
● Write OpenMP programs for sorting.
● Experiment with change of cache configuration.
● Mini project: identify a problem to solve using OpenMP/CUDA.

Suggested Evaluation Methods:
● Execute and Demonstration the OpenMP programs.
• List the bugs and fix the bugs.
• Evaluate the programs for different configurations of cache size/number of cores etc.
• Mini project: Check feasibility of project.

UNIT III PROGRAMMING GPUS


Suggested Activities:
• Write simple CUDA programs to understand threads, blocks and grids.
• Experiment with different sizes for threads, blocks and grids.
• Write CUDA programs for memory-intensive programs and experiment with different memory options.
• Mini project: Devise a solution for the problem identified in the earlier unit using CPU and GPU.

Suggested Evaluation Methods:
• Demonstration of the CUDA programs.
• Plot graphs of execution time versus various parameters.
• Mini project: Check design of the solution.

UNIT IV PROGRAMMING WITH CUDA

Parallel Patterns – Convolution – Prefix Sum – Sparse matrix – Vector Multiplication – Imaging Case Study.

Suggested Activities:
• Write CUDA programs for matrix operations and imaging applications.
• Experiment with different sizes for threads, blocks, grids and memory options.
• Identify the pattern and parameters for different applications.
• Mini project: Write CUDA code as per the solution devised in the earlier unit.

Suggested Evaluation Methods:
• Demonstration of the CUDA programs.
• Quiz to check understanding of patterns and effect of parameters.
• Mini project: Code demo/walkthrough.

UNIT V OTHER GPU PROGRAMMING PLATFORMS

Introduction to OpenCL – OpenACC – C++AMP – Thrust – Programming Heterogeneous Clusters – CUDA and MPI.

Suggested Activities:
• Write and execute simple OpenCL programs.
• Study the OpenACC programming model and identify the reduction in programming complexity.
• Identify and compare the different available parallel programming accelerator tools.
• Mini project: Compare OpenMP and CUDA versions of code.

Suggested Evaluation Methods:
• Demonstration of programs.
• Demonstration of use of tools.
• Mini project: Check performance analysis graph.

TOTAL: 45 PERIODS
OUTCOMES:
On completion of the course, the student will be able to:
1. Identify parallelism in an application.
2. Choose the right parallel processing paradigm for a given problem.
3. Write parallel programs using OpenMP.
4. Devise solutions for an application on a heterogeneous multi-core platform.
5. Program GPUs using CUDA / OpenCL.
6. Compare characteristics of and evaluate different GPU programming platforms.

TEXT BOOKS:

REFERENCES:

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

IT5004 GRAPH THEORY

OBJECTIVES:
- To comprehend graphs as modeling and analysis tools.
- To introduce various data structures with graph theory.
- To learn graph theoretic algorithms.
- To understand graph coloring and covering.
- To learn the usage and applications of graphs in social networking and media.

UNIT I INTRODUCTION

Suggested Activities:
- Solving simple Graph problems.
- Flipped classroom on isomorphism.
- External learning - Traveling salesman problem.
- Practical -
  o Implement a program to determine isomorphic graphs.
  o Implement a program to determine Hamiltonian circuits and Hamiltonian paths in a graph.
- Applications in real life problems.

**Suggested Evaluation Methods**
- Tutorials on graph algorithms.
- Assignment problems on isomorphism, hamiltonian graphs.
- Quizzes on connected components.

**UNIT II: TREES AND CONNECTIVITY**

**Suggested Activities:**
- Solving problems on tree properties and cut sets.
- Flipped classroom on spanning trees and fundamental circuits.
- External learning – Network flows.
- Practical -
  o Find all spanning trees of a graph.
  o Find all cut-sets in a graph.
- Applications in real life problems.

**Suggested Evaluation Methods:**
- Tutorials on spanning trees and cut sets.
- Assignment problems on fundamental circuits and cut sets.
- Quizzes on network flows.

**UNIT III: PLANARITY, COLOURING AND COVERING**
Combinational and Geometric Graphs – Planar Graphs – Kuratowski's Two Graphs – Different Representation of a Planar Graph – Chromatic Number – Chromatic Partitioning – Chromatic Polynomial – Matching – Covering – Four Color Problem.

**Suggested Activities:**
- Solving Problems on planar graphs, chromatic number.
- Flipped classroom on matching and covering.
- External learning - Self-dual graphs and digraphs.
- Practical -
  o Implement a program to determine if a given graph G is planar or nonplanar
  o Finding all maximal independent sets
- Applications in real life problems.

**Suggested Evaluation Methods:**
- Tutorials on planar graphs.
- Assignments on matching and covering.
- Quizzes on planar graphs, chromatic number.

**UNIT IV: DIRECTED GRAPH AND GRAPH THEORETIC ALGORITHMS**
and Components – A set of Fundamental Circuits.

**Suggested Activities:**
- Solving problem on Euler digraphs.
- Flipped classroom on directed graphs.
- External learning - Cut-Vertices and Separability.
- Practical - Implementation of graph algorithms.
- Finding connected components.
- Finding a set of fundamental circuits in a graph.
- Applications in real life problems.

**Suggested Evaluation Methods:**
- Tutorials on directed graphs.
- Assignments on Euler digraphs.
- Quizzes on graph theoretic algorithms.

**UNITV GRAPHS IN SOCIAL AND DIGITAL MEDIA**

Dominant Social Networking/Media Platforms – Collecting Data from Social Media Sites – Social Media Graphs – Graph Storage Formats and Visualization – Applications of Graph Analysis.

**Suggested Activities:**
- Flipped classroom on social network analysis using graphs.
- External learning - Algebraic graph analysis.
- Practical -
  - Study of an interactive visualization tool such as Gephi for social networks.
- Applications in real life problems.

**Suggested Evaluation Methods:**
- Tutorials on social network analysis using graphs.
- Assignments on graph storage formats and visualization.
- Quizzes on interactive visualization tools.

**OUTCOMES:**
On completion of the course, the students will be able to:
1. Demonstrate understanding of the fundamental theorems of graph theory.
2. Identify and differentiate the potential use of special graphs and describe the basic properties of each kind.
3. Design and develop programs involving basic graph algorithms.
4. Introduce graphs as a powerful modeling tool that can be used to solve practical problems in various fields.
5. Apply the abstract concepts of graph theory in modeling and solving non-trivial problems in different fields of study.
6. Analyze and formulate solutions using graphs for social networking and media.

**TEXTBOOKS:**

**REFERENCES:**

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

**IT5005**

**HUMAN COMPUTER INTERACTION**

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

**OBJECTIVES:**
- To learn the principles and fundamentals of human computer interaction (HCI).
- To analyze HCI theories, as they relate to collaborative or social software.
- To understand components of interfaces and screens, including windows, menus and controls.
- To understand user interface design principles, and apply them to designing an interface.
- To understand the rationale and guidelines for an effective interface design methodology.

**UNIT I  DESIGN PROCESS**


**Suggested Activities:**
- Practical - Analyze various web interfaces.
- Flipped classroom on basic knowledge on the HCI design process.
- External learning - Exploration of various scenarios for creating HCI system.
- Practical - Implementation of a simple user interface design using simple components

**Suggested Evaluation Methods:**
- Comparison table creation of web interfaces.
- Tutorials on basic design process.
Assignment on various design paradigms.
Demonstration of a simple user interface created using simple components.

UNIT II  DESIGN AND EVALUATION OF INTERACTIVE SYSTEMS

Suggested Activities:
- Practical - Design UIs using various tools like Sketch, Flinto, Adobe XD, React.
- Flipped classroom on designing a good user interface system based on design rules.
- External learning - Techniques related to evaluation of HCI design.
- Practical - Development and validation of user interfaces using various evaluation techniques.

Suggested Evaluation Methods:
- Demonstrations of created UIs and obtained evaluation metrics.
- Tutorials on UI design rules.
- Assignments on techniques related to UI evaluation.

UNIT III  MODELLING INTERFACES

Suggested Activities:
- Practical - To implement interfaces using design rules and various models.
- Flipped Classroom on basic knowledge of various models used in HCl design.
- External learning - Design and implementation of various models used in HCl design.

Suggested Evaluation Methods:
- Demonstration of created UI with design rules.
- Tutorial on models of HCI design.
- Assignments on models of HCI design.

UNIT IV  EXPERIMENTAL DESIGN AND STATISTICAL ANALYSIS OF HCI

Suggested Activities:
- Practical - Statistical analysis and user testing on existing user interfaces.
- Flipped classroom on basic concepts of probability and statistics.
- External learning - Practical problems related to hypothesis testing.

Suggested Evaluation Methods:
- Demonstration of user testing with arrived results.
- Tutorials on basic probability and statistical questions related to HCI design evaluation.
- Assignments on UI design evaluation strategies.
- Quizzes on evaluation methods.

**UNIT V CURRENT TRENDS**


**Suggested Activities:**
- Flipped classroom on basic concepts of dialogue notations and design.
- External learning - Usage of Virtual Reality in various real time UI application design.
- Practical - Implementation of Mixed Reality based UI design, Wearable user interfaces.

**Suggested Evaluation Methods:**
- Tutorials on various dialog notations and design.
- Assignments on development of VR based real time UI.
- Demonstration of multi modal user interfaces.

**OUTCOMES:**

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

1. Interpret the contributions of human factors and technical constraints on human-computer interaction.
2. Apply HCI techniques and methods to the design of software.
3. Apply exploratory and experimental research methods in HCI.
4. Design and develop various models that suit real time interface development.
5. Design and develop real time human computer interaction (HCI) system.
6. Be equipped with the principles and guidelines of user centered interface design process, evaluation methodologies and tools to analyze the interfaces.

**TEXT BOOKS:**


**REFERENCES:**


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

PO1

- CO1
- CO2

PO2

- CO3

PO3

- CO4
OBJECTIVES:
- To know the mathematical background of logic.
- To learn the basics of lower order logic.
- To study the background of higher order logic.
- To explore the real world applications with lower order logic.
- To explore the real world applications with higher order logic.

UNIT I
PROPOSITION LOGIC

Suggested Activities:
- Flipped classroom on natural deduction.
- In-class activity - Solving puzzles through proposition logic.
- Programming exercises for SAT solver.

Suggested Evaluation Methods:
- Quiz on deduction.
- Assignments on natural deduction and SAT solvers.
- Programming exercises must be evaluated.

UNIT II
PREDICATE LOGIC

Suggested Activities:
- Flipped classroom on micromodels of software.
- In-class activity - Problem solving exercise.

Suggested Evaluation Methods:
- Quiz on reasoning methods.
- Assignment problems on inference mechanisms in AI.

UNIT III
MODAL LOGIC INTRODUCTION

Suggested Activities:
- Flipped classroom on types of modal logic.
- In-class activity - Entailment through Kripke semantics.

Suggested Evaluation Methods:
- Quiz on different accessibility relations.
- Assignment problems based on Kripke structures.
UNIT IV  TEMPORAL LOGIC


Suggested Activities:
- Flipped Classroom on applications.
- In-class activity - Solving problems with Model checking.
- Model checking on the programming assignments.

Suggested Evaluation Methods:
- Quiz on model logic with types, temporal logic syntax and semantics.
- Assignment problems on semantics.
- Programming assignment on model checking.

UNIT V  EPISTEMIC LOGIC


Suggested Activities:
- Flipped classroom on multi-agent reasoning.
- In-class activity - Solving puzzles like muddy children and three wise men puzzle.

Suggested Evaluation Methods:
- Quiz on reasoning methods using muddy children and three wise men puzzle.
- Assignment problems on deduction and other reasoning methods.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of the course, the student will be able to:
1. Understand the mathematical underpinnings of logic.
2. Apply proposition logic to computer science domains.
3. Understand the reasoning process of predicate logic.
4. Understand the advantages of higher order logic over lower order logic.
5. Apply temporal logic to distributed systems.
6. Design Multi-agent systems using epistemic logic.

TEXT BOOK:

REFERENCES:

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
OBJECTIVES:
- To learn the fundamentals of data modeling and design in advanced databases.
- To study the working principles of distributed databases.
- To have an introductory knowledge about the query processing in object-based databases and its usage.
- To understand the basics of spatial, temporal and mobile databases and their applications.
- To learn emerging databases such as XML, Data warehouse and NoSQL.

UNIT I  DISTRIBUTED DATABASES

Suggested Activities:
- Practical - Design of distributed database with fragmentation using any DBMS.
- Flipped classroom on distributed transaction protocols.
- Writing distributed queries and optimizing the queries.

Suggested Evaluation Methods:
- Evaluation of designed Distributed Database system.
- Quizzes on distributed transactions.
- Tutorials on distributed queries and optimization.

UNIT II  NOSQL DATABASES

Suggested Activities:
- Exploring MongoDB using JAVA/Python/Ruby/PHP.
- Perform Database Operations using MongoDB/Cassandra/HIVE.
- Scenario based query development for database applications.

Suggested Evaluation Methods:
- Evaluation of the database operations.
- Tutorial on scenarios to analyze the need for DB in various applications.
- Quizzes on query language features.

UNIT III  ADVANCED DATABASE SYSTEMS
Spatial Databases: Spatial Data Types, Spatial Relationships, Spatial Data Structures, Spatial Access Methods – Temporal Databases: Overview – Active Databases – Deductive

Suggested Activities:
- Individual/group activities for application specific data handling.
- Discussion about advantages and drawbacks of transaction models for different applications involving spatial-temporal data.

Suggested Evaluation Methods:
- Tutorials on active and deductive databases.
- Assignments on spatial databases.
- Quizzes on mobile database transactions.

UNIT IV  XML AND DATAWAREHOUSE


Suggested Student Activities:
- Flipped classroom on demonstrate the operations on XML data and data warehouse.
- Practical - Use tools to solve data access scenarios.

Suggested Evaluation Methods:
- Assignments on XML parsers, XSL and XQuery.
- Demonstration and presentation of the practical assignments.

UNIT V  INFORMATION RETRIEVAL AND WEB SEARCH


Suggested Student Activities:
- Flipped classroom on queries in IR.
- Practical - Install any IR framework such as SOLR, and experiment with it.

Suggested Evaluation Methods:
- Practical demonstration on IR Queries.
- Quizzes on IR frameworks and related tools.

OUTCOMES:
On completion of the course, the student will be able to:
1. Design a distributed database system and execute distributed queries.
2. Use NoSQL database systems and manipulate the data associated with it.
3. Have knowledge of advanced database system concepts.
4. Design a data warehouse system and apply OLAP operations.
5. Design XML database systems and validating with XML schema.
6. Apply knowledge of information retrieval concepts on web databases.

TOTAL: 45 PERIODS

TEXT BOOKS:
REFERENCES:

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

IT5008 COMPUTER GRAPHICS L T P C
3 0 0 3

OBJECTIVES:
- To know the mathematical basis of computer graphics.
- To train the students to acquire knowledge in Computer Graphics modeling, animation, and rendering.
- To create graphical applications.
- To acquire knowledge about tools and technologies related to graphics.
- To create visually realistic animations.

UNIT I INTRODUCTION TO COMPUTER GRAPHICS 9

Suggested Activities:
- Flipped classroom on basic vector and arithmetic operations on vector.
- Practical: Use OpenGL to create visual objects using lines and apply clipping algorithms.
- Assignment problems on line drawing algorithms and clipping algorithms.

Suggested Evaluation Methods:
- Tutorials on arithmetic operations on vector.
• Demonstration of line drawing algorithms and applying clipping algorithms over the created objects.
• Solving problems on vectors.

UNIT II  MODELING AND TRANSFORMATIONS OF OBJECTS

Suggested Activities:
• Practical - Creating three dimensional solid objects and apply transformations.
• Brainstorming session on different modeling techniques.
• Assignments on three dimensional transformations.

Suggested Evaluation Methods:
• Demonstration on creation of three-dimensional solid objects and applying various transformations.
• Creativity and production of impressive visual imagery.
• Quizzes on transformation.

UNIT III  VIEWING AND VISUAL REALISM

Suggested Activities:
• Assignments on hidden surface removal methods.
• Practical - To add shadows and lighting effects on modeled objects.

Suggested Evaluation Methods:
• Tutorials on hidden surface removal algorithms.
• Demonstrations by creating visually aesthetic scenes.

UNIT IV  SURFACE DESIGN

Suggested Activities:
• Assignments on generating different types of curves.
• Practical - Drawing curves and curved objects.

Suggested Evaluation Methods:
• Demonstration on drawing curves and curved objects.
• Creativity and production of impressive three dimensional objects.
• Quizzes on color models and rendering methods.
UNIT V  ANIMATIONS


Suggested Activities:
- Practical - To create realistic animations.
- External learning - Process of animation movie making.

Suggested Evaluation Methods:
- Demonstration of animated movies created using various techniques.
- Quizzes on animation movie making.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Articulate the concepts and techniques used in three-dimensional graphics.
2. Understand and Implement algorithms related to graphics creation.
3. Design and model graphical structures.
4. Understand and comprehend the graphical algorithms.
5. Design visually realistic graphical applications.
6. Design and develop simple and realistic animations.

TEXTBOOKS:

REFERENCES:
OBJECTIVES:
- To enrich student learning in multimedia systems.
- To train the students to acquire knowledge in multimedia related technologies.
- To acquire knowledge about multimedia techniques to enhance quality of service.
- To acquire knowledge on multimedia architecture.
- To learn about the multimedia elements in a comprehensive way.

UNIT I  INTRODUCTION TO MULTIMEDIA ELEMENTS
Suggested Activities:
- Flipped classroom on multimedia concepts.
- Practical - Creating and editing visual elements using tools like Audacity, Fontographer, Blender, Photoshop and flash.

Suggested Evaluation Methods:
- Demonstration on creating visual elements using audio and video editing tools.
- Creativity and visual appearance.
- Quizzes on multimedia elements and their characteristics.

UNIT II  MULTIMEDIA COMPRESSION
Suggested Activities:
- Flipped classroom on different compression techniques.
- Practical - Adobe Premier Pro for digital video concepts.

Suggested Evaluation Methods:
- Demonstration on Adobe Packages.
- Assignment on compression techniques.
- Quizzes on video based visual effects.

