ANNA UNIVERSITY
AFFILIATED INSTITUTIONS
REGULATIONS – 2017
CURRICULUM AND SYLLABUS I TO IV SEMESTERS (FULL TIME)
MASTER OF COMPUTER APPLICATIONS

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):
I. To prepare students to pursue lifelong learning and do research in computing field by providing solid technical foundations.
II. To provide students with various computing skills like analysis, design and development of innovative software products to meet the industry needs and excel as software professionals.
III. To prepare students to communicate and function effectively in teams in multidisciplinary fields within the global, societal and environmental context

PROGRAM OUTCOMES (POS) :
On successful completion of the program:
1. Computational knowledge: Apply knowledge of computing fundamentals, computing specialisation, mathematics, and domain knowledge appropriate for the computing specialisation to the solution of complex problems.
2. Problem analysis: Identify, formulate, review research literature, and analyze complex computing problems reaching substantiated conclusions using first principles of mathematics, computing sciences, and relevant domain disciplines.
3. Design/development of solutions: Design solutions for complex computing problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern computing and IT tools including prediction and modeling to complex computing systems with an understanding of the limitations
6. Research Aptitude: Ability to independently carry out research / investigations, identify problems and develop solutions to solve practical problems.
7. Innovation and Entrepreneurship: Identify a timely opportunity and using innovation to pursue that opportunity to create value and wealth for the betterment of the individual and society at large.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the professional computing practice.
9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communication: Communicate effectively on complex system building activities with the stakeholders and with society at large, such as, being able to comprehend
and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

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

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

**PROGRAM SPECIFIC OBJECTIVES (PSO)**

**PSO 1**: Able to select suitable data model, appropriate architecture, platform to implement a system with good performance.

**PSO 2**: Able to design and integrate various system based components to provide user interactive solutions for various challenges.

**Mapping Of Programme Educational Objectives With Programme Outcomes And Programme Specific Objectives**

<table>
<thead>
<tr>
<th>Programme Educational Objectives</th>
<th>Programme Outcomes</th>
<th>PSO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>√</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 3. SEMESTER COURSE WISE PEO MAPPING

<table>
<thead>
<tr>
<th>YEAR</th>
<th>SEMESTER</th>
<th>SUBJECT NAME</th>
<th>PEO1</th>
<th>PEO2</th>
<th>PEO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>YEAR 1</td>
<td>SEM 1</td>
<td>Matrices, Probability and Statistics</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Advanced Data Structures and Algorithms</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Advanced Database Technology</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Object Oriented Software Engineering</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Python Programming</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Research Methodology and Intellectual Property Rights</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Advanced Database Technology Lab</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Advanced Data Structures and Python Programming Lab</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Communication Skills Enhancement – I</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>SEM 2</td>
<td>Internet Programming</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cloud Computing Technologies</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Artificial Intelligence and Machine Learning</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mobile Application Development</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cyber Security</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Elective I</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Software Project Management</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Agile Methodologies</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. E Learning</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Software Quality and Testing</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Advances in Operating Systems</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6. Digital Image Processing</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Internet Programming Laboratory</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Artificial Intelligence and Machine Learning Laboratory</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Communication Skills Enhancement–II</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>YEAR 2</td>
<td>SEM 3</td>
<td>Data Science</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Embedded Systems and Internet of Things</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Accounting and Financial Management for Application</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Development</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Elective II</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Compiler Optimization Techniques</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. C# and .NET programming</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Wireless Networking</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>YEAR</th>
<th>SEMESTER</th>
<th>SUBJECT NAME</th>
<th>PEO1</th>
<th>PEO2</th>
<th>PEO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>YEAR 2</td>
<td>SEM 3</td>
<td>Data Science</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Embedded Systems and Internet of Things</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Accounting and Financial Management for Application</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Development</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Elective II</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Compiler Optimization Techniques</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. C# and .NET programming</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Wireless Networking</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Elective III</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>1. Social Network Analytics</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Bio Inspired Computing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Information Retrieval Techniques</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Software Architecture</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Digital Forensics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Data Mining and Data Warehousing Techniques</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Elective IV</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Data Visualization Techniques</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Operations Research</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Professional Ethics in IT</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>4. Marketing Management</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Organizational Behavior</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>6. Business Data Analytics</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Elective V</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Cryptocurrency and Blockchain Technologies</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Advances in Networking</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Soft Computing Techniques</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Deep Learning</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Big Data Processing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Natural Language Processing</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Data Science Laboratory                         |          |          |          |
| Internet of Things Laboratory                   |          |          |          |
| Project Work                                    |          |          |          |

| SEM 4                                           | ✓        | ✓        | ✓        |
# ANNA UNIVERSITY, CHENNAI
## REGULATIONS – 2017
## AFFILIATED INSTITUTIONS
## CHOICE BASED CREDIT SYSTEM
## MASTER OF COMPUTER APPLICATIONS

### SEMESTER I

<table>
<thead>
<tr>
<th>SL. No.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>CONTACT HOURS</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>THEORY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>MA5101</td>
<td>Matrices, Probability and Statistics</td>
<td>FC</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>MC5301</td>
<td>Advanced Data Structures and Algorithms</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>MC5105</td>
<td>Advanced Database Technology</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>MC5106</td>
<td>Object Oriented Software Engineering</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>MC5107</td>
<td>Python Programming</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>MC5108</td>
<td>Research Methodology and Intellectual Property Rights</td>
<td>PC</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td><strong>PRACTICALS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>MC5114</td>
<td>Advanced Database Technology Laboratory</td>
<td>PC</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>8.</td>
<td>MC5115</td>
<td>Advanced Data Structures and Python Programming Laboratory</td>
<td>PC</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>9.</td>
<td>MC5116</td>
<td>Communication Skills Enhancement – I</td>
<td>EEC</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>29</td>
<td>17</td>
<td>2</td>
<td>10</td>
</tr>
</tbody>
</table>

### SEMESTER II

<table>
<thead>
<tr>
<th>SL. No.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>CONTACT HOURS</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>THEORY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>MC5206</td>
<td>Internet Programming</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>MC5207</td>
<td>Cloud Computing Technologies</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>MC5208</td>
<td>Artificial Intelligence and Machine Learning</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>MC5209</td>
<td>Mobile Application Development</td>
<td>PC</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>MC5210</td>
<td>Cyber Security</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>Professional Elective I</td>
<td>PEC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td><strong>PRACTICALS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>MC5214</td>
<td>Internet Programming Laboratory</td>
<td>PC</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>8.</td>
<td>MC5215</td>
<td>Artificial Intelligence and Machine Learning Laboratory</td>
<td>PC</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>9.</td>
<td>MC5216</td>
<td>Communication Skills Enhancement– II</td>
<td>EEC</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>29</td>
<td>17</td>
<td>0</td>
<td>12</td>
</tr>
</tbody>
</table>
### SEMESTER III