UNIT III  MULTIMEDIA ARCHITECTURES
Suggested Activities:
- Flipped classroom on concepts of Multimedia hardware architectures.
- External learning - Digital Repositories.

Suggested Evaluation Methods:
- Tutorials on OCR/OMR
- Quizzes on various multimedia storage
UNIT IV MULTIMEDIA OPERATING SYSTEM AND DATABASES

Suggested Activities:
- Flipped classroom on Multimedia Database and indexing structures.
- External learning - Data structures for storing multimedia data.

Suggested Evaluation Methods:
- Tutorials on memory and process management algorithms.
- Quizzes on deadlocks and synchronization.

UNIT V MULTIMEDIA COMMUNICATION & APPLICATIONS

Suggested Activities:
- Practical - Designing user interfaces and developing simple games.
- External learning - Mixed Reality.

Suggested Evaluation Methods:
- Demonstration of developed applications.
- Quizzes on virtual reality and augmented reality.

OUTCOMES:
On completion of the course, the students will be able to:
1. Handle the multimedia elements effectively.
2. Encode and decode the multimedia elements.
3. Understand the underlying multimedia computing architectures used for media development.
4. Develop effective strategies to deliver Quality-of-Experience in multimedia applications.
5. Design and implement algorithms and techniques related to multimedia objects.
6. Design and develop multimedia applications in various domains.

TOTAL: 45 PERIODS

TEXTBOOKS:

REFERENCES:
OBJECTIVES:

- To get an idea on designing analog and digital filters.
- To acquire knowledge related to Fourier transform and its applications.
- To learn the design of infinite and finite impulse response filters for filtering undesired signals.
- To understand signal processing concepts in systems having more than one sampling frequency.
- To design applications that involve signal and image processing.

UNIT I  
SIGNALS AND SYSTEMS


Suggested Activities:

- In-class activity - Problems based on Z transform Circular and linear convolution.
- Testing of frequency transformation and convolution problems using Matlab.

Suggested Evaluation Methods:

- Tutorials on Z transform circular and linear convolution.
- Assignment problems Z transform.
- Quizzes on signals and systems.

UNIT II  
FREQUENCY TRANSFORMATIONS


Suggested Activities:

- Tutorials on DFT, FFT problems.
- FFT computation in real world problems.
- DFT and FFT computation using a tool like Matlab.

Suggested Evaluation Methods:

- Tutorials on DFT and FFT.
- Assignments on FFT - DIT and DIF.
- Quizzes on frequency transformations.

**UNIT III  IIR FILTER DESIGN**


**Suggested Activities:**
- Analog filter design using Butterworth and Chebyshev approximation.
- Filter implementation using Matlab.

**Suggested Evaluation Methods:**
- Tutorials on IIR filter structures and design.
- Assignments on LPF, HPF, BRF, BRF filter design,
- Quizzes on filter design.

**UNIT IV  FIR FILTER DESIGN**


**Suggested Activities:**
- FIR filter design.
- Filter implementation using Matlab.
- Analysis on finite world length errors.

**Suggested Evaluation Methods:**
- Tutorials on FIR filter structures and design.
- Assignments on finite word length effects in digital filters.
- Quizzes on filter design.

**UNIT V  APPLICATIONS**


**Suggested Activities:**
- Signal processing activities using Matlab.

**Suggested Evaluation Methods:**
- Tutorials on multirate signal processing.
- Assignments on adaptive filters,
- Mini project using Matlab.

**OUTCOMES:**

On completion of the course, the students will be able to:
1. Analyze and apply appropriate frequency transformations for any class of signal.
2. Analyze and design filters for a given signal processing application.
3. Identify and compute the errors encountered in a digital signal processing systems.
4. Design applications that involve signal and image processing by adopting appropriate transformation and filtering techniques.
5. Justify and apply possible extensions to digital filters for a given application.

**TOTAL: 45 PERIODS**
6. Design a signal processing system.

**TEXT BOOK:**

**REFERENCES:**

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

**IT5011 MULTIMEDIA CODING TECHNIQUES**

**OBJECTIVES:**
- To enrich in the fundamentals of multimedia coding and standards.
- To acquire knowledge in text coding.
- To acquire knowledge behind the theory of image and video coding & decoding with standards.
- To learn principles of audio coding and standards.
- To get comprehensive learning in multimedia standard content description and formats.

**UNIT I LOSSLESS AND LOSSY CODING**


**Suggested Activities:**
- Flipped classroom on text coding concepts.
- Practical – Implement basic text coding and decoding algorithm using Python program.
Suggested Evaluation Methods:
- Estimate complexity and coding efficiency of a given algorithm.
- Numerical problem solving in coding theory.
- Quizzes on fundamentals of information theory, text based coding techniques etc.

UNIT II  IMAGE PROCESSING AND CODING


Suggested Activities:
- Flipped classroom on different image coding techniques.
- Practical – EXIF format for given camera.
- Analyze effects of change in RGB components in a digital color image.
- Case study on Google’s WebP image format.

Suggested Evaluation Methods:
- Program output of implementing effects quantization, color change etc.
- Assignment on image file formats.
- Quizzes on color models, color processing, image coding standards etc.

UNIT III  VIDEO PROCESSING AND CODING


Suggested Activities:
- Flipped classroom on concepts of video coding standards.
- Calculation of file size in different resolution and standards.
- Complexity estimation of different motion vector search methods.
- Measurement of video quality using tools.
- Case study of Google’s WebM video format.

Suggested Evaluation Methods:
- Program output of implementing effects quantization, chroma sub-sampling etc.
- Mini project processing of coded video.
- Quizzes on video formats, H.26x, MPEG-x standards etc.

UNIT IV  AUDIO PROCESSING AND CODING


Suggested Activities:
- Flipped classroom on audio coding standards.
- External learning – Dolby, DTS systems in cinema theatres.
- Case study of a multi-channel home theatre system.

Suggested Evaluation Methods:
- Numerical problems on digital audio.
- Real-time demos on surround sound.
• Quizzes on audio compression techniques, MPEG audio, home theatre systems etc.

UNIT V  MULTIMEDIA CONTENT DESCRIPTION AND FRAMEWORK


Suggested Activities:
• Practical – Designing, structure and user interface.
• Case study of media coding used by YouTube, Netflix etc.
• External learning – Media streaming for TV.

Suggested Evaluation Methods:
• Responsive web design using hypermedia.
• Demonstration of media streaming through internet.
• Quizzes on Hypermedia coding, MHEG, MPEG-7 & 21, MPEG-DASH etc.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Articulate the concepts and techniques used in multimedia basics and standard coding techniques.
2. Develop competence in implementing text coding.
3. Design and implement algorithms for image and video coding.
4. Choose and analyze suitable audio coding for a given multimedia application.
5. Design and develop multimedia projects with standard content formats and frameworks.

TEXTBOOK:

REFERENCES:

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

- To provide basic knowledge about the fundamentals of pattern recognition and its applications.
- To understand about unsupervised algorithms suitable for pattern classification.
- To familiarize with the feature selection algorithms and methods of implementing them in applications.
- To learn about the basis of algorithms used for training and testing the dataset.
- To learn basic fuzzy system and neural network architectures, for applications in pattern recognition, image processing, and computer vision.

UNIT I  PATTERN CLASSIFIER


Suggested Activities:

- Discussion on pattern recognition applications like image classification.
- Implementation of Bayesian belief network using MatLab.
- Implementing Naive Bayesian classifier using MatLab.

Suggested Evaluation Methods:

- Quizzes on pattern recognition applications like image classification.
- Programming assignments on various pattern classifier techniques.

UNIT II  CLUSTERING

Clustering Concept – Hierarchical Clustering Procedures – Partitional Clustering – Clustering of Large Data Sets – EM Algorithm – Grid Based Clustering – Density Based Clustering.

Suggested Activities:

- Implement hierarchical Clustering using MatLab.
- Implement EM Algorithm Using GMM using MatLab.

Suggested Evaluation Methods:

- Quizzes on various clustering techniques.
- Programming assignments on generating clusters for an unlabelled dataset.

UNIT III  FEATURE EXTRACTION AND SELECTION

Entropy Minimization – Karhunen Loeve Transformation – Feature Selection Through Functions Approximation – Binary Feature Selection – K-NN.

Suggested Activities:

- Implementation of K-NN in MatLab.
- Implementation of decision tree in MatLab.

Suggested Evaluation Methods:

- Quizzes on feature selection methods.
- Programming assignments on KL transformation.
UNIT IV  HIDDEN MARKOV MODELS AND SUPPORT VECTOR MACHINES  


Suggested Activities:
- Implement HMM algorithm in MatLab.
- Implement SVM classifier in MatLab.

Suggested Evaluation Methods:
- Quizzes on working principle of HMM.
- Programming assignments on SVM.

UNIT V  RECENT ADVANCES

Fuzzy Classification: Fuzzy Set Theory, Fuzzy And Crisp Classification, Fuzzy Clustering, Fuzzy Pattern Recognition – Introduction to Neural Networks: Elementary Neural Network For Pattern Recognition, Hebbnet, Perceptron, ADALINE, Back Propagation.

Suggested Activities:
- Develop a supervised model to train neural net that uses the AND/OR/XOR gate functions.
- Create and view custom neural networks using MatLab.

Suggested Evaluation Methods:
- Quizzes on basic fuzzy and neural logic.
- Programming assignments on fuzzy classification methods.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Implement basic pattern classifier algorithms.
2. Have knowledge about the working principle of unsupervised algorithms.
3. Have knowledge about functionality of classifiers.
4. Perceive the recent advancement in pattern recognition.
5. Apply SVM and HMM algorithms for real time applications.
6. Implement advanced methodologies over image processing applications.

TEXT BOOK:

REFERENCES:
OBJECTIVES:
- To understand the fundamentals of data visualization.
- To know the working principles of various information visualization tools.
- To acquire knowledge about the issues in data representation.
- To visualize the complex engineering design.
- To gain skill in designing real time interactive Information visualization system.

UNIT I INTRODUCTION

Suggested Activities:
- Blended Learning – Displaying Different types visualization images.
- Flipped classroom on the task of representing information.
- External learning – Practical problems related to acquiring data.
- Practical – Representing various varieties of data.

Suggested Evaluation Methods:
- Tutorials on different data visualizing images.
- Assignment on different data acquiring methods.
- Quizzes on various issues and solutions in different visualization applications.
- Demonstration – Techniques used for data representation.

UNIT II DATA REPRESENTATION

Suggested Activities:
- Blended Learning – Human visual and auditory system.
- Flipped classroom on color formats.
- Practical – Implementation of the interactive forms.
- External learning – Survey on different human computer interaction and types of user interface.

**Suggested Evaluation Methods:**
- Assignment on human visual and auditory system.
- Quizzes on color format.
- Assessment on design and creativity.
- Assignment on various human computer interaction user interface.

**UNIT III  DATA PRESENTATION**

9


**Suggested Activities:**
- Blended learning – Drawing charts for display.
- Flipped classroom on various presentation techniques.
- External learning – Different font and font styles, symbols and gesture representation.
- Practical – Implementation of these presentations through interfaces in computers.

**Suggested Evaluation Methods:**
- Assignment on chart preparation
- Tutorials on various presentation techniques.
- Assignment on gesture presentation.
- Demonstration – Designed interface layout.

**UNIT IV  INTERACTION**

9


**Suggested Activities:**
- Flipped classroom on various interacting Techniques.
- Practical – Implementations of interactive interfaces.
- External learning – Interaction facilities and high level support for animation design.

**Suggested Evaluation Methods:**
- Tutorials on interaction models.
- Demonstration based on interactivity.
- Assignment on animation design.

**UNIT V  CURRENT TRENDS**

9


**Suggested Activities:**
- Flipped classroom on implementation of virtual reality environment.
- Mini project for designing and implementing innovative interfaces.

**Suggested Evaluation Methods:**
- Demonstration – Mini Project.
- Tutorials on virtual reality application.
OUTCOMES:
On completion of the course, the students will be able to:
1. Apply mathematics and basic science knowledge for designing information visualizing system.
2. Collect data ethically and solve engineering problem in visualising the information.
3. Implement algorithms and techniques for interactive information visualization.
4. Conduct experiments by applying various modern visualization tool and solve the space layout problem.
5. Analyze and design systems to visualize multidisciplinary multivariate Data individually or in teams.
6. Develop a cost effective and a scalable information visualization system.

TEXT BOOKS:

REFERENCES

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

IT5014 C# AND .NET PROGRAMMING

OBJECTIVES:
- To learn the technologies of the .NET framework.
To cover all segments of programming in C# starting from the language basics, followed by the object oriented programming concepts.
To update and enhance skills in writing Windows applications, ADO.NET and ASP .NET.
To introduce advanced topics namely data connectivity, WPF, WCF and WPF with C# and .NET 4.5.
To implement mobile applications using .Net compact framework.

UNIT I    C# LANGUAGE BASICS

Suggested Activities:
- Installation of .Net framework and experimenting simple C# programs using IDE.
- Flipped Classroom on CLR internals.
- Creation of shared assemblies.

Suggested Evaluation Methods:
- Quiz on CLR internals.
- Tutorials on C# programming fundamentals.

UNIT II    C# ADVANCED FEATURES

Suggested Activities:
- Implementing delegates and handling events.
- Practical – Generic collections, memory management and exception handling.

Suggested Evaluation Methods:
- Demonstration of implemented programs.
- Tutorial case studies on advanced C# features.

UNIT III    BASE CLASS LIBRARIES AND DATA MANIPULATION

Suggested Activities:
- Implementation of Threads and Synchronization based application.
- Practical – Programs on XML and operations using parsers.
- Application development with ADO.NET.

Suggested Evaluation Methods:
- Tutorials on SAX and DOM parsers.
- Presentation of ADO.NET based application.
UNIT IV        WINDOW AND WEB BASED APPLICATIONS


Suggested Activities:
- Practical – Programs using ASP.NET and State management controls.
- Flipped classroom on web services with .NET.
- Tutorials on WCF framework.

Suggested Evaluation Methods:
- Quizzes on different topics of ASP .NET.
- Demonstration of the implemented programs on ASP.NET web services.

UNIT V        .NET COMPACT FRAMEWORK


Suggested Activities:

Suggested Evaluation Methods:
- Presentation of .NET compact framework application.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the student will be able to:
- Understand the difference between .NET and Java framework.
- Work with the basic and advanced features of C# language.
- Create applications using various data providers.
- Create web applications using ASP.NET
- Create mobile applications using .NET compact framework.
- Integrate all the features of C# language and build complex web applications in .NET framework.

TEXT BOOKS:

REFERENCES:
IT5015 SOFTWARE TESTING

L T P C
3 0 0 3

OBJECTIVES:
- To introduce the basics and necessity of software testing.
- To provide various testing techniques along with concepts of software bugs and its impact.
- To develop and validate a test plan.
- To build a testing team required.
- To understand the need for and challenges in test automation and to develop testing scripts.

UNIT I TESTING PRINCIPLES AND AXIOMS

Suggested Activities:
- Flipped classroom on testing axioms.
- Identify and analyze syntax error, semantic error, bug and defect for programs.

Suggested Evaluation Methods:
- Quiz and discussion on testing axioms.
- Identifying fallacies in requirements specification.
- Identify the various types of errors, bugs and defects for a case study.

UNIT II BLACK BOX, WHITE BOX TESTING AND TEST ADEQUACY

Suggested Activities:
- Flipped classroom on test adequacy criteria.
- External learning – Exploring white box testing tools like veracode, eclemma, rcunit, cppunit, junit, JSUnit etc.
- Analyzing the cyclomatic complexity of code segments.
Suggested Evaluation Methods:
- Quiz and discussion on cyclomatic complexity.
- Assignments on white box testing tools like Selenium, Appium, Robotium and carrying out simple BBT and WBT using tools.
- Solving problems related to cyclomatic complexity.

UNIT III LEVELS OF TESTING

Suggested Activities:
- External learning – Exploring the integration testing tools for various programming languages – VectorCAST/C++, CITRUS (Java), FitNesse (open source), Rational test integration tester, Protractor (Angular, Angular JS), Jasmine (JavaScript), Spock (Java) and the regression testing tools – Sahi Pro, Watir, IBM Rational Regression Tester, TestDrive etc.
- Flipped classroom on alpha and beta testing.
- Analyzing various levels of testing required for a software product.

Suggested Evaluation Methods:
- Assignments on integration testing tools and regression testing tools.
- Quiz and discussion on alpha and beta testing.
- Identifying and performing various levels of testing for a case study.

UNIT IV TEST MANAGEMENT

Suggested Activities:
- Flipped classroom on reporting test results.
- External learning – Exploring the organization structures and organizational behaviour in the context of software testing.
- Analyzing how to build testing groups for various types of projects and organizations.

Evaluation Methods:
- Quiz and discussion on reporting test results.
- Finding out the organization structure and organizational behaviour for given case studies.
- Building test groups for given case studies.

UNIT V TEST AUTOMATION

Suggested Activities:
- Flipped classroom on Test metrics and measurements.
- External learning – Exploring the risks involved in automated testing and exploring the ways to improve your testing skills apart from using testing tools.
• Practical – Install and learn popular software testing tools like Selenium, WinRunner, LoadRunner, Performance Tester etc.
• Learning to write test scripts.

Suggested Evaluation Methods:
• Quiz and discussion on test metrics and measurements.
• Assignments on evaluating the risks involved in automated testing for given case studies.
• Assignments on writing test scripts to carry out various types of testing in test automation tools.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
• Obtain an insight to software testing.
• Apply both black box testing and white box testing.
• Understand and apply multiple levels of testing.
• Understand the role of a tester as an individual and as a team member.
• Apply software testing for large projects using automated testing tools.
• Maintain documentation on testing.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To learn the various E-learning approaches and Components.
- To explore Design Thinking.
- To understand the types of design models of E-learning.
- To learn about E-learning Authoring tools.
- To know about evaluation and management of E-learning solutions.

UNIT I  INTRODUCTION
9
Need for E-Learning – Approaches of E-Learning – Components of E-Learning –
Synchronous and Asynchronous Modes of Learning – Quality of E-Learning – Blended
Learning: Activities, Team and Technology – Work Flow to Produce and Deliver E-Learning
Content – Design Thinking: Introduction – Actionable Strategy – Act to Learn – Leading
Teams to Win.

Suggested Activities:
- External learning - E-learning approaches and components.
- Discussion on design thinking.

Suggested Evaluation Methods:
- Assignment on E-learning approaches and components.
- Quizzes on design thinking.

UNIT II  DESIGNING E-LEARNING COURSE CONTENT
9
Design Models of E-Learning – Identifying and Organizing E-Learning Course Content:
Needs Analysis – Analyzing the Target Audience – Identifying Course Content – Defining
Learning Objectives – Defining the Course Sequence – Defining Instructional Methods –
Defining Evaluation and Delivery Strategies – Case Study.

Suggested Activities:
- Discussion on design models.
- External learning - E-Learning instructional methods.

Suggested Evaluation Methods:
- Assignment on design models of E-learning.
- Quiz on E-learning instructional methods.

UNIT III  CREATING INTERACTIVE CONTENT
9
Preparing Content: Tips for Content Development and Language Style – Creating
Storyboard: Structure of an Interactive E-Lesson – Techniques for Presenting Content –
Adding Examples – Integrating Multimedia Elements – Adding Examples – Developing
Practice and Assessment Tests – Adding Additional Resources – Courseware Development –

Suggested Activities:
- Discussion on creation of story boards.
- Discussion on courseware creation.
- External learning - Types of authoring tools.

Suggested Evaluation Methods:
- Demonstration of story boards creation with Moodle.
- Demonstration of creation of a complete courseware with Moodle.
• Quiz on authoring tools.

UNIT IV LEARNING PLATFORMS

Suggested Activities:
• Discussion on LMS categories for E-learning.
• External learning - Functional areas of E-learning.

Suggested Evaluation Methods:
• Assignment on proprietary and open source LMS.
• Quiz on LMS solutions.

UNIT V COURSE DELIVERY AND EVALUATION

Suggested Activities:
• Discussion on planning and documentation.
• External learning - Evaluation and delivery methods.

Suggested Evaluation Methods:
• Assignment on planning and documentation.
• Quiz on evaluation and delivery methods.

OUTCOMES:
On completion of course, the students will be able to:
1. Distinguish the phases of activities in models of E-learning.
2. Identify appropriate instructional methods and delivery strategies.
3. Choose appropriate E-learning Authoring tools.
5. Evaluate the E-learning courseware.
6. Manage the E-learning courseware.

TEXT BOOK:

REFERENCE BOOKS:

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
OBJECTIVE:
- To know the basics of IT Infrastructure.
- To study the basics of data centre and its performance metrics.
- To study the basics of compute and storage services provided in cloud.
- To learn the basics of cloud platforms and technologies.
- To study the Security issues associated with cloud infrastructure.

UNIT I INTRODUCTION TO INFRASTRUCTURE

Suggested Activities:
- Identifying IT building blocks for various applications development.
- Flipped classroom on IT projects failure articles or white papers.
- Study of performance metrics for IT infrastructure.

Suggested Evaluation Methods:
- Presentation on IT building blocks.
- Quizzes on IT project articles white papers.
- Tutorials on IT infrastructure performance measure.

UNIT II DATA CENTERS

Suggested Activities:
- Collection of major data center facilities across the world and their features.
- Discussion on technical details related to data center building.

Suggested Evaluation Methods:
- Presentation on major data center facilities.
- Quizzes on data centre performance and security.
UNIT III  COMPUTE & STORAGE 

Suggested Activities:
- Discussion on compute and storage building blocks
- Flipped classroom on technical details of DAS, NAS and SAN.

Suggested Evaluation Methods:
- Quizzes on virtualization and compute performance.
- Presentation on technical details of DAS, NAS and SAN.

UNIT IV  INFRASTRUCTURE DEPLOYMENTS

Suggested Activities:
- Study on web application hosting in cloud platform.
- Creating and deploying applications in AWS/Google AppEngine/Microsoft Azure.

Suggested Evaluation Methods:
- Quizzes on web application hosting in cloud.
- Demonstration of deployed cloud application.

UNIT V  INFRASTRUCTURE SECURITY

Suggested Activities:
- Study of risks associated with Infrastructure.
- Deployment of application with secured features.

Suggested Evaluation Methods:
- Quizzes on Infrastructure risks.
- Demonstration of security features in the deployed cloud application.

OUTCOMES:
On completion of the course, the students will be able to:
1. Understand the fundamentals of IT Infrastructure.
2. Know the data centre infrastructure and its associated performance metrics.
3. Have knowledge on infrastructure services (IaaS) provided by different vendors.
4. Be familiar with various Cloud platforms and associated technologies.
5. Understand various security issues associated with data centers and cloud applications.
6. Apply the infrastructure concepts to analyze, design, build, maintain and optimize IT operations.

TEXT BOOKS:

REFERENCES:

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

IT5018 QUANTUM COMPUTING L T P C 3 0 0 3

OBJECTIVES:
• To know the background of classical computing and quantum computing.
• To learn the fundamental concepts behind quantum computation.
• To study the details of quantum mechanics and the relation to Computer Science.
• To gain knowledge about the basic hardware and mathematical models of quantum computation.
• To learn the basics of quantum information and the theory behind it.

UNIT I FUNDAMENTAL CONCEPTS
Suggested Activities:
- Flipped classroom on quantum algorithms, information processing.
- Tutorials on applications of algorithms.

Suggested Evaluation Methods:
- Quiz on quantum bits.
- Problem solving assignment on quantum computation.
- Programming assignment on quantum algorithms.

UNIT II QUANTUM MECHANICS AND OVERVIEW OF COMPUTATIONAL MODELS

Suggested Activities:
- Flipped classroom on postulates, computational models.
- Computational analysis of common problems like Travelling Salesman.

Suggested Evaluation Methods:
- Quiz on postulates and computational models.
- Problem solving assignment on application of quantum mechanics.
- Programming assignment on Turing machines.

UNIT III QUANTUM COMPUTATION

Suggested Activities:
- Flipped classroom on simulation, Fourier transform.
- Simulation Exercises.
- Tutorials on quantum search algorithms.

Suggested Evaluation Methods:
- Quiz on the quantum algorithm and quantum circuits.
- Problem solving assignment on text book exercise questions.
- Programming assignment on search algorithms.

UNIT IV QUANTUM INFORMATION

Suggested Activities:
- Flipped classroom on quantum operations.
- Tutorials on examples and application of quantum operations.

Suggested Evaluation Methods:
- Quiz on quantum operations.
- Problem solving assignment on applications of quantum operations.
UNIT V QUANTUM INFORMATION THEORY


Suggested Activities:
- Flipped classroom on data compression, noisy quantum channels.
- Extra reading and discussion from reference books.

Suggested Evaluation Methods:
- Quiz on data compression and noisy quantum channels.
- Problem solving assignment on text book exercise questions.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the student will be able to:
1. Understand the basics of quantum computing.
2. Understand the background of Quantum Mechanics.
3. Analyse the computation models.
4. Model the circuits using quantum computation.
5. Understand the quantum operations such as noise and error–correction.
6. Appreciate the need of quantum computing.

TEXT BOOK:

REFERENCES:

<table>
<thead>
<tr>
<th>CO1</th>
<th>CO2</th>
<th>CO3</th>
<th>CO4</th>
<th>CO5</th>
<th>CO6</th>
</tr>
</thead>
<tbody>
<tr>
<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>
</tr>
<tr>
<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>
</tr>
<tr>
<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>
</tr>
</tbody>
</table>

PO1  PO2  PO3  PO4  PO5  PO6  PO7  PO8  PO9  PO10  PO11  PO12
OBJECTIVES:
- To give students knowledge of soft computing theories and fundamentals.
- To design a soft computing system required to address a computational task and use heuristics based on human experience.
- To understand fuzzy sets and fuzzy logic for problem solving.
- To become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inferencing systems.
- To familiarize with genetic algorithms and other random search procedures useful while seeking global optimum in self-learning situations.

UNIT I    FUZZY COMPUTING

Suggested Activities:
- Install MatLab Fuzzy Logic Toolbox and ANN toolbox to design and simulate systems.

Suggested Evaluation Methods:
- Quizzes on basic concepts of fuzzy logic and operations.

UNIT II    FUNDAMENTALS OF NEURAL NETWORKS

Suggested Activities:
- Practical – Develop a supervised model to train neural net that uses the AND/OR/XOR two input binary/bipolar input and output data and learn linear models to understand the importance of initialization parameters.

Suggested Evaluation Methods:
- Implementation evaluation with appropriate input set.

UNIT III    BACK PROPAGATION NETWORKS

Suggested Activities:
- Train neural net that uses the XOR three input binary/bipolar input and output data and learn linear models to understand the importance of learning parameters.
- Train a linear / non linear model with one hidden layer, two hidden layers.
- Observe the performance with different learning rates and draw the graph depicting the error rate with iterations.

Suggested Evaluation Methods:
- Implementation evaluation with new input set.
UNIT IV  COMPETITIVE NEURAL NETWORKS  9

Suggested Activities:
- Train a neural net that uses any dataset and plot the cluster of patterns.

Suggested Evaluation Methods:
- Implementation evaluation with new input set.

UNIT V  GENETIC ALGORITHM  9

Suggested Activities:
- Implement GA for the Travelling Salesman problem to find the shortest path that visits all cities in a set exactly once.

Suggested Evaluation Methods:
- Implementation evaluations by testing the code on different route maps and checking the optimal solution.

OUTCOMES:
On completion of the course, the student will be able to:
1. Identify and describe soft computing techniques and their roles in building intelligent machines.
2. Recognize the feasibility of applying a soft computing methodology for a particular problem.
3. Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
4. Apply genetic algorithms to optimization problems.
6. Compare different neural network approaches.

TEXTBOOKS:

REFERENCES:
OBJECTIVES:
- To gain knowledge about the empirical and theoretical study of social networks, its structure and social network data sources.
- To study about the semantic technologies for social network analysis.
- To gain knowledge on visualization of social networks and its applications.
- To gain knowledge about social network analysis software for characterizing the network structure.
- To engage in critical thinking regarding the applicability of social network theory to various sociological phenomena.

UNIT I   INTRODUCTION  

Suggested Activities:
- Practical – Study of existing social networks and calculate the social network related metrics.
- Flipped classroom on fundamental mathematical knowledge on graphs and tutorial activity.
- External learning – Problems on calculation of ties, density, path, length, distance, betweenness, centrality, clique.

Suggested Evaluation Methods:
- Demonstration of social network creation and calculating the related metrics.
- Tutorial on graphs and its related terminologies.
- Assignments on calculation of ties, density, path, length, distance, betweenness, centrality, clique.
UNIT II  
SOCIAL NETWORK ANALYSIS

Introduction to Social Networks Profiles – Types of Commercial Social Network Profiles (CSNP) – Quantitative and Qualitative Analysis of CSNP – Analysis of Social Networks Extracted from Log Files – Data Mining Methods Related to SNA and Log Mining – Clustering Techniques – Case Study.

Suggested Activities:
- Practical – Analysis of social network dataset.
- Flipped classroom on emerging applications of data mining based social network analysis techniques.
- External learning – Case study related to SNA.

Suggested Evaluation Methods:
- Demonstration of the analysis of social network log dataset.
- Tutorials on data mining applications.
- Assignments on data mining on SNA.

UNIT III  
SEMANTIC TECHNOLOGY FOR SOCIAL NETWORK ANALYSIS

Introduction to Ontology based Knowledge Representation – Ontology Languages for the Semantic Web – RDF and OWL – Modeling Social Network Data – Network Data Representation, Ontological Representation of Social Individuals and Relationships – Aggregating and Reasoning with Social Network Data – Advanced Representations.

Suggested Activities:
- Practical – Use of the features available in various ontology tools like Protégé.
- Flipped classroom on basic concepts of semantic web and ontology.
- External learning – Knowledge on semantic technology.

Suggested Evaluation Methods:
- Demonstration of created ontology.
- Tutorials on semantic web related terminologies.
- Quizzes on semantic technology for SNA.

UNIT IV  
SOCIAL NETWORK MINING


Suggested Activities:
- Practical – Detection and mining of communities using various tools.
- Flipped classroom on basic concepts of online social networks (OSNs) and social network mining algorithms.
- External learning – Practical problems related to evaluation of community metrics.

Suggested Evaluation Methods:
- Demonstration – Community creation and mining.
- Tutorials on Social Network Mining.
- Assignments on community detection methods.
UNIT V VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS

Visualization of Social Networks
- Node-Edge Diagrams
- Random Layout
- Force-Directed Layout
- Tree Layout
- Matrix Representations
- Hybrid Representations
- Visualizing Online Social Networks
- Applications
- Covert Networks
- Community Welfare
- Collaboration Networks
- Co-Citation Networks
- Data Privacy in Social Networks

Suggested Activities:
- Practical – Knowledge about tools related to social networks and implementation of social network visualizations using tools such as Gephi, Cytoscape.
- Flipped classroom on applications of social networks.
- External learning – How visualization is used in various real time SN applications.

Suggested Evaluation Methods:
- Demonstration of visual social networks
- Tutorials on applications of social networks.
- Quizzes on types of visualizations for social networks
- Group discussion on privacy and security of Aadhar.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Understand basic principles behind network analysis algorithms and develop practical skills of network analysis.
2. Model and represent knowledge for social semantic Web.
3. Apply data mining techniques on social networks.
4. Use extraction and mining tools for analyzing Social networks.
5. Develop secure social network applications.

TEXT BOOKS:

REFERENCES:

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

<table>
<thead>
<tr>
<th>CO2</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
OBJECTIVES:
- To learn the fundamentals of semantic web and to conceptualize and depict ontology for semantic web.
- To make a study of languages for semantic web.
- To learn about the ontology learning algorithms and to utilize in the development of an application.
- To know the fundamental concepts of ontology management.
- To learn the applications related to semantic web.

UNIT I THE QUEST FOR SEMANTICS

Suggested Activities:
- Flipped classroom on semantic web background and tutorial activity.
- Brainstorming session – Various knowledge representation formats.
- Practical – Design of simple ontology on their domain of interest using tools like Protégé.
- Practical – Installing EasyRdf in the system and including this in PHP (EasyRdf is a PHP library, which can be used to consume and produce RDF).

Suggested Evaluation Methods:
- Tutorials on semantic web basics.
- Quizzes on knowledge representation formats
- Demonstration of simple implemented ontology.

UNIT II LANGUAGES FOR SEMANTIC WEB AND ONTOLOGIES

Suggested Activities:
- Flipped classroom on comparison of various semantic web related languages and tutorial.
• Practical – Creation of RDF documents.
• Practical – Use of OWL language to represent relationships, properties and to provide inferences from created ontology.

Suggested Evaluation Methods:
• Quizzes on various ontology related languages
• Demonstration of knowledge inference from created ontologies.

UNIT III ONTOLOGY LEARNING FOR SEMANTIC WEB

Suggested Activities:
• Flipped classroom on natural language processing techniques like statistical text analysis, term extraction, word sense disambiguation, concept extraction and tutorial activity.
• Practical – Term extraction and term disambiguation from corpus using Alchemy like API.
• Extended Reading from the site – https://nlp.stanford.edu/fsnlp/.

Suggested Evaluation Methods:
• Tutorials on language processing techniques.
• Demonstration on term extraction and term disambiguation.

UNIT IV ONTOLOGY MANAGEMENT AND TOOLS

Suggested Activities:
• Flipped classroom on study of various ontology related tools.
• Practical – Use of any tool to apply SPARQL queries and implement reasoning for avoiding inconsistencies
• Practical – Merging two ontologies, applying association rules, applying clustering algorithms

Suggested Evaluation Methods:
• Tutorials on ontology related tools like Protege, Ontolingua, Webonto.
• Demonstration of clustering, merging ontologies and Sparql queries.

UNIT V APPLICATIONS

Suggested Activities:
• Flipped classroom on other applications of semantic web.
• Practical – Simple application like chat bot, semantic search engine creation using topic map data models extracted from Ontopia/Mappa.
• Practical – Creating intelligent expert systems using semantic Wikis like SMW+.
Suggested Evaluation Methods:
- Quizzes on semantic web applications
- Demonstration of applications created using tools.

OUTCOMES:
On completion of the course, the students will be able to:
1. Create ontology for a given domain.
2. Develop an application using ontology languages and tools.
3. Understand the concepts of semantic web.
4. Use ontology related tools and technologies for application creation.
5. Design and develop applications using semantic web.
6. Understand the standards related to semantic web.

TEXT BOOKS:

REFERENCES:

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

IT5022 INFORMATION RETRIEVAL

OBJECTIVES:
- To learn the fundamentals of Information Retrieval and its various models.
- To learn about the preprocessing techniques and query languages used in IR system.
- To understand the performance metrics of IR System.
• To learn the usage and design of Web Search Engines.
• To study the basics of recommender systems and information extraction system.

UNIT I INTRODUCTION

Suggested Activities:
• Understanding the basics of IR.
• Study of other retrieval models.
• Practical – Implementation of the retrieval model with Lemur Tool kit and test the performance of different retrieval algorithms.

Suggested Evaluation Methods:
• Quizzes on IR and other retrieval models.
• Assignments on retrieval models.

UNIT II PREPROCESSING

Suggested Activities:
• Study of indexing techniques.
• Practical – Implementation of vector space model.
• Flipped classroom on query expansion with thesaurus.

Suggested Evaluation Methods:
• Case studies on tokenization, stop word removal and stemming.
• Tutorials on query operations and languages.

UNIT III METRICS

Suggested Activities:
• Practical – Implementation of evaluation metrics.
• Study and implementation of PageRank algorithm.
• Study of web page duplicate detection technique.

Suggested Evaluation Methods:
• Tutorials on web search and crawling.
• Quizzes on precision, recall and f-measure.
• Assignments on web search engines.

UNIT IV CATEGORIZATION AND CLUSTERING
– Expectation Maximization (EM) – Applications to Information Filtering – Organization and Relevance Feedback.