<table>
<thead>
<tr>
<th>SL. NO.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>CONTACT HOURS</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>THEORY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>MC5306</td>
<td>Data Science</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>MC5307</td>
<td>Embedded Systems and Internet of Things</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>MC5308</td>
<td>Accounting and Financial Management for Application Development</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td>Professional Elective II</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td></td>
<td>Professional Elective III</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td></td>
<td>Professional Elective IV</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>7.</td>
<td></td>
<td>Professional Elective V:</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>PRACTICALS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>MC5314</td>
<td>Data Science Laboratory</td>
<td>PC</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>2.</td>
<td>MC5315</td>
<td>Internet of Things Laboratory</td>
<td>PC</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td></td>
<td>29</td>
<td>21</td>
<td>0</td>
<td>8</td>
<td>25</td>
</tr>
</tbody>
</table>

### SEMESTER IV

<table>
<thead>
<tr>
<th>SL. NO.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>CONTACT HOURS</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>PRACTICALS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>MC5414</td>
<td>Project Work</td>
<td>PC</td>
<td>24</td>
<td>0</td>
<td>0</td>
<td>24</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td></td>
<td>24</td>
<td>0</td>
<td>0</td>
<td>24</td>
<td>12</td>
</tr>
</tbody>
</table>

**TOTAL CREDITS: 83**
## PROFESSIONAL ELECTIVES

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>CONTACT PERIODS</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>MC5003</td>
<td>Software Project Management</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>MC5016</td>
<td>Agile Methodologies</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>MC5017</td>
<td>E Learning</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>MC5018</td>
<td>Software Quality and Testing</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>MC5019</td>
<td>Advances in Operating Systems</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>MC5020</td>
<td>Digital Image Processing</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

### PROFESSIONAL ELECTIVE – II, Semester 3

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>CONTACT PERIODS</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>MC5021</td>
<td>Compiler Optimization Techniques</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>MC5022</td>
<td>C# and .NET programming</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>MC5023</td>
<td>Wireless Networking</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>MC5024</td>
<td>Web Design</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>MC5025</td>
<td>Network Programming and Security</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>MC5026</td>
<td>Microservices and Devops</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

### PROFESSIONAL ELECTIVE – III, Semester 3

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>CONTACT PERIODS</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>MC5027</td>
<td>Social Network Analytics</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>MC5028</td>
<td>Bio Inspired Computing</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>MC5029</td>
<td>Information Retrieval Techniques</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>MC5030</td>
<td>Software Architecture</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>MC5031</td>
<td>Digital Forensics</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>MC5032</td>
<td>Data Mining and Data Warehousing Techniques</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

### PROFESSIONAL ELECTIVE – IV, Semester 3

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>CONTACT PERIODS</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>MC5033</td>
<td>Data Visualization Techniques</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>MC5034</td>
<td>Operations Research</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>MC5035</td>
<td>Professional Ethics in IT</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>MC5036</td>
<td>Marketing Management</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>MC5037</td>
<td>Organizational Behavior</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>MC5038</td>
<td>Business Data Analytics</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>
## PROFESSIONAL ELECTIVE – V, Semester 3

<table>
<thead>
<tr>
<th>SL. NO</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>CONTACT PERIODS</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>MC5039</td>
<td>Cryptocurrency and Blockchain Technologies</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>MC5040</td>
<td>Advances in Networking</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>MC5041</td>
<td>Soft Computing Techniques</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>MC5042</td>
<td>Deep Learning</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>MC5043</td>
<td>Big Data Processing</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>MC5044</td>
<td>Natural Language Processing</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

## FOUNDATION COURSES (FC)

<table>
<thead>
<tr>
<th>SL. NO</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>CONTACT PERIODS</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>MA5101</td>
<td>Matrices, Probability and Statistics</td>
<td>FC</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>4</td>
</tr>
</tbody>
</table>

## PROFESSIONAL CORE (PC)

<table>
<thead>
<tr>
<th>SL. NO</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>CONTACT PERIODS</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>MC5301</td>
<td>Advanced Data Structures and Algorithms</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>MC5105</td>
<td>Advanced Database Technology</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>MC5106</td>
<td>Object Oriented Software Engineering</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>MC5107</td>
<td>Python Programming</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>MC5108</td>
<td>Research Methodology and Intellectual Property Rights</td>
<td>PC</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>6.</td>
<td>MC5114</td>
<td>Advanced Database Technology Lab</td>
<td>PC</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>7.</td>
<td>MC5115</td>
<td>Advanced Data Structures and Python Programming Lab</td>
<td>PC</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>8.</td>
<td>MC5206</td>
<td>Internet Programming</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>9.</td>
<td>MC5207</td>
<td>Cloud Computing Technologies</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>10.</td>
<td>MC5208</td>
<td>Artificial Intelligence and Machine Learning</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>11.</td>
<td>MC5209</td>
<td>Mobile Application Development</td>
<td>PC</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>12.</td>
<td>MC5210</td>
<td>Cyber Security</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>13.</td>
<td>MC5214</td>
<td>Internet Programming Laboratory</td>
<td>PC</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>14.</td>
<td>MC5215</td>
<td>Artificial Intelligence and Machine Learning Laboratory</td>
<td>PC</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Sl. No.</td>
<td>Course Code</td>
<td>Course Title</td>
<td>Category</td>
<td>Contact Periods</td>
<td>L</td>
<td>T</td>
<td>P</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>MC5306</td>
<td>Data Science</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>16</td>
<td>MC5307</td>
<td>Embedded Systems and Internet of Things</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>17</td>
<td>MC5308</td>
<td>Accounting and Financial Management for Application Development</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>18</td>
<td>MC5314</td>
<td>Data Science Laboratory</td>
<td>PC</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>19</td>
<td>MC5315</td>
<td>Internet of Things Laboratory</td>
<td>PC</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

**EMPLOYABILITY ENHANCEMENT COURSE (EEC)**

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Category</th>
<th>Contact Periods</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MC5116</td>
<td>Communication Skills Enhancement – I</td>
<td>EEC</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>MC5216</td>
<td>Communication Skills Enhancement– II</td>
<td>EEC</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>MC5414</td>
<td>Project Work</td>
<td>EEC</td>
<td>24</td>
<td>0</td>
<td>0</td>
<td>24</td>
<td>12</td>
</tr>
</tbody>
</table>

**BRIDGE COURSES**

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Contact Periods</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MA5102</td>
<td>Mathematical Foundations of Computer Science</td>
<td></td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>BX5001</td>
<td>Problem Solving And Programming In C</td>
<td></td>
<td>5</td>
<td>3</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>BX5002</td>
<td>Digital logic and Computer Organization</td>
<td></td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>BX5003</td>
<td>Operating Systems</td>
<td></td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>BX5004</td>
<td>Data Structures and Algorithms</td>
<td></td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>BX5005</td>
<td>Programming and Data structures using C lab</td>
<td></td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
</tbody>
</table>