**Suggested Activities:**
- Study of different classification techniques and its uses in different applications.
- Practical – Implementation of classification and clustering techniques with WEKA tool.
- Assignments on clustering algorithms.

**Suggested Evaluation Methods:**
- Quizzes on different categorization and clustering methods.
- Exercise on categorization and clustering algorithms for real time applications.

**UNIT V  EXTRACTION AND INTEGRATION**


**Suggested Activities:**
- Study of types of collaborative filtering techniques.
- Flipped classroom on semantic web.

**Suggested Evaluation Methods:**
- Assignments on item based and user based collaborative filtering techniques.
- Quizzes on semantic web.

**OUTCOMES:**
On completion of the course, the student will be able to:
1. Build an Information Retrieval system using the available tools.
2. Apply indexing and query expansion techniques for efficient retrieval.
3. Apply performance metrics to validate any information retrieval system.
5. Design and analyze the Web content structures.
6. Design and implement recommender and information extraction system.

**TEXT BOOKS:**

**REFERENCES:**
**IT5023**  
**FUNDAMENTALS OF DIGITAL IMAGE PROCESSING**  
**L T P C**  
**3 0 0 3**

**OBJECTIVES:**
- To learn the basic concepts of digital image processing and various image transforms.
- To familiarize the student with the image enhancement techniques.
- To expose the student to a broad range of image processing techniques and their applications.
- To appreciate the use of current technologies that are specific to image processing systems.
- To expose the students to real-world applications of image processing.

**UNIT I  FUNDAMENTALS OF IMAGE PROCESSING**  
9

**Suggested Activities:**
- Discussion on image processing applications.
- External learning – Open source tools like Octave/SciLab/OpenCV, types of images.
- Practical – Reading and writing of images in Matlab and OpenCV/Octave/SciLab.

**Suggested Evaluation Methods:**
- Tutorials on image operations, image connectivity and distance measures.
- Assignments on sampling, quantization and image operations.
- Quizzes on image types.

**UNIT II  IMAGE ENHANCEMENT**  
9

**Suggested Activities:**
- Discussion of mathematical transforms.
- Numerical problem solving using Fourier transform.
• External learning – image noise and types of noises.
• Practical – Implementation of simple spatial filters like low pass filters and high pass filters in Matlab/OpenCV.

Suggested Evaluation Methods:
• Tutorials on image transforms, image smoothing.
• Assignments on histogram specification and equalization, spatial filters.
• Quizzes on noise modeling.

UNIT III IMAGE RESTORATION AND MULTI-RESOLUTION ANALYSIS

Suggested Activities:
• Discussion on image artifacts and blur.
• Discussion on the role of wavelet transforms in filter and analysis.
• Practical – Implementation of noise modeling in Matlab/Octave/SciLab.
• Practical – Implementation of wavelet transforms and deconvolution algorithms in Matlab/Octave.

Suggested Evaluation Methods:
• Tutorials on wavelet transforms.
• Assignments on order statistics filters and multi resolution expansions.
• Quizzes on wavelet transforms.

UNIT IV IMAGE SEGMENTATION AND FEATURE EXTRACTION

Suggested Activities:
• Flipped classroom on importance of segmentation.
• External learning – Discussion of features, feature selection and reduction.
• Practical – Implementation of SIFT, SURF in Matlab/Octave/SciLab.
• Practical – Implementation of PCA in Matlab/Octave.

Suggested Evaluation Methods:
• Tutorials on image segmentation and edge detection.
• Assignments on feature extraction and reduction.
• Quizzes on feature selection and extraction.

UNIT V IMAGE PROCESSING APPLICATIONS

Suggested Activities:
• Discussion on machine learning in image processing.
• Discussion on image classifiers.
• Discussion on biometrics such as iris, fingerprint and face recognition.
• Discussion on image security such as steganography and digital watermarking.
• External learning – Medical imaging and remote sensing.
• External learning – Study of visual effects and Forensic applications.
• Practical – Image classifier using SVM in Matlab/Octave.
• Practical – Extraction of features in fingerprint using Matlab/Octave.

Suggested Evaluation Methods:
• Tutorials on image classifier and clustering.
• Assignments on support vector machines and em algorithm.
• Quizzes on image processing applications.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Implement basic image processing operations.
2. Apply and develop new techniques in the areas of image enhancement and restoration.
3. Understand the image segmentation algorithms.
4. Extract features from images.
5. Apply classifiers and clustering algorithms for image classification and clustering.
6. Design and develop an image processing application that uses different concepts of image processing.

TEXT BOOKS:

REFERENCES:

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

✓表示已覆盖的内容。
OBJECTIVES:
- To impart the fundamental aspects and principles of mixed reality technologies.
- To know the internals of the hardware and software components involved in the development of mixed reality enabled applications.
- To learn about the graphical processing units and their architectures.
- To gain knowledge about mixed reality application development.
- To evaluate the mixed reality based applications.

UNIT I INTRODUCTION

Suggested Activities:
- Flipped classroom on the use of MR applications.
- Experience the virtual reality effect by watching videos.
- Assignment on comparison of VR with traditional multimedia applications.

Suggested Evaluation Methods:
- Tutorials on MR applications.
- Brainstorming session – AR effects.
- Quizzes on comparison of VR with traditional multimedia applications.

UNIT II MR COMPUTING ARCHITECTURE

Suggested Activities:
- Flipped classroom on basic graphics pipeline.
- External learning – Different types of graphics architectures and workstations.
- Practical – GPU programming.

Suggested Evaluation Methods:
- Tutorials on graphics pipeline.
- Brainstorming session – Graphics architectures.
- Quizzes on various topics of the unit.
- Demonstration of GPU programs for creating simple multimedia Applications.

UNIT III MR MODELING

Suggested Activities:
- Flipped classroom on modeling three dimensional objects.
- External learning – Collision detection algorithms.
- Practical – Creating three dimensional models.

Suggested Evaluation Methods:
- Tutorials on 3D modeling techniques.
- Brainstorming session – Collision detection algorithms.
- Demonstration of three dimensional models.

UNIT IV MR PROGRAMMING

Suggested Activities:
- External learning – Different types of programming toolkits.
- Practical – Create VR scenes using toolkits like World ToolKit, Java 3D, Ghost, PeopleShop, Unity.

Suggested Evaluation Methods:
- Tutorial on different programming toolkits for MR.
- Demonstration of MR scene creation.

UNIT V APPLICATIONS

Suggested Activities:
- External learning – Learn different types of available MR applications.
- Practical – Develop MR application in any domain of your interest.
- Tutorials on MR applications

Suggested Evaluation Methods:
- Evaluation of the developed MR application.
- Demonstration of MR application development and appropriate evaluation.

OUTCOMES:
On completion of the course, the student will be able to:
1. Discuss the basic concepts of Mixed Reality.
2. Design and develop the Mixed Reality applications in different domains.
3. Design various models using modeling techniques.
5. Understand the working principles of input output devices used in mixed reality applications.
6. Evaluate mixed reality based applications.

TOTAL: 45 PERIODS
TEXTBOOKS:

REFERENCES:

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

IT5025 GAME PROGRAMMING

OBJECTIVES:
- To know the basics of 2D and 3D graphics for game development.
- To know the stages of game development.
- To understand the basics of game engine.
- To survey the gaming development environment and toolkits.
- To learn and develop simple games using Pygame environment.

UNIT I 3D GRAPHICS FOR GAME PROGRAMMING

Suggested Activities:
- Discussion about computer and video games origin and history.
- Discussion of graphics objects, open source language for game development like Pygame and Processing.py - a Language for Creative Arts.
- External learning - Practical problems in translation, scaling, zooming and rotation of 2D and 3D objects.
- Practical - Installation of Pygame and Pygame Zero and Implementation of colour models and shading models in Python.

Suggested Evaluation Methods:
- Tutorials on 2D and 3D transformations.
- Evaluation of programming exercises for Python implementation.
- Assignments on image projections and colour models.
- Quizzes on 2D and 3D game object transforms.

UNIT II GAME DESIGN PRINCIPLES

Suggested Activities:
- Flipped classroom on animation.
- Creation of game script in natural language and story creation.
- External learning - Practical problems in game level design.
- Practical - Producing game level design document, detailed document.

Suggested Evaluation Methods:
- Tutorials on script writing.
- Assignments on game proposal writing.
- Quizzes on game design document.

UNIT III GAME ENGINE DESIGN

Suggested Activities:
- Flipped classroom on rendering.
- External learning - Image rendering and animation.
- Practical - Implementation of simple animations in Pygame and Processing.py

Suggested Evaluation Methods:
- Tutorials on collision detection.
- Assignments on game AI and path finding.
- Quizzes on rendering.

UNIT IV OVERVIEW OF GAMING PLATFORMS AND FRAMEWORKS
Pygame Game development – Unity – Unity Scripts – Mobile Gaming, Game Studio, Unity – Single player and Multi-Player games.

Suggested Activities:
- Flipped classroom on gaming environments.
- External learning - Unity Game Engine.
- Practical - Installation of Unity and scripts.
- Practical - Pygame routines for character rendering, transformations and sound processing.

Suggested Evaluation Methods:
- Tutorials on collision detection.
- Assignments on Unity Game Engine.
- Quizzes on all topics related to Unity and Pygame.

UNIT V GAME DEVELOPMENT USING PYGAME
Developing 2D and 3D Interactive Games using Pygame – Avatar Creation – 2D and 3D

Suggested Activities:
- External learning - Writing Unity scripts and assets.
- Practical - Implementation of simple games.

SUGGESTED EVALUATION METHODS:
- Tutorials on 2D and 3D graphics programming.
- Programming problems like asset creation
- Quizzes on game development in Pygame.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Have knowledge on the concepts of 2D and 3D graphics.
2. Know about games and their genres with their origin and history.
3. Prepare game design documents.
4. Understand the implementation of gaming engines.
5. Survey gaming environments and frameworks.
6. Implement a simple game in Pygame.

TEXT BOOK:

REFERENCES:

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<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></td>
</tr>
</tbody>
</table>
OBJECTIVES:
- To have basic knowledge on Intellectual property rights and the importance of protecting it.
- To understand the classifications of IPR.
- To have awareness on International treaties of IPR.
- To learn the basics of Indian IPR legislations.
- To study the patents related information in Electronics and IT.

UNIT I       INTRODUCTION TO IPR

Suggested Activities:
- Study of basics of intellectual property.
- Understanding protection mechanisms of IPR.

Suggested Evaluation Methods:
- Quizzes on IPR basics.
- Tutorials on downloading and understanding IPR documents.

UNIT II        CLASSIFICATIONS OF IPR

Suggested Activities:
- Study of different kinds of inventions protected by a patent.
- Exploring free databases for searching patents, copyrights, trademarks and Industrial designs.
- Study of different types of trademarks.
- Study of industrial designs and integrated circuits.
- Flipped classroom on various IPR.

Suggested Evaluation Methods:
- Case studies – Intellectual property rights search.
- Assignments on patent drafting.

UNIT III       INTERNATIONAL TREATIES ON IPR

Suggested Activities:
- Study of principal, administrative and financial provisions of various treaties.
- Study of functioning of the patent co-operation treaty system.
Suggested Evaluation Methods:
- Quizzes on treaties.
- Assignments on international treaties.

UNIT IV INDIAN IPR LEGISLATIONS

Suggested Student Activities:
- Assignments on drafting a national intellectual property.

Suggested Evaluation Methods:
- Tutorials on patent ordinance.

UNIT V IPR IN ELECTRONICS AND INFORMATION TECHNOLOGY

Suggested Student Activities:
- Study of protection of computer programs under patents and copyright.
- Study of international norms concerning copyright protection of software inventions.

Suggested Evaluation Methods:
- Quizzes on patents pertaining to Electronics and IT.
- Tutorials on analyzing software inventions.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the student will be able to:
1. Understand the basics of IPR and its importance.
2. Know and classify IPR under various categories.
3. Have basic knowledge of International treaties on IPR.
4. Have familiarity with the basics of Indian IPR legislations.
5. Have awareness on patents relating to Electronics and IT.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To develop an awareness of the need for project planning and management.
- To know about software effort estimation and activity planning.
- To explore risk and people management.
- To learn about project monitoring and control mechanisms.
- To know about software quality management.

UNIT I INTRODUCTION

Suggested Activities:
- Discussion on software project management planning.
- External learning - Process models.

Suggested Evaluation Methods:
- Assignment on project management framework.
- Quiz on process models.

UNIT II SOFTWARE EFFORT ESTIMATION AND ACTIVITY PLANNING

Suggested Activities:
- Discussion on software effort estimation methods.
- External learning - Software activity planning.

Suggested Evaluation Methods:
- Quiz on software effort estimation methods.
• Assignment on activity planning of a case study.

UNIT III SOFTWARE RISK AND PEOPLE MANAGEMENT


Suggested Activities:
• Discussion on risk management approaches.
• External learning - People Management.

Suggested Evaluation Methods:
• Assignment on risk management.
• Quiz on people management.

UNIT IV SOFTWARE PROJECT MONITORING AND CONTROL


Suggested Activities:
• Discussion on project monitoring.
• External learning - Software control mechanisms.

Suggested Evaluation Methods:
• Assignment on project monitoring.
• Quiz on software control mechanisms.

UNIT V SOFTWARE QUALITY MANAGEMENT


Suggested Activities:
• Discussion on components of software quality management.
• External learning - Software quality measures.

Suggested Evaluation Methods:
• Assignment on various SQM standards and bodies.
• Quiz on software quality measures.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Differentiate between various software process models.
2. Prepare project planning documents.
3. Estimate the software cost for projects.
4. Perform effective activity planning.
5. Prepare effective project scheduling work product.
6. Perform software quality management activities.

TEXT BOOKS:

REFERENCES:

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

IT5028 SERVICE ORIENTED ARCHITECTURE AND MICROSERVICES

OBJECTIVES:
- To understand the basic principles of service orientation.
- To analyze various software architectures.
- To introduce service-oriented and micro-services architecture.
- To analyze and implement web service based applications.
- To understand the technology underlying service design and micro-services applications.

UNIT I SOFTWARE ENGINEERING PRACTICES
Suggested Activities:
- Sample application for each type of architecture.
- Study of popular enterprise applications.
- Cloud computing platforms comparison.
- DevOPs solution fundamentals.

Suggested Evaluation Methods:
- Quiz on various concepts.
- Simple development based on the solutions and study.

UNIT II  
SOA AND MICROSERVICE ARCHITECTURE BASICS

Suggested Activities:
- Applications of SOA and MSA.
- OOAD and SOAD comparison.
- Identifying simple services based on SOA and MSA.

Suggested Evaluation Methods:
- Case studies of various SOA applications.
- Application based comparison.

UNIT III  
WEB SERVICES

Suggested Activities:
- XML processing.
- Exploring the structure of SOAP, WSDL and UDDI.
- Creation of web services in Java/.NET/Python environment.
- RESTful web services.
- Study of middleware services for IoT.

Suggested Evaluation Methods:
- Implementing XML, DOM and SAX.
- Programming exercises.

UNIT IV  
SERVICE ORIENTED ANALYSIS AND DESIGN

Suggested Activities:
- Study for various service design.
- SOA best practices case studies.

Suggested Evaluation Methods:
- Quiz on service design principles.
- Practical - Programming exercises on service orchestration.
UNIT V  
MICROSERVICE BASED APPLICATIONS


Suggested Activities:
- Implementation of microservices architecture with python.
- Creation of container services.
- Cloud deployment.

Suggested Evaluation Methods:
- Micro service based application case study.
- Cloud deployment in different platforms.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Analyze and design SOA based solutions.
2. Understand the basic principles of service orientation.
3. Analyze and implement a web service based applications.
4. Understand the technology underlying service design.
5. Implement SOA with Micro Services applications.
6. Classify and make reasoned decision about the adoption of different SOA platforms.

TEXT BOOKS:

REFERENCES:

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>CO2</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>CO3</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>CO4</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>CO5</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<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>✔</td>
</tr>
</tbody>
</table>
OBJECTIVES:
- To give a clear picture on quality management, documentation and control for software quality.
- To provide knowledge on standards, models and tools used for quality management.
- To perform measurement and assessment of software quality.
- To introduce the basics and necessity of software testing.
- To introduce various testing techniques along with software production.

UNIT I  INTRODUCTION TO SOFTWARE QUALITY & ARCHITECTURE  9

Suggested Activities:
- External learning – Software quality models.
- Practical - Preparation of report on quality plans.

Suggested Evaluation Methods:
- Assignment on quality models and plans.

UNIT II  SQA COMPONENTS AND PROJECT LIFE CYCLE  9

Suggested Activities:
- Discussion on software quality assurance components.
- External learning - Quality assurance tools.

Suggested Evaluation Methods:
- Quizzes on software quality assurance components.
- Assignment on quality assurance tools.

UNIT III  SOFTWARE QUALITY INFRASTRUCTURE  9

Suggested Activities:
- Discussion on configuration management audit.
- Discussion on documentation control.

Suggested Evaluation Methods:
- Assignment configuration management audit report.
- Quizzes on documentation control.
UNIT IV SOFTWARE QUALITY MANAGEMENT, METRICS & STANDARDS


Suggested Activities:
- Discussion on ISO quality standards.
- External learning - Software quality metrics.

Suggested Evaluation Methods:
- Assignment on ISO quality standards.
- Quizzes on process and product metrics.

UNIT V SOFTWARE TESTING


Suggested Activities:
- Discussion on test case generation and testing methods.

Suggested Evaluation Methods:
- Assignment on test case generation tools.
- Quizzes on testing procedures.

OUTCOMES:

On completion of the course, the students will be able to:
1. Learn to document, control and manage software quality with the aid of tools and standards.
2. Distinguish between various software quality models.
3. Measure and assess software quality through process and product metrics.
4. Distinguish between the software quality standards.
5. Perform automated testing using test tools.
6. Document the testing procedures.

TEXT BOOK:

REFERENCES:

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

**IT5030 AUTONOMOUS GROUND VEHICLE SYSTEMS**  
**L T P C**  
**3 0 0 3**

**OBJECTIVES:**
- To learn the fundamentals of autonomous driving.
- To study the different ways of sensing internal states of Autonomous Ground Vehicles (AGVs).
- To learn the environment perception for autonomous driving.
- To explore the navigation techniques of AGVs.
- To learn the fundamentals of vehicle control systems and connected vehicles.

**UNIT I INTRODUCTION TO AUTONOMOUS DRIVING**


**Suggested Activities:**
- Flipped classroom on autonomous driving system architecture.
- External learning - Building blocks of typical Unmanned Aerial Vehicles.
- Flipped classroom on robot operating system.
- External learning - Applications of autonomous vehicles (aerial, under water, ground vehicles).
- Assignment on the design requirement specifications of autonomous vehicles (aerial, under water, ground vehicles).

**Suggested Evaluation Methods:**
- Viva voce on assignment topics.
- Quizzes on Advanced Driver Assistance Systems (ADAS).
- Group Discussion on Google’s self-driving car.
UNIT II SENSORS FOR AUTONOMOUS GROUND VEHICLES


Suggested Activities:
- Flipped Classroom on sensor characteristics.
- External learning - Working principle of IMU/GPS/RADAR sensors.
- External learning - Exploring Velodyne Lidar sensor dataset in Veloview software.

Suggested Evaluation Methods:
- Practical - Experiments on interfacing IMU sensor to Raspberry Pi board and recording the acceleration of a dummy vehicle.
- Practical - Experiments on interfacing Lidar/RADAR sensor to Raspberry Pi board and recording the distances to the nearby objects.
- Practical - Experiments on interfacing camera to Raspberry Pi board and capturing images/videos.

UNIT III ENVIRONMENT PERCEPTION AND MODELING

Road Recognition: Basic Mean Shift Algorithm, Mean Shift Clustering, Mean Shift Segmentation, Mean Shift Tracking, Road Recognition Algorithm – Vehicle Detection and Tracking: Generating ROIs, Multi Resolution Vehicle Hypothesis, Vehicle Validation using Gabor Features and SVM, Boosted Gabor Features – Multiple Sensor Based Multiple Object Tracking.

Suggested Activities:
- Flipped classroom on basic mean shift algorithm.
- External learning - Lane detection algorithm.
- Flipped classroom on vehicle tracking.

Suggested Evaluation Methods:
- Practical - Implementation of Mean Shift Clustering / Mean Shift Segmentation Algorithm.
- Practical - Experiments on stationary obstacle detection algorithm using Lidar sensor.

UNIT IV NAVIGATION FUNDAMENTALS


Suggested Activities:
- Flipped classroom on GPS orbits/GPS Signals.
- External learning - Indian Regional Navigation Satellite System (IRNSS).
- Assignment on the working principles of Google Map.

Suggested Evaluation Methods:
- Quizzes on GNSS signal structure.
- Viva Voce on assignment topics.
- Practical - Simulation of Waypoint Navigation Algorithm.

UNIT V VEHICLE CONTROL AND CONNECTED VEHICLE

Suggested Activities:
- Flipped classroom on cruise control.
- External learning - Study on proportional integral derivative (PID) control.
- Assignment - Communication protocols for connected vehicles.

Suggested Evaluation Methods:
- Viva Voce on assignment topic.
- Practical - Experiment on simple velocity control.
- Practical - Experiment on simple longitudinal motion control.

OUTCOMES:
On completion of the course, the students will be able to:
1. Identify the requirements and design challenges of AGVs.
2. Select suitable sensors to sense the internal state and external world of AGVs.
3. Implement lane detection, road detection & vehicle detection algorithms.
4. Simulate/implement ground vehicle navigation algorithms.
5. Simulate/implement ground vehicle control systems.
6. Design communication protocols for connected vehicles.

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:

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

- To understand the major issues, problems and solutions in the current networks.
- To understand MPLS related concepts.
- To learn about Software Defined concepts, architectures, protocols and applications.
- To identify reliability issues and provide solutions.
- To gain in-depth coverage of SAN fundamentals.

UNIT I  INTERNETWORKING

Suggested Activities:
- Practical - Identify IPv4 and IPv6 addresses of devices.
- Practical - Test bandwidth for different parameters using iperf tool.

Suggested Evaluation Methods:
- Assess by finding out addresses of the devices in LAN.
- Evaluate various traffic scenarios.

UNIT II  MPLS
MPLS Architecture and Related Protocols – Traffic Engineering (TE) and TE with MPLS – Quality of Service (QoS) with MPLS technology – Network recovery and restoration with MPLS technology.

Suggested Activities:
- Practical - Configure MPLS network using GNS3 / any open source tools.
- Practical - Simulate network recovery and restoration scenarios.

Suggested Evaluation Methods:
- Assess different network topology.
- Evaluate the scenarios.

UNIT III  SOFTWARE DEFINED NETWORKING

Suggested Activities:
- Practical - Configure OpenFlow switches.
- Practical - View switch configuration and capability using dpctl command in mininet.

Suggested Evaluation Methods:
- Evaluate some basic SDN applications using various open source SDN controller.

UNIT IV  NETWORK FUNCTION VIRTUALIZATION
Suggested Activities:
- Practical - Develop SDN in a big data application (application-driven network control).
- Practical - Develop NFV/service chaining both in and outside the data center.

Suggested Evaluation Methods:
- Evaluating the assignments for different scenarios.
- Analyzing the effect of big data application in SDN.

UNIT V STORAGE AREA NETWORKS

Suggested Activities:
- Practical - Simulate data centric storage area networking using simulator such as simsans.
- Assignments on classifying the components to change storage needs based on network, application, and business environment.

Suggested Evaluation Methods:
- Evaluation to select appropriate strategies depending upon the business storage needs.
- Simulate for different scenarios.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Understand the fundamentals of IPv6.
2. Apply traffic engineering in MPLS.
3. Analyze the need for separation of data and control plane.
4. Understand the functionality of NFV.
5. Understand design and development of SAN technology.
6. Gain an in-depth coverage of various networking technologies.

TEXT BOOK:

REFERENCES:
OBJECTIVES:

- To learn the basics of socket programming using TCP Sockets.
- To learn about socket options.
- To explore the features of raw sockets.
- To learn and develop macros for including objects in MIB structure.
- To have knowledge on various network management tools.

UNIT I        SOCKETS AND APPLICATION DEVELOPMENT


Suggested Activities:

- Assignment on Syntax and interpretation of various Socket Programming System Calls.
- Practical - Implement basic socket programs using C.

Suggested Evaluation Methods:

- Quiz on system calls.
- Evaluation of the implemented programs with appropriate test cases.

UNIT II        SOCKET OPTIONS


Suggested Activities:

- Assignment on socket options implementing using C for specific scenarios.
- Practical - Implementation of DNS operation with gethostbyname, gethostbyaddr, getservbyname and getservbyport functions using C.
- Practical - Implementation of protocol independent functions in C.

**Suggested Evaluation Methods:**
- Testing for the respective socket option's role in the scenario chosen.
- Quiz on roles of various protocols dependent and independent functions.

**UNIT III **ADVANCED SOCKETS **9**

**Suggested Activities:**
- Assignments on IPv4 and IPv6.
- Practical - Programs using Pthread.
- Practical - Implementation of program in C for handling raw socket.

**Suggested Evaluation Methods:**
- Quiz on IPv4 and IPv6 interoperability.
- Testing the program implemented using raw sockets.

**UNITIV **SIMPLE NETWORK MANAGEMENT **9**

**Suggested Activities:**
- Assignment on SNMP architecture and features of versions.
- Assignment to develop macros for new objects in MIB.

**Suggested Evaluation Methods:**
- Quiz on SNMP versions.
- Test for the correct definition of the access rights for the MIB objects.

**UNIT V **NETWORK MANAGEMENT TOOLS & SYSTEMS **9**

**Suggested Activities:**
- Practical - Examine the headers and contents of IP using tcpdump or Wireshark.
- Practical - Using suitable network monitoring tool, analyze the traffic conditions in TCP/IP network.
- Practical - Analyze the network performance (delay) using appropriate system utilities.

**Suggested Evaluation Methods:**
- Verification of header and contents.
- Performance evaluation for various scenarios.

**OUTCOMES:**
On completion of the course, the students will be able to:
1. Implement client/server communications using TCP and UDP Sockets.
2. Describe the usage of socket options for handling various Sockets in programming.
3. Understand handling of raw sockets.
4. Explain functionalities of SNMP and MIB structure.
5. Experiment with various tools available to manage a network.
6. Handle technical issues in a network.

TEXT BOOKS:

REFERENCES:

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

IT5033 TCP/IP DESIGN AND IMPLEMENTATION L T P C 3 0 0 3

OBJECTIVES:
- To learn about the design of TCP/IP Protocol structure.
- To learn about the implementation of TCP and IP functionalities in the form of data structures.
- To learn about handling TCP input and output with synchronization.
- To learn about the importance of timers and how it is managed in a TCP communication.
- To learn about the functionality of ICMP error processing routines.

UNIT I FUNDAMENTALS
Suggested Activities:
- Assignment on exploring various internetworking devices in terms of their hardware and software components.
- External learning - Configuring the devices over a network topology using tool such as packet tracer.
- Practical - Implementation of network programming concepts using Network APIs - Socket system calls.

Suggested Evaluation Methods:
- Verifying the understanding about the components by comparing with other internetworking devices in terms of their functionality and features.
- Testing the configured topology with various IP assignment.
- Evaluation of various programs implemented using system calls with possible test cases.

UNIT II    ARP AND IP
Structure of TCP/IP in OS – Data Structures for ARP – Cache Design And Management – IP Software Design And Organization – Sending a Datagram to IP.

Suggested Activities:
- Practical - Implementation of the data structure for ARP cache using any programming language.
  i. Implement cache table.
  ii. Implement ARP broadcast.
  iii. Implement timer maintenance.
- Practical - Implementation of IP software module to perform the following:
  i. Forwarding of datagrams (IP Forwarding algorithm)
  ii. Handling of incoming datagrams.

Suggested Evaluation Methods:
- Evaluation of the program output for correctness using multiple test cases.

UNIT III    IP ROUTING IMPLEMENTATION
Routing Table – Routing Algorithms – Fragmentation and Reassembly – Error Processing (ICMP) – Multicast Processing (IGMP).

Suggested Activities:
- Practical - Using packet tracer, design a network topology with n nodes and m routers, show the initial routing table contents of all the routers. Use any routing algorithm and show the updations in the routers.
- Tutorials on fragmentation and reassembly.
- Practical - Implementation of the operation of ICMP messages.

Suggested Evaluation Methods:
- Testing the topology with various numbers of nodes and routers and evaluating the performance.
- Verifying fragmentation and reassembly for different combinations of intermediate networks.
- Testing the functionality of respective ICMP messages.

UNIT IV    TCP I/O PROCESSING AND FSM
Suggested Activities:
- Practical - Implementation of the data structure for TCP FSM states using any programming language.
- Practical - Implementation of the data structure for TCP I/O processing using any programming language.

Suggested Evaluation Methods:
- Test with appropriate data to verify the operation of TCP states.
- Test with appropriate data to verify the operation of TCP I/O processing.

UNIT V TCP TIMER AND FLOW CONTROL


Suggested Activities:
- Practical - Implement the data structure for timer event using any programming language.
- Practical - Implement flow control by variable window size using any programming language.

Suggested Evaluation Methods:
- Test with data to verify the operation of timer event.
- Test with variable window size.
- Quiz on TCP Congestion handling.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Configure various network devices.
2. Explain the data structures of ARP, IP and TCP software design.
3. Analyze the routing of packets by routers using its table contents.
4. Interpret the states in the TCP module.
5. Justify the need for various Timers and transmission policies in TCP module.
6. Implement data structures of TCP/IP protocol.

TEXT BOOKS:

REFERENCES:

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
<td>✔</td>
<td></td>
</tr>
</tbody>
</table>
OBJECTIVES:
- To understand Blockchain’s fundamental components, and examine decentralization using blockchain.
- To explain how cryptocurrency works, from when a transaction is created to when it is considered part of the Blockchain.
- To explain the components of Ethereum and Programming Languages for Ethereum.
- To study the basics of Hyperledger and Web3.
- To know about alternative Blockchains and Blockchain projects in different domains.

UNIT I  INTRODUCTION TO BLOCKCHAIN
9

Suggested Activities:
- External learning - Programming to create your own Blockchain.
- Flipped classroom on studying Blockchain security issues.

Suggested Evaluation Methods:
- Practical assessment to be conducted to evaluate the program for creating Blockchain.

UNIT II  INTRODUCTION TO CRYPTOCURRENCY
9

Suggested Activities:
- External learning - Creating the Wallets.
- Flipped classroom on showing the tracking process of transactions in Cryptocurrency.

Suggested Evaluation Methods:
- Assignment to be given on cryptocurrency failures.

UNIT III  ETHEREUM
9
Suggested Activities:
- External learning - Exploring Ethereum tools like Ganache and GO.
- Practical - Setup the Ethereum development environment.
- Practical - Develop smart contract on private Blockchain.

Suggested Evaluation Methods:
- Evaluation of developed smart contract on private Blockchain

UNIT IV WEB3 AND HYPERLEDGER


Suggested Activities:
- Practical - Creating and deploying a business network on Hyperledger Composer Playground.
- Practical - Implementation of business network in Blockchain using hyperledger Fabric.

Suggested Evaluation Methods:
- Evaluation of developed business network on Hyperledger fabric.

UNIT V ALTERNATIVE BLOCKCHAINS AND NEXT EMERGING TRENDS


Suggested Activities:
- External learning - Blockchain using multichain.
- Assignments on Blockchain frameworks and business applications.

Suggested Evaluation Methods:
- Practical assessment of developing Blockchain based solution using Multichain for banking system.

OUTCOMES:
On completion of the course, the students will be able to:
1. Understand the technology components of Blockchain and how it works behind the scenes.
2. Identify different approaches to developing decentralized applications.
3. Understand Bitcoin and its limitations by comparing with other alternative coins.
4. Devise solution using the Ethereum model.
5. Understand and use Hyperledger and its development framework.
6. Track alternative Blockchains and emerging trends in Blockchain.

TOTAL: 45 PERIODS

TEXTBOOK:

REFERENCES:

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

IT5035 IOT BASED SMART SYSTEMS L T P C 3 0 0 3

OBJECTIVES:
- To understand smart objects and IoT Architectures.
- To learn about various IoT related protocols.
- To build simple IoT systems using open hardware such as Arduino and Raspberry Pi.
- To understand data analytics and cloud in the context of IoT.
- To build IoT based smart systems.

UNIT I FUNDAMENTALS OF IoT 9

Suggested Activities:
- Survey of different real world IoT applications.
- Assignments on operational principles of sensors and actuators.
- Mini project on building a smart system - Identify the sensors required for the system, connect sensors (such as temperature, pressure, light) to a suitable IoT hardware platform and take measurements.

Suggested Evaluation Methods:
- Evaluation of survey for breadth and depth - pair-wise comparison.
- Quiz on sensors and actuators.
- Demonstration of practical setup on connecting sensors.
UNIT II  IoT PROTOCOLS - I

Suggested Activities:
- Assignment on access technologies (simulator could be used).
- Flipped classroom on 6LoWPAN.
- Mini project on building a smart system - Choose appropriate access technology and connect the hardware to the Internet.

Suggested Evaluation Methods:
- Quiz on access technologies.
- Quiz on 6LoWPAN.
- Demonstration of practical setup on connecting to the Internet.

UNIT III  IoT PROTOCOLS - II
Routing over Low Power and Lossy Networks (RPL) – Application Transport Methods: Application Layer Not Present, Supervisory Control and Data Acquisition (SCADA) – Application Layer Protocols: CoAP and MQTT – Service discovery – mDNS.

Suggested Activities:
- Assignment on RPL (simulator could be used).
- Mini project on building a smart system - Choose appropriate application protocol and connect to the cloud using available open platforms (such as IBM Bluemix).

Suggested Evaluation Methods:
- Quiz on RPL for different topologies.
- Demonstration of practical setup on connecting to the cloud.

UNIT IV  CLOUD, FOG AND DATA ANALYTICS FRAMEWORKS

Suggested Activities:
- Use a simulator such as FogSim to study the characteristics of fog computing.
- Mini project on building a smart system - Choose appropriate analytics mechanisms to analyze the data collected, and build the application.

Suggested Evaluation Methods:
- Quiz on fog characteristics.
- Demonstration of application with analytics.

UNIT V  APPLICATIONS
Smart and Connected Cities: Street Layer, City Layer, Data Center Layer and Services Layer, Street Lighting, Smart Parking Architecture and Smart Traffic Control – Smart Transportation – Connected Cars.

Suggested Activities:
- Design the architecture and use cases for various smart systems (eg., agriculture, home automation, smart campus, smart hostel).
• Mini project on building a smart system - Enhance the system with additional smart features.

**Suggested Evaluation Methods:**
• Report and presentation of architecture solutions.
• Demonstration of complete smart system.

**OUTCOMES:**
On completion of the course, the student will be able to:
1. Explain the concept and architecture of IoT.
2. Choose the right sensors and actuators for an application.
3. Analyze various protocols for IoT.
4. Apply data analytics and use cloud/fog offerings related to IoT.
5. Analyze applications of IoT in real time scenario.
6. Design an IoT based smart system using open hardware platforms and open cloud offerings.

**TEXTBOOK:**

**REFERENCES:**

<table>
<thead>
<tr>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<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>
</tr>
</tbody>
</table>
OBJECTIVES:
- To understand the basic concepts of machine learning and probability theory.
- To appreciate supervised learning and their applications.
- To understand unsupervised learning like clustering and EM algorithms.
- To understand the theoretical and practical aspects of probabilistic graphical models.
- To learn other learning aspects such as reinforcement learning, representation learning, deep learning, neural networks and other technologies.

UNIT II
INTRODUCTION

Suggested Activities:
- Flipped classroom on Artificial Intelligence and Expert Systems.
- Practical - Installing Python and exploring the packages required for machine learning including numpy, scikit-learn, and matplotlib, IPython hmmpython and pgmpy.

Suggested Evaluation Methods:
- Assignments on different types of learnings.
- Tutorials on probability theory.