**Semester II**

|    | BX5006      | Data Base Management Systems            |                 | 3  | 3  | 0  | 0  | 3  |
| 8   | BX5007      | Java Programming                        |                 | 3  | 3  | 0  | 0  | 3  |
| 9   | BX5008      | Software Engineering                     |                 | 3  | 3  | 0  | 0  | 3  |
| 10  | BX5009      | Basics of Computer Networks              |                 | 3  | 3  | 0  | 0  | 3  |
| 11  | BX5010      | Java Programming Lab                     |                 | 4  | 0  | 0  | 4  | 2  |
| 12  | BX5011      | Data Base Management Systems Lab         |                 | 4  | 0  | 0  | 4  | 2  |
OBJECTIVES:

- To provide methods for understanding the consistency and solving the equation as well as for finding the Eigenvalues and Eigenvectors of square matrix.
- To provide foundation on Applied Probability
- To introduce the concepts of correlation and regression of random variables
- To use various statistical techniques in Application problems
- To introduce the concept of Design of Experiments for data analysis

UNIT - I MATRICES AND EIGENVALUE PROBLEMS 5
Matrices - Rank of a Matrix - Consistently of a system of linear equations - Solution of the matrix equation \( \Delta x = b \) - Row-reduced Echelon Form - Eigenvalues and Eigenvectors - Properties - Cayley - Hamilton Theorem - Inverse of a matrix.

UNIT - II PROBABILITY AND RANDOM VARIABLES 15

UNIT - III TWO-DIMENSIONAL RANDOM VARIABLES 15
Joint probability distributions - Marginal and conditional probability distributions - Covariance - Correlation - Linear regression lines - Regression curves - Transform of random variables - Central limit theorem (for independent identically random variables).

UNIT - IV TESTING OF HYPOTHESIS 15
Sampling distributions - Tests based on small and large samples - Normal, Student’s t, Chi-square and F distributions for testing of mean, variance and proportion and testing of difference of means variances and proportions - Tests for independence of attributes and goodness of fit.

UNIT - V DESIGN OF EXPERIMENTS 15
Analysis of variance - Completely randomized design - Random block design (One-way and Two-way classifications) - Latin square design \( -2^2 \) Factorial design.

OUTCOMES:
After the completion of the course the student will be able to

- Test the consistency and solve system of linear equations as well as find the Eigenvalues and Eigenvector.
- Apply the Probability axioms as well as rules and the distribution of discrete and continuous ideas in solving real world problems.
- Apply the concepts of correlation and regression of random variables in solving application problems.
- Use statistical techniques in testing hypothesis on data analysis.
- Use the appropriate statistical technique of design of experiments in data analysis.
REFERENCE BOOKS:

<table>
<thead>
<tr>
<th>CO/PO s &amp; PSOs</th>
<th>PO</th>
<th>PSO</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>√</td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>√</td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>CO4</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>CO5</td>
<td>√</td>
<td>√</td>
</tr>
</tbody>
</table>

MC5301 ADVANCED DATA STRUCTURES AND ALGORITHMS L T P C 3 0 0 3

OBJECTIVES:
- Understand and apply linear data structures-List, Stack and Queue
- Understand the graph algorithms.
- Learn different algorithm analysis techniques.
- Apply data structures and algorithms in real time applications
- Analyze the efficiency of an algorithm

UNIT I LINEAR DATA STRUCTURES

UNIT II NON-LINEAR DATA STRUCTURES
UNIT III          GRAPHS
Representation of graph - Graph Traversals - Depth-first and breadth-first traversal -
Applications of graphs - Topological sort – shortest-path algorithms - Dijkstra’s algorithm –
Bellman-Ford algorithm – Floyd's Algorithm - minimum spanning tree – Prim's and Kruskal’s
algorithms.

UNIT IV          ALGORITHM DESIGN AND ANALYSIS
Algorithm Analysis – Asymptotic Notations - Divide and Conquer – Merge Sort – Quick Sort -
Binary Search Tree - Warshall’s Algorithm for Finding Transitive Closure.

UNIT V          ADVANCED ALGORITHM DESIGN AND ANALYSIS
Backtracking – N-Queen’s Problem - Branch and Bound – Assignment Problem - P & NP
problems – NP-complete problems – Approximation algorithms for NP-hard problems –
Traveling salesmen problem-Amortized Analysis.

OUTCOMES:
• Implement a program using stack, queue, linked list data structures
• Design and Implement Tree data structures and Sets
• Apply the Graph Data structure and to find shortest path among the several
   possibilities
• Perform analysis of various algorithms
• Analyze and design algorithms to appreciate the impact of algorithm design in
   practice.

REFERENCES:
1. AnanyLevitin “Introduction to the Design and Analysis of Algorithms” 3rd
2. Jean Paul Tremblay and Paul G. Sorensen. “An Introduction to Data Structures
   Education 2014
5. V. Aho, J. E. Hopcroft, and J. D. Ullman, “Data Structures and Algorithms”, 1st

<table>
<thead>
<tr>
<th>COs/POs &amp; PSOs</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</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>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

TOTAL: 45 PERIODS
MC5105  ADVANCED DATABASE TECHNOLOGY  L T P C
3 0 0 3

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  9

UNIT II  NOSQL DATABASES  9

UNIT III  ADVANCED DATABASE SYSTEMS  9

UNIT IV  XML AND DATABAWAREHOUSE  9

UNIT V  INFORMATION RETRIEVAL AND WEB SEARCH  9

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. Design a data warehouse system and apply OLAP operations.
4. Design XML database systems and validating with XML schema.
5. Apply knowledge of information retrieval concepts on web databases.

TOTAL: 45 PERIODS

13
REFERENCES:

<table>
<thead>
<tr>
<th>COs/POs &amp; PSOs</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</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>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

MC5106 OBJECT ORIENTED SOFTWARE ENGINEERING L T P C
3 0 0 3

OBJECTIVES:
- To understand the phases in object oriented software development
- To gain fundamental concepts of requirements engineering and analysis.
- To know about the different approach for object oriented design and its methods
- To learn about how to perform object oriented testing and how to maintain software
- To provide various quality metrics and to ensure risk management.

UNIT I SOFTWARE DEVELOPMENT LIFE CYCLE
9

UNIT II OBJECT ORIENTED REQUIREMENTS ELICITATION & ANALYSIS
9

UNIT III OBJECT ORIENTED SOFTWARE DESIGN 9

UNIT IV OBJECT ORIENTED TESTING AND MAINTENANCE 9

UNIT V SOFTWARE QUALITY & METRICS 9

TOTAL: 45 PERIODS

OUTCOMES:
- Able to identify the appropriate process model to develop the object oriented software
- Gain knowledge about requirement elicitation and analyzing techniques
- Able to choose and design suitable UML diagrams and methods
- Able to apply correct testing methods and maintain software systems.
- Able to estimate the object oriented application by applying metric data.