UNIT II
SUPERVISED LEARNING

Suggested Activities:
- Flipped classroom on basics about classification and regression.
- Practical - Collection of data from different resources and summarize the data.
- Practical - Build linear, multi-linear, logistic regression model to predict the data.

Suggested Evaluation Methods:
- Evaluation of the practical assignment against appropriate test sets.

UNIT III
UNSUPervised LEARNING

Suggested Activities:
- Flipped classroom on mixture models.
- External learning - Improving performance of the model using kernel methods.
Suggested Evaluation Methods:
- Assignments on mixture models.

UNIT IV   GRAPHICAL MODELS

Suggested Activities:
- Flipped classroom on Bayesian and Markov models.
- Practical - Implementation of Naive Bayes classifier for credit card analysis.
- Practical - Implement HMM for an application.
- External learning - Gaussian Processes and Topic Modeling.

Suggested Evaluation Methods:
- Quizzes on Markov model and HMM.
- Evaluation of the HMM application.

UNIT V   ADVANCED LEARNING

Suggested Activities:
- Flipped classroom on neural networks.
- Practical - Implement bagging approach for credit card analysis.
- External learning - Deep networks.

Suggested Evaluation Methods:
- Evaluation of the practical implementation.
- Assignments on deep networks.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Choose and implement classification or regression algorithms for an application using an open source tool.
2. Implement probabilistic discriminative and generative algorithms for an application and analyze the results.
3. Use a tool to implement typical clustering algorithms for different types of applications.
4. Design and implement an HMM for a sequence model type of application.
5. Implement appropriate learning algorithms for any real time application using an open source tool.
6. Identify applications suitable for different types of machine learning with suitable justification.

TEXT BOOK:

REFERENCES:

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

IT5037 COGNITIVE COMPUTING

OBJECTIVES:
- To know the theoretical background of cognition.
- To understand the link between cognition and computational intelligence.
- To explore probabilistic programming language.
- To study the computational inference models of cognition.
- To study the computational learning models of cognition.

UNIT I PHILOSOPHY, PSYCHOLOGY AND NEUROSCIENCE


Suggested Activities:
- Flipped classroom on logic and sciences in the mind.
- Case study on how philosophy (western and eastern), psychology and neuroscience (thought process in normal persons, children and differently-abled) helps in cognition.
- Mindmap of cognition with various attributes such as mind, logic, information processing etc.
- Discussion and debate on cognition.

Suggested Evaluation Methods:
- Quiz on logic and sciences in the mind.
- Active discussion on the case study and how the factors such as learning and memory affect cognition.
- Essay writing on how various factors influence cognition.
UNIT II  COMPUTATIONAL INTELLIGENCE


Suggested Activities:
- Flipped classroom on knowledge based systems.
- Mindmap on different methods of cognition in computational domain.
- Discussion on the influence of human cognition systems with a link to computational domain.

Suggested Evaluation Methods:
- Quiz on knowledge based systems.
- Collaborative wiki editing of computational tools linking with cognition.
- Essay writing on the computational cognitive systems with the background of human cognitive systems.

UNIT III  PROBABILISTIC PROGRAMMING LANGUAGE


Suggested Activities:
- Flipped classroom on Javascript libraries.
- Exploring the existing mathematical models.
- Practical - Programming the common mathematical functions using PPL.

Suggested Evaluation Methods:
- Quiz on the basics of Javascript and WebPPL.
- Practical - Programming assignment on developing miniature programs using WebPPL for inference mechanisms.
- Evaluation of the programming assignments.

UNIT IV  IMPLEMENTING THE INFERENCE MODELS OF COGNITION


Suggested Activities:
- Flipped classroom on dependence.
- Perform sample calculation of models manually.

Suggested Evaluation Methods:
- Quiz on statistical dependence
- Practical - Automate the mathematical functions through WebPPL.
- Practical - Programming assignments on analyzing data through cognitive models with webPPL.
- Evaluation of the programming assignments.

UNIT V  IMPLEMENTING THE LEARNING MODELS OF COGNITION

Suggested Activities:
- Flipped classroom on mixture models.
- Perform sample calculation of models manually.

Suggested Evaluation Methods:
- Quiz on mixture models.
- Practical - Automate the mathematical functions through WebPPL.
- Practical - Programming assignment on learning models for continuous functions.
- Evaluation of the programming assignments.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the student will be able to:
1. Understand the underlying theory behind cognition.
2. Connect to the cognition elements computationally.
3. Implement mathematical functions through WebPPL.
4. Develop a cognitive inference model.
5. Develop a cognitive learning model.
6. Explore the recent trends in cognitive computing.

TEXT BOOK:

REFERENCES:

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<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></td>
</tr>
</tbody>
</table>
OBJECTIVES:
- To gain knowledge about the fundamentals of language processing.
- To study about the language parsing and recognition.
- To gain knowledge on statistical language modeling.
- To understand the fundamentals of computational linguistic models.
- To engage in critical thinking regarding the applicability of computation linguistic models to various real world applications.

UNIT I FOUNDATIONS

Suggested Activities:
- Assignments on problem solving using regular expressions.
- Assignments on solving exercises using context free grammars.
- In-class discussion on collected papers related with natural language applications of finite state technology.

Suggested Evaluation Methods:
- Assignment problems on regular expressions and context free grammars.
- Quizzes on different topics of the unit.

UNIT II COMPUTATIONAL COMPLEXITY IN NATURAL LANGUAGE

Suggested Activities:
- Mapping real world decision problems to Turing problem specifications.
- Collect natural language reviews from social network applications and identify logical relationships between reviews.
- Practical - Group activities on implementing and comparing various parsing algorithms on structured and unstructured data.

Suggested Evaluation Methods:
- Evaluation of the implemented algorithms.
- Presentations on real world applications involving semantic parsing.
- Quizzes on different topics of the unit.

UNIT III STATISTICAL LANGUAGE MODELING

Suggested Activities:
- Solving simple problems using metrics for evaluating language models.
- Demonstrating real world applications involving language constraints using context free grammars.
Suggested Evaluation Methods:
- Case study on writing simple parsers in groups for regional languages.
- Case study on using real time parsers for various web applications.
- Assignments on CFGs.

UNIT IV COMPUTATIONAL LINGUISTIC MODELS


Suggested Activities:
- Solving numerical problems using simple data sets for understanding the working of various language models.
- Demonstrating working of linguistic models using free open source tools.
- Exercises involving mapping scenarios and model selection.

Suggested Evaluation Methods:
- Quizzes on learning and grammar induction
- Mini projects using linguistic models using various free tools.

UNIT V DOMAINS OF APPLICATION


Suggested Activities:
- Case Studies on applications involving language models.
- Demonstration of simple application specific modules using tools.

Suggested Evaluation Methods:
- Quizzes on different topics of the unit.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Understand basic principles behind formal language theory and grammar.
2. Apply statistical language processing for domain specific applications.
3. Recognize and represent knowledge semantics using parsing.
4. Use linguistic models for analyzing text data.
5. Develop simple applications using language models.

TEXT BOOK:

REFERENCES:
OBJECTIVES:
- To understand the basic ideas and principles of neural networks.
- To understand the basic concepts of deep learning.
- To familiarize with image processing facilities like TensorFlow and Keras.
- To appreciate the use of deep learning applications.
- To understand and implement deep learning architectures.

UNIT I BASICS OF NEURAL NETWORKS 9
Basic Concept of Neurons – Perceptron Algorithm – Feed Forward and Backpropagation Networks.

Suggested Activities:
- Discussion of role of neural networks.
- External learning - Boltzmann Machine, perceptron.
- Practical - Implementation of simple neural network in Matlab

SUGGESTED EVALUATION METHODS
- Tutorials on perceptron.
- Assignments on backpropagation networks.
- Quizzes on neural networks.

UNIT II INTRODUCTION TO DEEP LEARNING 9

Suggested Activities:
- Discussion of role of Gradient Descent in deep learning.
- External learning - Feature extraction and feature learning.
- Practical - Implementation of TensorFlow and Keras applications.
Suggested Evaluation Methods:
- Tutorials on gradient descent and regularization
- Assignments on optimization.
- Quizzes on deep learning regularization and optimization.

UNIT III  CONVOLUTIONAL NEURAL NETWORKS

Suggested Activities:
- Discussion of role of convolutional networks in Machine Learning.
- External learning - Concept of convolution and need for Pooling.

Suggested Evaluation Methods:
- Tutorials on image classification and recurrent nets.
- Assignments on image classification performances.
- Quizzes on convolutional neural networks.

UNIT IV  ADDITIONAL DEEP LEARNING ARCHITECTURES

Suggested Activities:
- Discussion of role of Deep Learning architectures.
- External learning - Compression of features using Auto-encoders.
- Practical - Implementation of simple deep learning architectures.

Suggested Evaluation Methods:
- Tutorials on LSTM and Autoencoders.
- Assignments on deep generative models, Deep Belief Networks.
- Quizzes on deep learning architectures.

UNIT V  APPLICATIONS OF DEEP LEARNING

Suggested Activities:
- Discussion of role of deep learning in image and NLP applications.
- External learning - NLP concepts.
- Practical - Implementation of simple deep learning for object detection and recognition in images.

Suggested Evaluation Methods:
- Tutorials on images segmentation.
- Assignments on parsing and sentiment analysis.
- Quizzes on deep learning applications
OUTCOMES:
On completion of the course, the students will be able to:
- Understand the role of deep learning in machine learning applications.
- Get familiar with the use of TensorFlow and Keras in deep learning applications.
- Design and implement deep learning applications.
- Critically analyze different deep learning models in image related projects.
- Know about applications of deep learning in NLP and image processing.

TEXT BOOKS:

REFERENCES:

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

MA5002 PROBABILITY AND RANDOM PROCESSES LT PC
3 1 0 4

OBJECTIVES:
- To understand the basics of random variables with emphasis on the standard discrete and continuous distributions.
- To understand the basic probability concepts with respect to two dimensional random variables along with the relationship between the random variables and the significance of the Central Limit theorem.
- To learn the classifications of random processes with emphasis on stationarity of various orders along with strict sense stationarity, wide-sense stationarity and ergodicity.
- To understand the concepts of correlation functions and power spectral density and their properties.
To be able to apply the knowledge gained so far with respect to linear systems with random inputs.

UNIT I RANDOM VARIABLES
Discrete and Continuous Random Variables – Moments – Moment Generating Functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal Distributions – Functions of a Random Variable.

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

UNIT III RANDOM PROCESSES

UNIT IV CORRELATION AND SPECTRAL DENSITIES

UNIT V LINEAR SYSTEMS WITH RANDOM INPUTS

TOTAL: 60 PERIODS

OUTCOMES
On completion of the course, the students will be able to:
1. Analyze the performance in terms of probabilities and distributions achieved by the determined solutions.
2. Familiar with some of the commonly encountered two dimensional random variables and be equipped for a possible extension to multivariate analysis.
3. Appreciate wide sense stationarity with respect to Poisson and Random Telegraph processes.
4. Gain proficiency in determining the correlation functions and spectral density characteristics of random processes.
5. Demonstrate the specific applications to linear systems with random inputs and white noise models.

TEXT BOOKS:

REFERENCES:

MA5356  LINEAR ALGEBRA AND NUMERICAL METHODS  L T P C
                                                                 3 1 0 4

OBJECTIVES:
1. To understand Vector spaces and subspaces; linear independence and span of a set of vectors, basis and dimension; the standard bases for common vector spaces;
2. To understand the linear maps between vector spaces, their matrix representations, null-space and Range spaces, the Rank- Nullity Theorem;
3. To understand Inner product spaces: Cauchy-Schwarz inequality, orthonormal bases, the Gramm-Schmidt procedure, orthogonal complement of a subspace, orthogonal projection;
4. To analyze Eigenvalues and eigenvectors, diagonalizability of a real symmetric matrix, canonical forms;
5. To understand Mathematical foundations of numerical techniques for solving linear systems, eigenvalue problems and generalized inverses.

UNIT I  VECTOR SPACES  12
Vector Spaces – Subspaces – Linear Combinations - Linear Span – Linear Dependence - Linear Independence – Bases and Dimensions.

UNIT II  LINEAR TRANSFORMATIONS  12

UNIT III  INNER PRODUCT SPACES  12

UNIT IV  NUMERICAL SOLUTION OF LINEAR SYSTEM OF EQUATIONS  12

UNIT V  NUMERICAL SOLUTION OF EIGENVALUE PROBLEMS AND GENERALISED INVERSES  12

TOTAL: 60 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Solve system of linear equations, to use matrix operations and vector spaces using algebraic methods.
2. Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions.
3. Apply numerical methods to obtain approximate solutions to mathematical problems.
4. Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations.
5. Analyse and evaluate the accuracy of common numerical methods.

**TEXT BOOKS:**

**REFERENCES:**

**IT5040 VIDEO PROCESSING AND ANALYTICS**

**OBJECTIVES:**
- To have a better knowledge about video representation and its formats.
- To know the fundamental concepts of data science and analytics.
- To familiarize with video processing tools for analytics.
- To understand data analytics for processing video content.
- To expose to emerging trends in video analytics.

**UNIT I VIDEO FUNDAMENTALS**
9

**Suggested Activities:**
- In-class activity - Numerical problems on sampling and standard conversions.
- Flipped classroom on description about video features.

**Suggested Evaluation Methods:**
- Assignments on sampling and standard conversions.
- Quiz on video features.
UNIT II MOTION ESTIMATION
Fundamentals of Motion Estimation – Optical Flow – 2D and 3D Motion Estimation – Block Based Point Correspondences – Gradient Based Intensity Matching – Feature Matching – Frequency Domain Motion Estimation.

Suggested Activities:
- In-class activity - Numerical problems on motion estimation.
- External learning - Survey on optical flow techniques.

Suggested Evaluation Methods:
- Quiz on optical flow techniques.
- Assignments on numerical problems in motion estimation.

UNIT III VIDEO SEGMENTATION AND ANALYTICS
Video Segmentation – Video Shot Boundary Detection – Model Based Annotation – Video Mining – Multimodal Approach to Image and Video Data Mining – Probabilistic Semantic Mode.

Suggested Activities:
- In-class activity - video segmentation techniques.
- Flipped classroom on description about video data mining methods.

Suggested Evaluation Methods:
- Assignments on video segmentation techniques.
- Quiz on video data mining methods.

UNIT IV MINING DATA STREAMS

Suggested Activities:
- Flipped classroom on discussion on streaming data.
- External learning - Survey on video based content retrieval.

Suggested Evaluation Methods:
- Quiz on data streams.
- Assignments on video based content retrieval.

UNIT V EMERGING TRENDS

Suggested Activities:
- External learning - Survey on Affective Video Content Analysis.
- Flipped classroom on discussion on forensic video analysis.
- Practical - Automatic video trailer generation.

Suggested Evaluation Methods:
- Assignments on affective video content analysis.
- Quiz on forensic video analysis.
- Evaluation based on demonstration.

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

TOTAL: 45 PERIODS
1. Compute basic video processing functions.
2. Segment video based on its features.
3. Compute optical flow and motion estimation.
4. Visualize data using graphical presentation for analysis.
5. Index and retrieve videos for faster access.
6. Design applications for video analytics in current trend.

TEXT BOOKS:

REFERENCES:

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

IT5041 FULL STACK SOFTWARE DEVELOPMENT L T P C 3 0 0 3

OBJECTIVES:
- To get an overview of the full stack software and web development.
- To understand the object oriented structure and user interface programming through Python.
- To gain knowledge of web development using Flask Framework.
- To learn the web application deployment in real time scenarios.
- To learn to deploy the software in Linux and Windows platforms.

UNIT I OBJECT ORIENTED APPROACH IN PYTHON 9

Suggested Activities:
- Flipped classroom on object oriented methods.
Practical - Programming exercises involving the object oriented concepts.

Suggested Evaluation Methods:
- Quiz on object oriented methods
- Programming assignments.

UNIT II USER INTERFACE APPLICATIONS IN PYTHON AND VERSION CONTROL SYSTEM

Suggested Activities:
- Flipped classroom on user interface programming models.
- Practical - Design of game with functional modules.

Suggested Evaluation Methods:
- Practical - Programming assignment on developing simple applications using wx Python.
- Quiz on windows elements and collaborative version control systems.
- Setting up a version control repository and the number of commits.

UNIT III FLASK FRAMEWORK FOR WEB DEVELOPMENT

Suggested Activities:
- Flipped classroom on HTML, shell commands and basic web development strategies
- Design of the Web layout
- Practical - Programming snippets and connection to the Mongodb database.

Suggested Evaluation Methods:
- Quiz on HTML basics, shell commands and running server with LAMP
- Programming assignment on Development of a web application with a connected database

UNIT IV REAL TIME DEPLOYMENT OF WEB APPLICATION
- Deploy Web Applications with Flask and MongoDB – Example Applications – Blogs – Forums – Auto Evaluation of Student Assignments – Deployment Using AWS or Google Cloud or Heroku.

Suggested Activities:
- Flipped classroom on the development cycle of web.
- Programming and actual deployment of web applications.
- Use of git.

Suggested Evaluation Methods:
- Quiz on the cycle of web development.
- Porting the developed web applications in AWS/Google cloud/Heroku.
- Number of commits in git repository.

UNIT V DEPLOYMENT OF SOFTWARE IN LINUX AND WINDOWS PLATFORM

Suggested Activities:
- Flipped classroom on the method of packaging the software in Windows and Linux environments.
- Sample application deployment in Linux and Windows platform.

Suggested Evaluation Methods:
- Programming assignment on packaging the software developed from Unit I and Unit II.
- Deployment in Linux and Windows platform.
- Test cases.

OUTCOMES:
On completion of the course, the student will be able to:
1. Understand the object-oriented approach in Python.
2. Develop GUI applications with Python.
3. Use the collaborative version control system, git.
4. Package the developed code in Linux and Windows environment.
5. Deploy the developed web application using Flask in real time scenarios such as AWS.
6. Developer of the industrial software.