REFERENCES:
### MC5107  PYTHON PROGRAMMING  L T P C  3 0 0 3

**OBJECTIVES:**
- 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  PYTHON BASICS**  10

**UNIT II  DATA TYPES IN PYTHON**  10

**UNIT III  FILE HANDLING AND EXCEPTION HANDLING**  8
- Files: Introduction – File Path – Opening and Closing Files – Reading and Writing Files – File Position – Exception: Errors and Exceptions, Exception Handling, Multiple Exceptions

**UNIT IV  MODULES, PACKAGES**  9

**UNIT V  OBJECT ORIENTED PROGRAMMING IN PYTHON**  8
- Creating a Class, Class methods, Class Inheritance, Encapsulation, Polymorphism, class method vs. static methods, Python object persistence

**TOTAL: 45 PERIODS**

**OUTCOMES:**
Upon completion of the course, students will be able to
- Develop algorithmic solutions to simple computational problems
- Structure simple Python programs for solving problems.
• Read and write data from/to files in Python Programs.
• Represent compound data using Python lists, tuples, dictionaries.
• Decompose a Python program into functions.

REFERENCES:

<table>
<thead>
<tr>
<th>COs/POs &amp; PSOs</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</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>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MC5108       RESEARCH METHODOLOGY AND INTELLECTUAL PROPERTY RIGHTS
L T P C
2 0 0 2

COURSE OBJECTIVES:
The course should enable the students to:
• Identify an appropriate research problem in their interesting domain.
• Understand ethical issues; understand the Preparation of a research project thesis report.
• Understand the Preparation of a research project thesis report
• Understand the law of patent and copyrights.
• Acquire adequate knowledge of IPR.

UNIT I      RESEARCH METHODOLOGY
6
Research Methodology – An Introduction, Objectives, Types of research, Research approaches, Significance, Research methods versus Methodology, Research and Scientific method, Importance, Research process, Criteria, Problems encountered by researchers.
Defining the research problem – Research problem, Selecting the problem, Necessity, Technique involved, An illustration.

Reviewing the Literature – The place of the literature review in research, How to review the Literature, Writing about the literature reviewed.

UNIT II RESEARCH DESIGN 6
Research Design – Meaning, Need, Features, Different research design, Basic principles of experimental designs, Important experimental designs.
Measurement & Scaling techniques – Sampling Design, Measurement in research, Measurement scales, Error, Measurement tools, Scaling, Meaning, Scale classification, Scale construction techniques
Data Collection – Collection of primary data, Collection of secondary data, Selection of appropriate method for data collection.

UNIT III RESEARCH TECHNIQUE AND TOOLS 6
Testing of Hypothesis – Basic concepts, Procedure, Test of Hypothesis, Important parametric Tests, Hypothesis Testing unifications.
Interpretation & Report writing – Meaning, techniques, Precaution in Interpretation, Significance of Report writing, steps, Layout, types, mechanics, precautions.
Use of Tools/ Techniques for research – Use of Encyclopedias, Research Guides, Handbook etc., Academic Databases for Computer Science Discipline, Use of tools / techniques for Research methods to search required information effectively, Reference Management Software like Zotero/Mendeley, Software for paper formatting like LaTeX/MS Office, Software for detection of Plagiarism

UNIT IV INTELLECTUAL PROPERTY RIGHTS 6
Intellectual Property – The concept, IPS in India, development, Trade secrets, utility Models, IPR & Bio diversity, CBD, WIPO, WTO, Right of Property, Common rules, PCT, Features of Agreement, Trademark, UNESCO.

UNIT V PATENTS 6

TOTAL: 30 PERIODS

REFERENCE BOOKS:
2. Research Methodology a step-by-step guide for beginners by Ranjit Kumar, SAGE publications Ltd 3rd Edition 2011 (For the topic Reviewing the Literature under Unit I)
OUTCOMES: (Cos)
On completion of the course the student would be able to:
CO1: Understand the research problem and Literature review.
CO2: Understand the various research designs and their characteristics.
CO3: Prepare a well-structured research paper and scientific presentations.
CO4: Explore on various IPR Components and process of filing.
CO5 Develop awareness the patent law and procedural mechanism in obtaining a patent.

<table>
<thead>
<tr>
<th>CO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO 1</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 2</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 3</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td>√</td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 4</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 5</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MC5114        ADVANCED DATABASE TECHNOLOGY LABORATORY            L T P C
                             0 0 4 2

OBJECTIVES:
The student should be able:
- To understand the concepts of Open Source DBMS.
- To understand the process of distributing tables across multiple systems
- To understand the process of storing, retrieving spatial and temporal data
- To understand the process of storing, retrieving objects in a database
- To understand the process of storing and retrieving data from a XML Database
- To use the open source database for building a mobile application

EXPERIMENTS IN THE FOLLOWING TOPICS:
1. NOSQL Exercises
   a. MongoDB – CRUD operations, Indexing, Sharding, Deployment
   b. Cassandra: Table Operations, CRUD Operations, CQL Types
   c. HIVE: Data types, Database Operations, Partitioning – HiveQL
   d. OrientDB Graph database – OrientDB Features
2. MySQL Database Creation, Table Creation, Query
3. MySQL Replication – Distributed Databases
4. Spatial data storage and retrieval in MySQL
5. Temporal data storage and retrieval in MySQL
6. Object storage and retrieval in MySQL
7. XML Databases, XML table creation, XQuery FLWOR expression
8. Mobile Database Query Processing using open source DB (MongoDB/MySQL etc)

TOTAL: 60 PERIODS

OUTCOMES:
Upon completion of this course, the student should be able to:
- Design and Implement databases.
- Formulate complex queries using SQL
- Design and implement applications that have GUI and access databases for backend connectivity
- To design and implement Mobile Databases
- To design and implement databases to store spatial and temporal data objects

### Mapping of COs with POs and PSOs

<table>
<thead>
<tr>
<th>COs/POs &amp; PSOs</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</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>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### MC5115 ADVANCED DATA STRUCTURES AND PYTHON PROGRAMMING LABORATORY

**OBJECTIVES:**
- To learn the basic programming constructs in Python.
- To implement Recursive programming in Python
- To implement Divide and Conquer algorithmic technique in Python
- To implement Tree Data structures in Python
- To implement Graphs in Python
- To deploy the standard libraries in Python

**EXPERIMENTS:**
1. Towers of Hanoi using Recursion
2. To implement Binary Search
3. Merge Sort
4. To implement AVL Trees using Python
5. To implement Splay Trees using Python
6. To implement Red black Trees using Python
7. To implement Graphs using Python
9. Implementing real-time/technical applications using Files and Exception handling.

**OUTCOMES:**
On completion of the course, students will be able to:
1. Develop algorithmic solutions to simple computational problems
2. Develop and execute Python programs.
3. Decompose a Python program into functions.

**TOTAL: 60 PERIODS**
4. Represent compound data using Python data structures.
5. Apply Python features in developing software applications.

<table>
<thead>
<tr>
<th>COs/POs &amp; PSOs</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</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>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

MC5116 COMMUNICATION SKILLS - I

OBJECTIVES:
- To provide opportunities to learners to practice English and thereby make them proficient users of the language.
- To enable learners to fine-tune their linguistic skills (LSRW) with the help of Technology.
- To enhance the performance of students listening, speaking, reading and writing and thereby develop their career opportunities.

LIST OF ACTIVITIES:
1. Listening:
   - Listening and practicing neutral accents
   - Listening to short talks and lectures and completing listening comprehension exercises
   - Listening to TED Talks
2. Speaking:
   - Giving one minute talks
   - Participating in small Group Discussions
   - Making Presentations
3. Reading:
   - Reading Comprehension
   - Reading subject specific material
   - Technical Vocabulary
4. Writing:
   - Formal vs Informal Writing
   - Paragraph Writing
   - Essay Writing
   - Email Writing

TOTAL: 30 PERIODS

REFERENCES / MANUALS / SOFTWARE: Open Sources / websites

OUTCOMES:
On completion of the course the students will be able to:
- Listen and comprehend Lectures in English
- Articulate well and give presentations clearly
- Participate in Group Discussions successfully
- Communicate effectively in formal and informal writing
- Write proficient essays and emails

<table>
<thead>
<tr>
<th>COs/POs &amp; PSOs</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</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>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>√</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MC5206  INTERNET PROGRAMMING  L  T  P  C  3 0 0 3

COURSE OBJECTIVES:
- To understand the fundamentals of web programming and client side scripting.
- To learn the server side development using servlets, websocket.
- To learn the Spring framework and build applications using Spring.
- To learn and implement the concept of Java Persistence API.
- To learn the advanced client side scripting and framework.

UNIT I  INTRODUCTION TO WEB & CLIENT SIDE PROGRAMMING  9
Introduction to Web: Server - Client - Communication Protocol (HTTP), JavaScript: Data Types and Variables - Expressions - Operators and Statements - Objects and Arrays - Functions - Classes - Modules - DOM - Events - Storage: LocalStorage, Cookies, IndexedDB, JSON, AJAX

UNIT II  SERVER SIDE PROGRAMMING  9

UNIT III  SPRING  9

UNIT IV  JAVA PERSISTENCE API AND HIBERNATE  9
UNIT V  ADVANCED CLIENT SIDE PROGRAMMING


TOTAL: 45 PERIODS

Course Outcomes:
Upon completion of the course the students should be able to:

- To write client side scripting.
- To implement the server side of the web application.
- To implement Web Application using Spring.
- To implement a Java application using Java Persistence API.
- To implement a full-stack Single Page Application using React, Spring and JPA.

REFERENCE BOOKS
   https://reactjs.org/docs

<table>
<thead>
<tr>
<th>CO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</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>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td></td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</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>
<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>
<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>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td></td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MC5207  CLOUD COMPUTING TECHNOLOGIES  L T P C
3 0 0 3

OBJECTIVES:
- To understand the basic concepts of Distributed systems
- To learn about the current trend and basics of Cloud computing
- To be familiar with various Cloud concepts
- To expose with the Server, Network and storage virtualization
- To be aware of Microservices and DevOps
UNIT I  DISTRIBUTED SYSTEMS  9

UNIT II  INTRODUCTION TO CLOUD COMPUTING  9

UNIT III  CLOUD INFRASTRUCTURE  9

UNIT IV  CLOUD ENABLING TECHNOLOGIES  9

UNIT V  MICROSERVICES AND DEVOPS  9

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to
● Use Distributed systems in Cloud Environment
● Articulate the main concepts, key technologies, strengths and limitations of Cloud computing
● Identify the Architecture, Infrastructure and delivery models of Cloud computing
● Install, choose and use the appropriate current technology for the implementation of Cloud
● Adopt Microservices and DevOps in Cloud environment
REFERENCES:

<table>
<thead>
<tr>
<th>CO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO 1</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>√</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 2</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 3</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 4</td>
<td></td>
<td></td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 5</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MC5208 ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING L T P C
3 0 0 3

OBJECTIVES:
- To familiarize with the principles of Artificial intelligence like problem solving, inference, perception, knowledge representation, and learning.
- To understand the various characteristics of Intelligent agents
- To design and implement the machine learning techniques for real world problems
- To gain experience in doing research using Artificial intelligence and Machine learning techniques.

UNIT I ARTIFICIAL INTELLIGENCE

UNIT II KNOWLEDGE AND REASONING
Logical Agents: Knowledge Based Agents-Logic-Propositional Logic-Propositional Theorem Proving-Model Checking-Agent based on Propositional Logic. First-Order Logic: Syntax and Semantics- Using First-Order Logic-Knowledge Engineering. Inference in First-Order Logic:
UNIT III  BAYESIAN LEARNING


UNIT IV  PARAMETRIC MACHINE LEARNING

Logistic Regression: Classification and representation – Cost function – Gradient descent – Advanced optimization – Regularization - Solving the problems on overfitting. Perceptron – Neural Networks – Multi – class Classification - Backpropagation – Non-linearity with activation functions (Tanh, Sigmoid, Relu, PRelu) - Dropout as regularization.

UNIT V  NON PARAMETRIC MACHINE LEARNING


TOTAL: 45 PERIODS

REFERENCES:

OUTCOME:
- Apply the techniques of Problem Solving in Artificial Intelligence.
- Implement Knowledge and Reasoning for real world problems.
- Model the various Learning features of Artificial Intelligence
- Analyze the working model and features of Decision tree
- Apply k-nearest algorithm for appropriate research problem.
OBJECTIVES:
- To understand the need and characteristics of mobile applications.
- To design the right user interface for mobile application.
- To understand the design issues in the development of mobile applications.
- To understand the development procedure for mobile application.
- To develop mobile applications using various tools and platforms.

UNIT I INTRODUCTION

UNIT II USER INTERFACE
Generic UI Development – Multimodal and Multichannel UI – Gesture Based UI – Screen Elements and Layouts – Voice XML.

Lab Component:
1. Implement mobile application using UI toolkits and frameworks.
2. Design an application that uses Layout Managers and event listeners.

UNIT III APPLICATION DESIGN

Lab Component:
1. Design a mobile application that is aware of the resource constraints of mobile devices.
2. Implement an android application that writes data into the SD card.
UNIT IV MOBILE OS


Lab Component:
   i. Develop an application that makes use of mobile database
   ii. Implement an android application that writes data into the SD card.

UNIT V APPLICATION DEVELOPMENT

Communication via the Web – Notification and Alarms – Graphics and Multimedia: Layer Animation, Event handling and Graphics services – Telephony – Location based services

Lab Component:
   i. Develop web based mobile application that accesses internet and location data.
   ii. Develop an android application using telephony to send SMS.

TOTAL: 60 PERIODS

OUTCOMES
On completion of the course, the student will be able to
   ● Understand the basics of mobile application development frameworks and tools
   ● To be able to develop a UI for mobile application
   ● To design mobile applications that manages memory dynamically
   ● To build applications based on mobile OS like Android, iOS
   ● To build location based services

REFERENCES:
OBJECTIVES

- To learn the principles of cyber security and to identify threats and risks.
- To learn how to secure physical assets and develop system security controls.
- To understand how to apply security for Business applications and Network Communications.
- To learn the technical means to achieve security.
- To learn to monitor and audit security measures.