TEXT BOOKS:

REFERENCES:
6. https://pypi.org/project/py2exe/0.9.2.0/

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
OBJECTIVES:
- To learn about the physical layer and MAC layer of WSNs.
- To understand the data centric computing followed in WSNs.
- To study about the routing protocols followed in WSNs.
- To explore multichannel handling and MIMO in WMNs.
- To understand enhanced routing metrics and routing protocols followed in WMNs.

UNIT I WIRELESS SENSOR NETWORKS AND MESH NETWORKS

Suggested Activities:
- External learning - Exploring various sensors, their corresponding actuators and finding out their price, various motes and their configuration (sensors supported, microcontroller and the clock speed, Flash, RAM, Battery capacity, RF transceivers and data rate supported).
- Flipped classroom on accuracy, resolution and hysteresis.
- Exploring various mesh routers and their configuration (Built-in radio interfaces in terms of IEEE 802.11 and its variants, connectivity (both wired and wireless), data rate supported, number of mesh clients supported, MU-MIMO capabilities).

Suggested Evaluation Methods:
- Assignments on types of sensors and their actuators available in the market, various motes and their configuration.
- Quiz and discussion on accuracy, hysteresis and resolution.
- Assignments on various mesh routers, commercial sink node gateways and sink node placement strategies.

UNIT II MAC LAYER OF WSN AND ZIGBEE STANDARD

Suggested Activities:
- External learning - Exploring Arduino IDE and mesh Wi-Fi systems.
- Flipped classroom on roles of nodes and types of Zigbee devices.
- Analyzing duty cycle and sleep cycle of S-MAC protocol.

Suggested Evaluation Methods:
- Assignments on Arduino IDE and Mesh Wi-Fi systems.
- Quiz and discussion on roles of nodes in WSN and types of ZigBee devices.
- Problem solving related to duty cycle.
UNIT III  DATA CENTRIC COMPUTING IN WSN

Suggested Activities:
- Exploring and analyzing Contiki OS and COOJA IDE.
- Flipped classroom on TinyOS.
- External learning - Exploring sensor network platforms and tools and sensor network databases.

Suggested Evaluation Methods:
- Creating a sensor network topology in Contiki OS using COOJA IDE.
- Quiz and discussion on TinyOS.
- Assignments on sensor network platforms and tools and sensor network databases.

UNIT IV  RADIO AND MAC LAYERS FOR WMN

Suggested Activities:
- External learning - Exploring the role of MIMO technology in WMNs and Wi-Max networks.
- Flipped classroom on non-overlapping channels in IEEE 802.11 and its variants.
- Analyzing channel allocation and utilization.

Suggested Evaluation Methods:
- Assignments on role of MIMO technology in WMNs and Wi-Max networks.
- Quiz and discussion on non-overlapping channels in IEEE 802.11 and its variants.
- Problem solving in radio frequency management, radio spectrum management, channel allocation and utilization.

UNIT V  ROUTING AND TRANSPORT LAYER IN WMN

Suggested Activities:
- Analyze a WMN deployment in terms of the following parameters.
  o Number of hops.
  o Number of users per hop.
  o Traffic load per hop.
  o Direction of traffic flow.
  o Number of radios in mesh nodes.
  o Range and multipath conditions.
  o Fail over conditions.
Suggested Evaluation Methods:
- Designing a WMN for the given scenario (a street, an area of a city).

OUTCOMES:
On completion of the course, the students will be able to:
1. Identify the appropriate sensors and corresponding actuators frequently used in WSNs.
2. Understand the working of mesh routers and configuring them.
3. Identify and address the challenges regarding ZigBee MAC layer.
4. Adopt data centric computing required for WSNs.
5. Design and deploy WMNs in urban scenarios.
6. Design and deploy WSNs in unattended environment.

TEXT BOOKS:

REFERENCES:

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

IT5043 ETHICAL HACKING L T P C 3 0 0 3

OBJECTIVES:
- To explore the concepts of security testing and the knowledge required to protect against the hacker and attackers.
- To understand reconnaissance and the publicly available tools used to gather information on potential targets.
- To discover the scanning techniques used to identify network systems open ports.
- To identify network system vulnerabilities and confirm their exploitability.
- To explore techniques for identifying web application vulnerabilities and attacks.

UNIT I  INTRODUCTION TO HACKING

Suggested Activities:
- In-class activity to understand the penetration testing methodologies.
- Practical - Use security tools in Kali Linux to assess the vulnerabilities.
- Prepare Vulnerability Assessment summary reports.

Suggested Evaluation Methods:
- Assignment on categories of penetration testing and vulnerability summary reports.
- Quiz on penetration testing methodologies, OSSTMM and OWASP.

UNIT II  INFORMATION GATHERING AND SCANNING

Suggested Activities:
- Explain different ways to gather the information of a system in the network.
- Demonstrate the network command tools to identify the system.
- Understand the network protocols and port scanning techniques using Kali Linux.

Suggested Evaluation Methods:
- Assignment problems on information gathering and traceroute of ICMP, DNS and SNMP.
- Quizzes on enumeration, port scanning techniques and firewall/IDS evading techniques.

UNIT III  NETWORK ATTACKS

Suggested Activities:
- Familiarizing with different types of attacks such as sniffing, spoofing etc.
- Demonstrating the MITM attack using ARP Poisoning using Kali Linux.
- Teaching with case studies: SSL Stripping, SQL Injection, Brute Force attacks.

Suggested Evaluation Methods:
- Assignment on denial of service (DoS) attack and hijacking session with MITM attack.
UNIT IV EXPLOITATION

Quizzes on SSL stripping, ARP spoofing and weak authentication.

UNIT IV EXPLOITATION


Suggested Activities:
- Case studies: Understand the Metasploit and Exploitations.
- Demonstrating email with malicious attachment and cracking the hashes.
- Practical - Implementing hashing algorithms and cracking the hashes.

Suggested Evaluation Methods:
- Assignments on social engineering toolkit and browser exploitation.
- Quizzes on reconnaissance with Metasploit and client–side exploitation methods.

UNIT V WIRELESS AND WEB HACKING


Suggested Activities:
- Cracking the WEP and WPA/WPA2 passphrase using Cracking tool in Kali Linux.
- Design a web application with different authentication mechanism.
- Understand the protection mechanism to prevent against various server attacks.

Suggested Evaluation Methods:
- Assignment on evil twin attack and denial of service attack on access point in WLAN.
- Quizzes on types of authentication and vulnerabilities in a web application.

OUTCOMES:
On completion of the course, the students will be able to:
1. Use the various security tools to assess the computing system.
2. Predict the vulnerabilities across any computing system using penetration testing.
3. Identify prediction mechanism to prevent any kind of attacks.
4. Protect the system from malicious software and worms.
5. Evaluate the wireless network flaws and able to apply security patches.
6. Analyze the risk and support the organization for effective security measures.

TEXT BOOK:
REFERENCES:

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

IT5044 NEXT GENERATION NETWORKS

OBJECTIVES:
- To learn the fundamentals of 5G internet.
- To understand the concept of small cells in 5G mobile networks.
- To learn the mobile clouds in 5G network context.
- To understand the role of cognitive radios in 5G networks.
- To learn the security issues in 5G networks.

UNIT I PERSUASIVE CONNECTED WORLD AND 5G INTERNET

- Historical Trend of Wireless Communications – Evolution of LTE Technology to Beyond 4G

Suggested Activities:
- Flipped classroom on Ten Pillars of 5G.
- Assignment on millimeter wave mobile communication.
- External learning - 5G in global level.

Suggested Evaluation Methods:
- Viva Voce on assignment topic.
- Group discussion on different generations of telecommunication networks.
- Quizzes on spectrum allocation strategies for 5G.

UNIT II SMALL CELLS FOR 5G MOBILE NETWORKS


Suggested Activities:
- Flipped classroom on the types of small cells.
- Assignment on issues in femtocells.
- External learning – Small cell challenges.
Suggested Evaluation Methods:
- Viva voce on assignment topic.
- Quiz on the drawbacks of dense deployment of Wi-Fi systems.

UNIT III COOPERATION FOR NEXT GENERATION WIRELESS NETWORKS


Suggested Activities:
- Flipped classroom on network coding.
- External learning – Cooperative MAC protocols.
- Assignment on packet exchange in PRCSMA.

Suggested Evaluation Methods:
- Viva voce on assignment topic.
- Quiz on NCCARQ operation under realistic channel conditions.
- Practical - Assessing the performance of NC-aided MAC protocols in event-driven C++ simulator.

UNIT IV MOBILE CLOUDS AND COGNITIVE RADIO


Suggested Activities:
- External learning - Network coding.
- Assignment on spectrum optimization using cognitive radio.
- External learning – Key requirements and challenges for 5G cognitive terminals.
- Assignment on component of a cognitive radio terminal.

Suggested Evaluation Methods:
- Viva voce on assignment topics.
- Quiz on carrier aggregation.

UNIT V SECURITY AND SELF ORGANISING NETWORKS


Suggested Activities:
- External learning - 5G communications system architecture.
- Flipped classroom on security issues and challenges in communication systems.
- Assignment on centralised 5G mobile botnet.

Suggested Evaluation Methods:
- Viva voce on assignment topics.
- Quiz on D-SON and C-SON architectures.
- Group discussion on Attacks on 4G Access Network.
OUTCOMES:
On completion of the course, the students will be able to:
- Compare the 5G network with older generations of networks.
- Identify suitable small cells for different applications in 5G networks.
- Simulate 5G network scenarios.
- Connect applications to mobile cloud.
- Design applications with 5G network support.
- Analyze the security risks in 5G networks.

TEXT BOOK:

REFERENCES:

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

IT5045 COMPUTER FORENSICS

OBJECTIVES:
- To provide an understanding of computer forensics fundamentals.
- To analyze various computer forensics technologies.
- To identify methods for data recovery.
- To apply the methods for preservation of digital evidence.
- To learn about the types of attacks and remedial actions in the context of systems, networks, images and videos.

UNIT I INCIDENT AND INCIDENT RESPONSE
Suggested Activities:
- Survey of forensics tools such as WinHex, EnCase, FTK, or ProDiscover.
- External learning - Demonstrate some of the mechanisms used by malicious attackers as well as forensic experts to disrupt computer networks and manipulate information access.

Suggested Evaluation Methods:
- Demonstration on forensic tools
- Assignments on problem solving with sample cyber crime reports.

UNIT II FILE STORAGE AND DATA RECOVERY

Suggested Activities:
- Practical - Experiments with USB disk and hard disk using FTK or other tool.
- External learning - Tools for data storage and access, bypassing filtered [blocked] ports, reviewing Internet activity, open source forensic tools for file storage and data recovery will be introduced.

Suggested Evaluation Methods:
- Evaluate the experiment by checking the total quantity of files recovered from the disk for reconstruction.
- Quiz on forensic analysis of file system.

UNIT III NETWORK AND EMAIL FORENSICS

Suggested Activities:
- External learning - Familiarizing with port redirection tools: Quick 'n Easy FTP Server, FPIPE and FPORT.
- Practical - Study of the forensics tools.

Suggested Evaluation Methods:
- Demonstration on port redirection tools.
- Real-time problems like email analysis for tracing.

UNIT IV SYSTEM FORENSICS

Suggested Activities:
- Demonstration on MD5Hash tool.
- Practical - IE activity analysis.
Suggested Evaluation Methods:
- Assignment problems - Live windows and Linux investigation.
- Quiz on ethical hacking.

UNIT V IMAGE AND VIDEO FORENSICS 9

Suggested Activities:
- External learning - Survey on image file formats steganography tools.
- Practical - JPHS tool for steganography

Suggested Evaluation Methods:
- Assignment problems on forgery detection in images.
- Quiz on locating and recovering graphics files.

OUTCOMES:
On completion of the course, the students will be able to:
1. Recognize attacks on systems.
2. Design a counter attack incident response and incident response methodology.
3. Illustrate the methods for data recovery, evidence collection and data seizure.
4. Understand network and email attacks and forensic investigation with tools.
5. Use forensic tools and collect evidences of a computer crime.
6. Analyze various image encryption/decryption, steganography and fraud in image.

TOTAL: 45 PERIODS

TEXT BOOK:

REFERENCES:

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

- To teach history and philosophy of Indian Constitution.
- To describe the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To summarize powers and functions of Indian government.
- To explain emergency rule.
- To explain structure and functions of local administration.

UNIT I INTRODUCTION

History of Making of The Indian Constitution – Drafting Committee – (Composition & Working) – Philosophy of The Indian Constitution – Preamble – Salient Features

UNIT II CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES


UNIT III ORGANS OF GOVERNANCE


UNIT IV EMERGENCY PROVISIONS


UNIT V LOCAL ADMINISTRATION


OUTCOMES:

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

1. Understand history and philosophy of Indian Constitution.
2. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
3. Understand powers and functions of Indian government.
4. Understand emergency rule.
5. Understand structure and functions of local administration.

TEXTBOOKS:

OBJECTIVES:
- To develop knowledge of self-development.
- To explain the importance of Human values.
- To develop the overall personality through value education.
- To overcome the self-destructive habits with value education.
- To interpret social empowerment with value education.

UNIT I
INTRODUCTION TO VALUE EDUCATION

UNIT II
IMPORTANCE OF VALUES

UNIT III
INFLUENCE OF VALUE EDUCATION

UNIT IV
REINCARNATION THROUGH VALUE EDUCATION

UNIT V
VALUE EDUCATION IN SOCIAL EMPOWERMENT
Equality, Non Violence, Humility, Role of Women, All Religions and Same Message, Mind Your Mind, Self-Control, Honesty, Studying Effectively.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
2. Learn the importance of Human values.
3. Develop the overall personality through value education.
4. Overcome the self-destructive habits with value education.
5. Interpret social empowerment with value education.
REFERENCES:

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

AD5093 PEDAGOGY STUDIES  
L T P C  
3 0 0 0

OBJECTIVES:
- To understand the methodology of pedagogy.
- To compare pedagogical practices used by teachers in formal and informal classrooms in developing countries.
- To infer how can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy.
- To illustrate the factors necessary for professional development.
- To identify the Research gaps in pedagogy.

UNIT I  
INTRODUCTION AND METHODOLOGY
9

UNIT II  
THEMATIC OVERVIEW
9
Pedagogical Practices are Being Used by Teachers in Formal and Informal Classrooms in Developing Countries – Curriculum, Teacher Education.

UNIT III  
EVIDENCE ON THE EFFECTIVENESS OF PEDAGOGICAL PRACTICES
9

UNIT IV  
PROFESSIONAL DEVELOPMENT
9
Professional Development: Alignment With Classroom Practices and Follow up Support – Peer Support – Support From the Head Teacher and the Community – Curriculum and Assessment – Barriers to Learning: Limited Resources and Large Class Sizes.
OUTCOMES:
On completion of the course, the students will be able to:
1. Understand the methodology of pedagogy.
2. Understand Pedagogical practices used by teachers in formal and informal classrooms in developing countries.
3. Find how can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy.
4. Know the factors necessary for professional development.
5. Identify the Research gaps in pedagogy.

REFERENCES:
UNIT I  INTRODUCTION TO YOGA  9

UNIT II  YAM  9
Do’s and Don’t’s in Life.
Shaucha, Santosh, Tapa, Swadhyay, Ishwarpranidhan.

UNIT III  NIYAM  9
Ahinsa, Satya, Astheya, Bramhacharya And Aparigraha.

UNIT IV  ASAN  9
Various Yog Poses and Their Benefits for Mind and Body.

UNIT V  PRANAYAM  9
Regularization of Breathing Techniques and Its Effects-Types of Pranayam.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Develop healthy mind in a healthy body thus improving social health also improve efficiency.
2. Learn Do’s and Don’t’s in life through Yam.
3. Learn Do’s and Don’t’s in life through Niyam.
4. Develop a healthy mind and body through Yog Asans.
5. Learn breathing techniques through Pranayam.

REFERENCES:
1. Swami Vivekananda, Advaita Ashrama, “Rajayoga or conquering the Internal Nature”, Publication Department, Kolkata.

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

AD5095 PERSONALITY DEVELOPMENT THROUGH LIFE L T P C
ENLIGHTENMENT SKILLS 3 0 0 0

OBJECTIVES:
- To develop basic personality skills holistically.
- To develop deep personality skills holistically to achieve happy goals.
• To rewrite the responsibilities.
• To reframe a person with stable mind, pleasing personality and determination.
• To discover wisdom in students.

UNIT I  NEETISATAKAM-HOLISTIC DEVELOPMENT OF PERSONALITY - I  9
Verses- 19,20,21,22 (Wisdom) - Verses- 29,31,32 (Pride & Heroism) – Verses- 26,28,63,65 (Virtue)

UNIT II  NEETISATAKAM-HOLISTIC DEVELOPMENT OF PERSONALITY - II  9
Verses- 52,53,59 (dons) - Verses- 71,73,75,78 (does)

UNIT III  APPROACH TO DAY TO DAY WORK AND DUTIES  9
Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48 - Chapter 3-Verses 13, 21, 27, 35
Chapter 6-Verses 5,13,17,23, 35 - Chapter 18-Verses 45, 46, 48

UNIT IV  STATEMENTS OF BASIC KNOWLEDGE – I  9
Statements of Basic Knowledge - Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68
Chapter 12-Verses 13, 14, 15, 16,17, 18

UNIT V  PERSONALITY OF ROLE MODEL - SHRIMAD BHAGWADGEETA  9
Chapter2-Verses 17, Chapter 3-Verses 36,37,42 - Chapter 4-Verses 18, 38,39 Chapter18 – Verses 37,38,63

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Develop basic personality skills holistically.
2. Develop deep personality skills holistically to achieve happy goals.
3. Rewrite the responsibilities.
4. Reframe a person with stable mind, pleasing personality and determination.
5. Awaken wisdom in students.