UNIT I  PLANNING FOR CYBER SECURITY  9

UNIT II  SECURITY CONTROLS  9

UNIT III  CYBER SECURITY FOR BUSINESS APPLICATIONS AND NETWORKS  9

UNIT IV  TECHNICAL SECURITY  9

UNIT V  SECURITY ASSESSMENT  9

TOTAL: 45 PERIODS

OUTCOMES

On completion of the course, the student will be able to

- Develop a set of risk and security requirements to ensure that there are no gaps in an organization’s security practices.
- Achieve management, operational and technical means for effective cyber security.
- Audit and monitor the performance of cyber security controls.
- To spot gaps in the system and devise improvements.
• Identify and report vulnerabilities in the system

REFERENCES:
6. OWASP ZAP: https://owasp.org/www-project-zap/
7. ACUNETIX: https://www.acunetix.com/

<table>
<thead>
<tr>
<th>CO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO 1</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 3</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 4</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>CO 5</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MC5214           INTERNET PROGRAMMING LABORATORY                  L T P C
                  0 0 4 2

Course Objectives:
1. To implement the client side of the web application using javascript.
2. To implement the server side of the web application using Servlets and WebSockets.
3. To develop a web application using Spring.
4. To implement a Persistence layer using Hibernate and Spring Data JPA.
5. To develop a full stack single page application using React, Spring and Hibernate.

1. Create an event registration application using javascript. It should implement different widgets for registration form and registered records view using tabs. It should perform the form validation.

2. Create a javascript application in an Object Oriented way using Classes and Modules. It should also use browser storage for persistence.

3. Build a web application using Gradle. The server side of the application should implement RESTful APIs using Servlet and do necessary logging. The client side of the application should be a single page application which consumes the RESTful APIs through AJAX.

4. Build a chat application using WebSocket.
5. Create a Spring MVC application. The application should handle form validation, file upload, session tracking.

6. Implement a RESTful Spring Boot application using Spring REST, Spring Security and Spring Cache.

7. Design a complex system using JPA and Hibernate. The system should have multiple entities and relationships between the entities. The database schema should be generated through Hibernate. Provide RESTful endpoints for CRUD operations for the defined entities. Also, support pagination and searching using JPA’s JPQL and Criteria API.

8. Create a Spring RESTful Application with Spring Data JPA. Support pagination and searching using Specifications.

9. Create a React application with different components and interactions between the components.

10. Develop a full-stack application using React and Spring. Make use of Spring REST, Spring Security, Spring Data JPA, Hibernate, Spring Boot, Gradle and React’s higher order component.

**Course Outcomes:**

1. To implement client and server side of the web application.
2. To implement a real time application using WebSocket.
3. To use Spring framework in web development.
4. To implement applications using Java Persistence API.
5. To implement applications using the JavaScript framework React.

<table>
<thead>
<tr>
<th>CO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO 1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO 2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO 3</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO 4</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO 5</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

**TOTAL : 60 PERIODS**
OBJECTIVES:
- To familiarize with the machine learning algorithms and implement in practical situations.
- To involve the students to practice AI algorithms and techniques.
- Learn to use different algorithms for real time data sets.

List of Experiments:
1. Write a program to illustrate problem solving as a search.
2. Write a program to illustrate local search algorithms.
3. Write a program to demonstrate logical agents.
4. Evaluate forward chainer and rule base on at least four different databases. Try to create at least one database that demonstrates an interesting feature of the domain, or an interesting feature of forward chaining in general.
5. Demonstrate agent based on propositional logic.
6. Write a program to implement the naïve Bayesian classifier for a sample training data set. Compute the accuracy of the classifier, considering few test data sets.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set.
8. Apply EM algorithm to cluster a set of data stored in a .CSV file.
9. Write a program to implement k-Nearest Neighbor algorithm to classify the data set.
10. Apply the technique of pruning for a noisy data monk2 data, and derive the decision tree from this data. Analyze the results by comparing the structure of pruned and unpruned tree.
11. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
12. Implement Support Vector Classification for linear kernel.
13. Implement Logistic Regression to classify the problems such as spam detection. Diabetes predictions so on.

OUTCOMES:
- Apply the techniques of Problem Solving in Artificial Intelligence.
- Implement Knowledge and Reasoning for real world problems.
- Model the various Learning features of Artificial Intelligence.
- Analyze the working model and features of Decision tree.
- Apply k-nearest algorithm for appropriate research problem.

<table>
<thead>
<tr>
<th>COs/POs &amp; PSOs</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

Total: 60 Periods
MC5216 COMMUNICATION SKILLS ENHANCEMENT II

OBJECTIVES:
- To provide opportunities to learners to practice their communication skills to make them become proficient users of English.
- To enable learners to fine-tune their linguistic skills (LSRW) with the help of Technology to communicate globally.
- To enhance the performance of learners at placement interviews and group discussions and other recruitment procedures

1. SOFT SKILLS
   - People skills
   - Interpersonal skills
   - Team building skills
   - Leadership skills
   - Problem solving skills

2. PRESENTATION SKILLS
   - Preparing slides with animation related to the topic
   - Introducing oneself to the audience
   - Introducing the topic
   - Presenting the visuals effectively – 5 minute presentation

3. GROUP DISCUSSION SKILLS
   - Participating in group discussions
   - Brainstorming the topic
   - Activities to improve GD skills.

4. INTERVIEW SKILLS
   - Interview etiquette – dress code – body language
   - Attending job interviews
   - Answering questions confidently
   - Technical interview – telephone/Skype interview
   - Emotional and cultural intelligence
   - Stress Interview

TOTAL: 30 PERIODS

REFERENCES / MANUALS / SOFTWARE: Open Sources / websites

OUTCOMES:
Upon Completion of the course, the students will be able to:
- Students will be able to make presentations and participate in Group discussions with confidence.
- Students will be able to perform well in the interviews.
Students will make effective presentations.

<table>
<thead>
<tr>
<th>COs/POs &amp; PSOs</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
</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>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MC5306 DATA SCIENCE L T P C 3 0 0 3

OBJECTIVES:
- To know the fundamental concepts of data science and analytics.
- To learn fundamental data analysis using R.
- To understand various data modeling techniques.
- To learn the basic and advanced features of open source big data tools and frameworks.
- To study various analytics on stream data.

UNIT I INTRODUCTION TO DATA SCIENCE AND BIG DATA

UNIT II DATA ANALYSIS USING R

UNIT III DATA MODELING

UNIT IV DATA ANALYTICAL FRAMEWORKS
Introduction to Hadoop: Hadoop Overview – RDBMS versus Hadoop – HDFS (Hadoop Distributed File System): Components and Block Replication – Introduction to MapReduce –
Running Algorithms Using MapReduce – Introduction to HBase: HBase Architecture, HLog and HFile, Data Replication – Introduction to Hive, Spark and Apache Sqoop.