REFERENCES:
2. Sringar-vairagya, New Delhi, 2010,

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

CO1

CO2

CO3

CO4

CO5
COURSE OBJECTIVES
The course will introduce the students to
- get a knowledge about Indian Culture
- Know Indian Languages and Literature religion and philosophy and the fine arts in India
- Explore the Science and Scientists of Ancient, Medieval and Modern India
- Understand education systems in India

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

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

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

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

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

TOTAL: 45PERIODS

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

REFERENCES:
5. Satya Prakash, "Founders of Sciences in Ancient India", Vijay Kumar Publisher, 1989

AD5098  SANGA TAMIL LITERATURE APPRECIATION     L T P C
                    3 0 0 0

Course Objectives: The main learning objective of this course is to make the students an appreciation for:

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

UNIT I  SANGA TAMIL LITERATURE AN INTRODUCTION  9


UNIT II  ‘AGATHINAI’ AND ‘PURATHINAI’  9


UNIT III  ‘ATTRUPPADAI’.  9

Attruppadai Literature–Attruppadai in’Puranaanuru’-Attruppadai in ‘Pathitru paththu’-Attruppadai in ‘Paththu aattu’.

UNIT IV  ‘PURANAANURU’  9

Puranaanuru on Good Administration, Ruler and Subjects–Emotion & its Effect in Puranaanuru.

UNIT V  ‘PATHITRU PATHTHU’  9

Pathitrupaththu in’Ettuthogai’–Pathitru paththu’s Parables–Tamil dynasty: Valor, Administration, Charity in Pathitru paththu- Message to Society from Pathitru paththu.

TOTAL (L:45) = 45 PERIODS
COURSE OUTCOMES: Upon completion of this course, the students will be able to:

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

REFERENCES:


<table>
<thead>
<tr>
<th>CO</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

HSMC– ELECTIVES – HUMANITIES I (ODD SEMESTER)

HU5171 LANGUAGE AND COMMUNICATION L T P C 3 0 0 3

COURSE DESCRIPTION
This course offers an introduction to language and communication. The primary goal of this course is to familiarize students with key ideas related to communication using language as well as non-verbal means. Ideas related to the use of language and the underlying power structures are also examined. The course also examines the role of media in communication and in the dissemination of ideas as well as opinions.

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

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

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

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

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

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

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

TOTAL : 45 PERIODS

TEXT BOOKS:

HU5172
VALUES AND ETHICS
L T P C
3 0 0 3

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

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

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

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

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

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

TOTAL: 45 PERIODS

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

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

TEXTBOOKS:
HU5173

HUMAN RELATIONS AT WORK

L T P C
3 0 0 3

OBJECTIVES:

- Illustrate human relations at work its relationship with self.
- Explain the importance of interacting with people at work to develop teamwork.
- Infer the importance of physical health in maintaining human relations at work.
- Describe the importance of staying psychologically healthy.
- Identify the essential qualities for progressing in career.

UNIT I UNDERSTANDING AND MANAGING YOURSELF

Human Relations and You: Self-Esteem and Self-Confidence; Self-Motivation and Goal Setting; Emotional Intelligence, Attitudes, and Happiness; Values and Ethics and Problem Solving and Creativity.

UNIT II DEALING EFFECTIVELY WITH PEOPLE

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

UNIT III STAYING PHYSICALLY HEALTHY

Yoga, Pranayam and Exercise: Aerobic and anaerobic.

UNIT IV STAYING PSYCHOLOGICALLY HEALTHY

Managing Stress and Personal Problems, Meditation.

UNIT V DEVELOPING CAREER THRUST


TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to

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

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

TEXT BOOK:

REFERENCES:

HU5174 PSYCHOLOGICAL PROCESSES L T P C 3 0 0 3

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

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

UNIT 1: INTRODUCTION

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

UNIT 3: COGNITION & AFFECT

UNIT 4: THINKING, PROBLEM-SOLVING & DECISION MAKING

UNIT 5: PERSONALITY & INTELLIGENCE
Psychological phenomena & Attributes of humans - cognition, motivation, and behavior - thoughts, feelings, perceptions, and actions – personality dimensions, traits, patterns -
Specialized knowledge, performance accomplishments, automaticity or ease of functioning, skilled performance under challenge - generative flexibility, and speed of learning or behavior change.

REFERENCES

HU5175 EDUCATION, TECHNOLOGY AND SOCIETY

COURSE DESCRIPTION
This course introduces students to multidisciplinary studies in Education, Technology and Society. Students will get an understanding of the relationship between education, technology and society. They will also learn about the long lasting impact of good education in a technologically advanced society.

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

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

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

UNIT II LEARNING THEORIES
Learning Theories – Behaviorism – Cognitivism – Social Constructivism – Humanism
Learning Styles – Multiple Intelligences – Emotional Intelligence – Blooms Taxonomy

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

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

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

TOTAL:45 PERIODS

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

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

INTERNAL (100 % WEIGHTAGE)
(a) Written Test (40 marks)
(b) Assignment: Write a real time report of the technology use in any school / college (15
marks)
(c) Presentation: Students choose any one of the technological tools and present its
relevance to education and society (15 marks)
(d) Group discussion: Students discuss in groups on case studies relating to various
challenges in education and technology use in society (20 marks)
(e) Blog entry: Making weekly blog posts in Class Blog on the topics related to the course
posted by the instructor and commenting on others’ posts. (10 marks)

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

HU5176 PHILOSOPHY L T P C
3 0 0 3

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

UNIT I KNOWLEDGE

UNIT II ORIGIN

UNIT III WORD

UNIT IV KNOWLEDGE AS POWER/OPPRESSION

UNIT V SELF KNOWLEDGE/BRAHMAN

TOTAL : 45 PERIODS

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

REFERENCES:
4. Swami Lokesvarananda: Chandogya Upanishad, Swami Lokeswarananda, Ramakrishna Mission Institute of Culture, Kolkata.
7. Bacon, Francis: Power as Knowledge
UNIT I  INTRODUCTION  
Nature and fields.

UNIT II  PSYCHOLOGY IN INDUSTRIES AND ORGANIZATIONS  
Job analysis; fatigue and accidents; consumer behavior.

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

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

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

TOTAL: 45 PERIODS

TEXTBOOKS
HSMC – ELECTIVES – HUMANITIES II (EVEN SEMESTER)

HU5271  GENDER, CULTURE AND DEVELOPMENT  L T P C  3 0 0 3

COURSE DESCRIPTION
This course offers an introduction to Gender Studies that asks critical questions about the meanings of sex and gender in Indian society. The primary goal of this course is to familiarize students with key issues, questions and debates in Gender Studies, both historical and contemporary drawing from Indian literature and media studies, to examine cultural assumptions about sex, gender, and sexuality. This course integrates analysis of current events through student presentations, aiming to increase awareness of contemporary and historical experiences of women, and of the multiple ways that sex and gender interact with class, caste and other social identities. This course also seeks to build an understanding of the concepts of gender, gender-based violence, sexuality, and rights and their impact on development through a number of discussions, exercises and reflective activities.

Objectives
✔ To familiarize students with the concepts of sex and gender through literary and media texts.
✔ To help students ask critical questions regarding gender roles in society.
✔ To provide students with the material to discuss gender issues such as gender based discrimination, violence and development.
✔ To help students think critically about gender based problems and solutions.

Learning Outcomes
➢ Students will be able to critically read literary and media texts and understand the underlying gender perspectives in them.
➢ Students will be able to analyse current social events in the light of gender perspectives.
➢ Students will be able to discuss, analyse and argue about issues related to gender and their impact on society, culture and development.

UNIT I: Introduction to Gender
- Definition of Gender
- Basic Gender Concepts and Terminology
- Exploring Attitudes towards Gender
- Social Construction of Gender

Texts:
1. Sukhu and Dukhu (Amar Chitra Katha)
2. The Cat who Became a Queen (Folk tale, J. Hinton Knowles, Folk-Tales of Kashmir. London: Kegan Paul, Trench, Trübner, and Company, 1893, pp. 8-10.)

UNIT II: Gender Roles and Relations
- Types of Gender Roles
- Gender Roles and Relationships Matrix
- Gender-based Division and Valuation of Labour

Texts:
1. Muniyakka (Short Story, Lakshmi Kannan, Nandanvan and Other Stories, Hyderabad: Orient Blackswan, 2011)
UNIT III: Gender Development Issues
- Identifying Gender Issues
- Gender Sensitive Language
- Gender, Governance and Sustainable Development
- Gender and Human Rights
- Gender and Mainstreaming

Texts:
2. Tell Us Marx (Poem, Mallika Sengupta, Translated by Sanjukta Dasgupta)

UNIT IV: Gender-based Violence
- The concept of violence
- Types of Gender-based violence
- The relationship between gender, development and violence
- Gender-based violence from a human rights perspective

Texts:
1. Lights Out (Play, Manjula Padmanabhan)
2. Lights Out (Video of play enacted)

UNIT V: Gender and Culture
- Gender and Film
- Gender, Media and Advertisement

Texts:
1. Mahanagar (Movie: Satyajit Ray)
2. Beti Bachao Beti Padhao Advertisements

READINGS: Relevant additional texts for readings will be announced in the class. Classes will consist of a combination of activities: dialogue-based lectures, discussions, collaborative learning activities, group work and in-class assignments.

ASSESSMENT AND GRADING:
Discussion & Classroom Participation: 20%
Project/Assignment: 30%
End Term Exam: 50%

HU5272 ETHICS AND HOLISTIC LIFE

OBJECTIVES:
- To emphasize the meaning and nature of ethics, human values and holistic life for leading a good, successful and happy life through continuous examination of thoughts and conduct in day to day life.
- To understand the status and responsible role of individual in abatement of value crisis in contemporary world in order to develop a civilized and human society. Understanding the process of ethical decision making through critical assessment of incidents/cases of ethical dilemmas in personal, professional and social life.
- To view the place of Ethics and Human Values in the development of individual and society through identification and cross examination of life values and world view of his/her role models in society.
UNIT I  HUMAN LIFE, ITS AIM AND SIGNIFICANCE
The concept of a successful life, happy life and a meaningful life, Ethical and decision making capability and its development: Meaning of Ethical dilemma, sharing real life experiences.

UNIT II  CREATIVE AND LEADERSHIP ABILITY AND THEIR DEVELOPMENT
Intellectual, Emotional, Creative, Ethico - spiritual development, Aesthetic sense, Self-dependency, Activeness, Development of positive attitude.

UNIT III  HARMONY IN PERSONAL AND SOCIAL LIFE:
Concept of personal and group Ethics; Balance between - rights and duties-welfare of self and welfare of all, Creating a value based work culture in hostel, classroom and other places in the campus and society.

UNIT IV  CHARACTER, RIGHTEOUSNESS AND VIRTUES FOR A MEANINGFUL LIFE
Egolessness, Humility, Righteousness, Purity, Truthfulness, Integrity, Self-restraint, Self-control, Sense of responsibility, Empathy, Love, Compassion, Maitri / Comradeship, Cooperation, Tolerance.

UNIT V  DILEMMA BETWEEN MATERIALISTIC DEVELOPMENT AND HUMAN WELFARE

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Enable students to understand the concept of contemporary ethics at different levels: Individual, local and Global and enable them to cross examine the ethical and social consequences of the decisions of their life-view and world view.
2. Develop the ability of students to create a balance between their individual freedom and social responsibilities and enable them to identify the personal, professional and social values and integrate them in their personality after cross examination.
3. Enable students to cross examine their earlier decisions taken in life and understand the meaning of ethical dilemma to overcome the ethical dilemmas and engage in critical reflection.
4. Develop positive habits of thought and conduct and work cohesively with fellow beings who have variety of strengths, experiences, shortcomings and challenges, hence to enable them to handle diverse type of personalities.
5. Enable students to develop a method for making ethically sound decisions for themselves, within hostels, classrooms, university campus and society.

HU5273  LAW AND ENGINEERING  LTCP  3 0 0 3

UNIT I  THE LEGAL SYSTEM: SOURCES OF LAW AND THE COURT STRUCTURE
Enacted law -Acts of Parliament are of primary legislation, Common Law or Case law- Principles taken from decisions of judges constitute binding legal rules. The Court System in India and Foreign Courtiers. (District Court, District Consumer Forum, Tribunals, High Courts, Supreme Court) Arbitration: As an alternative to resolving disputes in the normal
courts, parties who are in dispute can agree that this will instead be referred to arbitration.

UNIT II LAWS

Basic principles of contract law, sale of goods law, laws relating to industrial pollution, accident, environmental protection, health and safety at work, patent law, constitutional law: the supreme law of the land, Information technology law and cyber crimes.

UNIT III BUSINESS ORGANISATIONS

Sole traders (Business has no separate identity from you, all business property belongs to you).

UNIT IV LAW AND SOCIETY

Interdisciplinary nature of law, legal ideologies/philosophy/schools of jurisprudence.

UNIT V CASE STUDIES

Important legal disputes and judicial litigations

TOTAL: 45 PERIODS

HU5274 FILM APPRECIATION

COURSE DESCRIPTION

This is an intensive course designed to promote comprehensive understanding and insights into the nature of cinema and other related forms and practices. Movies, though at times are used more as escapism, they are also a true art form and expressive tool used by writers, directors and actors. This course will explore the aesthetics of cinema, the concepts behind storytelling and various other elements of a film. It will also explore the impact of movies in our society and in our lives. It also encourages students to use films as a medium to analyse visual texts and read underlying messages.

OBJECTIVES:

- To help learners understand the various movie genres and its types.
- To understand various elements that contributes to film making.
- To make them realize the impact of film in society.
- To analyse the visual media and interpret the underlying messages.

UNIT I THE COMPONENTS OF FILMS

Story, Screenplay & Script – Actors – Director – Crew Members – Mis En Scene – Structure of A Film – Narrative Elements – Linear & Non-Linear – Types of Movie Genres: Mysteries, Romantic Comedies, Horror Etc.

UNIT II EVOLUTION OF FILM

UNIT III            FILMS ACROSS THE WORLD

UNIT IV            INDIAN FILMS

UNIT V            INTERPRETING FILMS
Film Criticism & Appreciation – Censorship in Movies – Cultural Representation in Movies – Television – New Media & Online Media – Films Beyond Entertainment.

TOTAL: 45 PERIODS

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

- Recognize types of films, their impact on society and their roles in our lives.
- Have an understanding of the concepts of storytelling, Mise en Scene, and other elements of film making.
- Interpret the underlying messages in the movies.

Teaching Methods

- Each unit consists of reading materials, learning activities videos, websites. Students are expected to watch movies sometimes in class and at times at home and discuss in class.

Evaluation

- As this is course is critical appreciation course on films, there is no written end semester examination. The course is more on learning how to critically analyse a movie and appreciate its finer elements. Therefore evaluation can be based on assignments and discussions. Internals marks can be taken for the total marks.

Internal (100 % weightage)

- Assignment 1: Write a movie review with critical analysis (20 marks).
- Assignment 2: Write a script for a scene taken from a short story / novella (20 marks).
- Presentation: Students choose any one topic related to films and present it to the audience. (25 marks)
- Group discussion: Students discuss in groups on the various aspects of movies and its impact on society. (25 marks)
- Blog entry: Making weekly blog posts in Class Blog on the topics related to the course posted by the instructor and commenting on others' posts. (10 marks)

REFERENCES

1. A Biographical Dictionary of Film by David Thomson, Secker & Warburg, 1975
2. Signs and Meaning in the Cinema by Peter Wollen, Secker & Warburg, 1969
3. The World Viewed by Stanley Cavell 1971
4. Film Style and Technology: History and Analysis by Barry Salt, Starword, 1983

HU5275            FUNDAMENTALS OF LANGUAGE AND LINGUISTICS
L T P C
3 0 0 3

OBJECTIVES

- To broadly introduce students to the formal and theoretical aspects of linguistics.
To enable learners to understand the various practical applications of language and recent findings in the field of applied linguistics.

CONTENTS:

UNIT I  LANGUAGE AND LINGUISTICS: AN OVERVIEW

UNIT II  MORPHOLOGY - WORDS OF LANGUAGE

UNIT III  SYNTAX- THE SENTENCE PATTERNS OF LANGUAGE AND SEMANTICS- THE MEANING OF LANGUAGE

UNIT IV  PHONETICS – THE SOUNDS OF LANGUAGE

UNIT V  APPLIED LINGUISTICS - THE PRACTICAL APPLICATIONS OF LANGUAGE
Language learning and teaching (ELT)- lexicography-translation studies-computational linguistics-neurolinguistics (speech pathology and language disorders)- forensic linguistics – sociolinguistics.

TOTAL : 45 PERIODS

Teaching Methods:
Lectures, discussion.

Evaluation Internal and External:
Internal: 2 written tests + assignments, seminars, project (50+15+15+20).
External: A 3 hour written exam (50 marks)

REFERENCES:

HU5276  UNDERSTANDING SOCIETY AND CULTURE THROUGH LITERATURE  L T P C

OBJECTIVES
• To internalize the importance of language by understanding its role in the transformation of man.
• To look at language, literature and culture as locus of identity and change.
• To extract meaning from existing literatures and cultures.
• To identify meanings in modern life by reconnecting with lost cultures.
UNIT I  INTRODUCTION
Why study literature? Tracing the origin – pictures. Tokens as precursors of writing. Movement from three dimensions to two dimensions- Pictography. From visual to oral -Logography. Reading out literature to young children- Edmund J Farrell.

UNIT II  READING CULTURE

UNIT III  IDENTIFYING MEANING
Searching and locating meaning through literature. Looking for order in a chaotic world. The Myth of Sisyphus (Albert Camus) and Adi Shankar’s ‘Jagat Mithya’- the world as an illusion. The Indian version as ‘meaningless meaning’.

UNIT IV  POST MODERNISM
‘If on a winter’s night a traveler’- Italo Calvino. The book about the reader- the experience of reading as reading. Metafiction. Selfie Culture. Visual Culture as purpose of modern life.

UNIT V  RETURNING TO PICTURES

Reading list
1. Bond, Ruskin: ‘Night train at Deoli’
2. Ezekiel, Nissim: ‘The Night of the Scorpion’
3. Afrika, Tatamkhulu: ‘Nothing’s Changed’
4. Barthes, Roland: Mythologies
5. Shankaracharya: Viveka Chudamani
6. Camus, Albert- The Myth of Sisyphus
7. Calvino, Italo: If on a winter’s night a traveler

OUTCOME
- Can identify the connections among language, literature and culture.
- Is able to relate between seemingly different aspects of life.
- Understands the fractions in modern life and can assimilate meanings.