UNIT V STREAM ANALYTICS


TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Convert real world problems to hypothesis and perform statistical testing.
2. Perform data analysis using R.
3. Design efficient modeling of very large data and work with big data platforms.
4. Implement suitable data analysis for stream data.
5. Write efficient MapReduce programs for small problem solving methods.

REFERENCES:

<table>
<thead>
<tr>
<th>COs/POs &amp; PSOs</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</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>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

MC5307 EMBEDDED SYSTEMS AND INTERNET OF THINGS

OBJECTIVES:
- To learn the internal architecture and programming of an embedded processor.
• To introduce interfacing I/O devices to the processor and to run, debug programs in an IDE.
• To build a small low cost embedded system using Open Hardware Platforms.
• To apply the concept of Internet of Things in real world scenario.
• To deploy IoT application and connect to the cloud.

UNIT I EMBEDDED CONTROLLER
Microcontrollers and Embedded Processors, Introduction to 8051, PSW and Flag Bits, 8051 Register Banks and Stack, Internal Memory Organization of 8051, IO Port Usage in 8051, Types of Special Function Registers and their uses in 8051, Pins Of 8051. Memory Address Decoding, 8031/51 Interfacing With External ROM And RAM. 8051 Addressing Modes.

UNIT II EMBEDDED C PROGRAMMING

UNIT III FUNDAMENTALS OF IOT

UNIT IV BUILDING IOT
Open Hardware Platforms: Interfaces, Programming, APIs and Hacks – Web Services – Integration of Sensors and Actuators with Arduino/Raspberry Pi/ Other Light Weight Boards.

UNIT V APPLICATIONS

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
• Analyze architecture of embedded processors and micro controllers.
• Design and deploy timers and interrupts.
• Design and develop the prototype of embedded and IoT systems.
• Design portable IoT using Arduino/Raspberry Pi/equivalent boards.
• Analyze and develop applications of IoT in real time scenario.

REFERENCES:

<table>
<thead>
<tr>
<th>CO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO 1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO 2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO 3</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO 4</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO 5</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

MC5308 ACCOUNTING AND FINANCIAL MANAGEMENT FOR APPLICATION DEVELOPMENT

OBJECTIVES:
- To understand the basic principles of Double entry system and preparation of balance sheet.
- To understand partnership accounts
- To understand the process of estimating the depreciation of a particular asset.
- To understand single entry accounting

UNIT I INTRODUCTION TO ACCOUNTING 9

UNIT II FINAL ACCOUNTS 9
Preparation of Final Accounts of a Sole Trading Concern – Adjustments Receipts and Payments Account, Income & Expenditure Account and Balance Sheet of Non Trading Organizations

UNIT III PARTNERSHIP ACCOUNTS 9
Partnership Accounts-Final accounts of partnership firms – Basic concepts of admission, retirement and death of a partner including treatment of goodwill - rearrangement of capitals. (Simple problems on Partnership Accounts).

UNIT IV DEPRECIATION 9
UNIT V  SINGLE ENTRY ACCOUNTING  
Single Entry – Meaning, Features, Defects, Differences between Single Entry and Double Entry System – Statement of Affairs Method – Conversion Method

TOTAL: 45 PERIODS

OUTCOMES:
- Able to understand the basics of accounting
- Able to understand balance sheet preparation and do analysis
- Able to understand the partnership accounts
- Able to appreciate and depreciate the assets of an organization in accounting
- Able to understand Single Entry Accounting

REFERENCES:

<table>
<thead>
<tr>
<th>CO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO 1</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 2</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 3</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 4</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 5</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MC5314 DATA SCIENCE LABORATORY L T P C 0 0 4 2

OBJECTIVES:
- To provide hands-on cloud and data analytics frameworks and tools.
- To use the Python/R 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.

EXPERIMENTS:
Do the following experiments using R/Python:
1. Download, install and explore the features of R/Python for data analytics.
2. Use the Diabetes data set from UCI and Pima Indians Diabetes data set for performing the following:
b. Bivariate Analysis: Linear and logistic regression modeling.

c. Multiple Regression Analysis

d. 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.

Implement the following using Hadoop, Map Reduce, HDFS, Hive:

1. Perform setting up and Installing Hadoop in its two operating modes: pseudo-distributed and fully distributed.

2. Implement the following file management tasks in Hadoop: adding files and directories, Retrieving files and Deleting files

3.  
   (i) Performing a MapReduce Job for word search count (look for specific keywords in a file)
   (ii) Implement stop word elimination problem: Input a large textual file containing one sentence per line and a small file containing a set of stop words (one stop word per line) and save the results in an output textual file containing the same sentences of the large input file without the words appearing in the small file.

4. Implement a MapReduce program that processes a weather data set to:
   (i) Find average, max and min temperature for each year in National Climate DataCentre data set.
   (ii) Filter the readings of a set based on value of the measurement. The program must save the line of input files associated with a temperature value greater than 30.0 and store it in a separate file.

5. Install, deploy & configure Apache Spark cluster. Run Apache Spark applications using Scala.

6. Install and run Hive then use Hive to create, alter, and drop databases, tables, views, functions, and indexes.

7. Mini projects on the following:
   (i) Simulate a simple recommender system with Amazon product dataset, SocialTweet data set etc. on Hadoop.
   (ii) Perform a very large text classification run on Hadoop.

**TOTAL: 60 PERIODS**

**OUTCOMES:**

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

1. Install analytical tools and configure distributed file system.

2. Have skills in developing and executing analytical procedures in various distributed frameworks and databases.

3. Develop, implement and deploy simple applications on very large datasets.

4. Implement simple to complex data modeling in NoSQL databases.

5. Develop and deploy simple applications in cloud.

**MC5315**  **INTERNET OF THINGS LABORATORY**  **L T P C**

**0 0 4 2**

**OBJECTIVES:**

- To learn tools relevant to embedded system and IoT development.
• To write simple assembly programs that uses various features of the processor.
• To design and develop IoT application Arduino/Raspberry pi for real world scenario.

EXPERIMENTS:

PART I:
1. Implement assembly and Interfacing Programs Using Embedded C.
2. Embedded Application Development
   (i) Using Arduino and Raspberry Pi
   (ii) Using Bluemix platform
3. IoT Application Development
   (i) Using sensors and actuators (temperature sensor, light sensor, infrared sensor)
   (ii) Interfacing sensors with Arduino/Raspberry Pi/other equivalent boards
   (iii) Reading data from sensors
4. Explore different communication methods with IoT devices.
5. Collecting and processing data from IoT systems in the cloud using Xively PaaS.

TOTAL: 60 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Write and implement simple assembly programs that use various features of the processor.
2. Test and experiment different sensors for application development Arduino/Raspberry Pi/ Equivalent boards.
3. Develop IOT applications with different platform and frameworks.

MC5003 SOFTWARE PROJECT MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:
• To know of how to do project planning for the software process.
• To learn the cost estimation techniques during the analysis of the project.
• To understand the quality concepts for ensuring the functionality of the software

UNIT I SOFTWARE PROJECT MANAGEMENT CONCEPTS 9

UNIT II SOFTWARE EVALUATION AND COSTING 9

UNIT III SOFTWARE ESTIMATION TECHNIQUES 9
Software Effort Estimation: Problems with over and under estimations, Basis of software

UNIT IV RISK MANAGEMENT

UNIT V GLOBALIZATION ISSUES IN PROJECT MANAGEMENT

TOTAL: 45 PERIODS

OUTCOMES:
- Understand the activities during the project scheduling of any software application.
- Learn the risk management activities and the resource allocation for the projects.
- Can apply the software estimation and recent quality standards for evaluation of the software projects
- Acquire knowledge and skills needed for the construction of highly reliable software project
- Able to create reliable, replicable cost estimation that links to the requirements of project planning and managing.

REFERENCES:

MC5016 AGILE METHODOLOGIES L T P C
3 0 0 3

OBJECTIVES:
- To provide students with a theoretical as well as practical understanding of agile software development practices and how small teams can apply them to create high-quality software.
● To provide a good understanding of software design and a set of software technologies and APIs.
● To do a detailed examination and demonstration of Agile development and testing techniques.
● To understand the benefits and pitfalls of working in an Agile team.
● To understand Agile development and testing

UNIT I AGILE METHODOLOGY

UNIT II AGILE PROCESSES

UNIT III AGILITY AND KNOWLEDGE MANAGEMENT

UNIT IV AGILITY AND REQUIREMENTS ENGINEERING

UNIT V AGILITY AND QUALITY ASSURANCE

TOTAL: 45 PERIODS

OUTCOMES:
● Realize the importance of interacting with business stakeholders in determining the requirements for a software system
● Perform iterative software development processes: how to plan them, how to execute them.
● Point out the impact of social aspects on software development success.
● Develop techniques and tools for improving team collaboration and software quality.
● Show how agile approaches can be scaled up to the enterprise level
REFERENCES

<table>
<thead>
<tr>
<th>CO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO 1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 3</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 4</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 5</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MC5017 E-LEARNING

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

UNIT II DESIGNING E-LEARNING COURSE CONTENT
UNIT III CREATING INTERACTIVE CONTENT

UNIT IV LEARNING PLATFORMS

UNIT V COURSE DELIVERY AND EVALUATION

TOTAL: 45 PERIODS

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

REFERENCE BOOKS:

<table>
<thead>
<tr>
<th>COs/POs &amp; PSOs</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 – Slight, 2 – Moderate, 3 – Substantial.
OBJECTIVES:
- To know the behavior of the testing techniques and to design test cases to detect the errors in the software
- To get insight into software testing methodologies
- To understand standard emerging areas in testing
- To learn about the software quality models.
- To understand the models and metrics of software quality and reliability.

UNIT I INTRODUCTION

UNIT II SOFTWARE TESTING METHODOLOGY

UNIT III EMERGING SPECIALIZED AREAS IN TESTING

UNIT IV SOFTWARE QUALITY MODELS

UNIT V QUALITY THROUGH CONTINUOUS IMPROVEMENT PROCESS
Role of Statistical Methods in Software Quality – Transforming Requirements into Test Cases – Deming’s Quality Principles – Continuous Improvement through Plan Do Check Act (PDCA)

OUTCOMES:
Up on completion of the course the students will be able to
- choose the software testing techniques to cater to the need of the project
- identify the components of software quality assurance systems
- apply various software testing strategies
- design and develop software quality models
- make use of statistical methods in software quality.

REFERENCE BOOKS:

<table>
<thead>
<tr>
<th>COs/POs &amp; PSOs</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</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>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

MC5019 ADVANCES IN OPERATING SYSTEMS

OBJECTIVES:
- To learn the fundamentals of Operating Systems
- To gain knowledge on Distributed operating system concepts that includes architecture, Mutual exclusion algorithms, Deadlock detection algorithms and agreement protocols
- To gain insight on to the distributed resource management components viz. the algorithms for implementation of distributed shared memory, recovery and commit protocols
- To know the components and management aspects of Real time, Mobile operating systems

UNIT I FUNDAMENTALS OF OPERATING SYSTEMS

UNIT II DISTRIBUTED OPERATING SYSTEMS

UNIT III DISTRIBUTED RESOURCE MANAGEMENT

UNIT IV REAL TIME AND MOBILE OPERATING SYSTEMS 9

Basic Model of Real Time Systems - Characteristics- Applications of Real Time Systems –
Real Time Task Scheduling - Handling Resource Sharing - Mobile Operating Systems –
Micro Kernel Design - Client Server Resource Access – Processes and Threads - Memory
Management - File system.

UNIT V CASE STUDIES 9

Linux System: Design Principles - Kernel Modules - Process Management Scheduling -
Memory Management - Input-Output Management - File System – Interprocess
Communication. iOS and Android: Architecture and SDK Framework - Media Layer -
Services Layer - Core OS Layer - File System.

TOTAL: 45 PERIODS

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

- Discuss the various synchronization, scheduling and memory management issues
- Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of
  Distributed operating system
- Discuss the various resource management techniques for distributed systems
- Identify the different features of real time and mobile operating systems
- Install and use available open source kernel

REFERENCES:
1. Abraham Silberschatz; Peter Baer Galvin; Greg Gagne, “Operating System
   Distributed, Database, and Multiprocessor Operating Systems”, Tata McGraw-
   2018.
   media, 2011.
5. Rajib Mall, “Real-Time Systems: Theory and Practice”, Pearson Education India,
6. Daniel P Bovet and Marco Cesati, “Understanding the Linux kernel”, 3rd

<table>
<thead>
<tr>
<th>COs/POs &amp; PSOs</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td></td>
<td></td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</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>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>√</td>
<td></td>
</tr>
</tbody>
</table>
OBJECTIVES:

- Learn digital image fundamentals.
- Be exposed to simple image processing techniques.
- Learn to represent image enhancement in the spatial and frequency domain.
- Be familiar with image restoration and segmentation techniques.

UNIT I  DIGITAL IMAGE FUNDAMENTALS  9
Elements of visual perception, Electromagnetic Spectrum-overview, Image Sensing and Image Acquisition Systems, Sampling and Quantization, Image Formation, Image Geometry, Relationship between pixels, Basic concepts of distance transform, Color Image fundamentals-RGB-HIS Models, Different color models-conversion

UNIT II  IMAGE TRANSFORMS  9
Unitary Image Transforms-1D Discrete Fourier Transform (DFT), Properties of DFT, 2D transforms – 2D DFT, Discrete Cosine Transform, Hadamard, Walsh and PCA.

UNIT III  IMAGE ENHANCEMENT  9

UNIT IV  IMAGE RESTORATION  9

UNIT V  MORPHOLOGICAL IMAGE PROCESSING AND SEGMENTATION  9
Basic Morphological operators-erosion, dilation, opening and closing-Basic Morphological Reconstruction Algorithms. Segmentation: point, line, edge detection, Region based segmentation, Region Splitting and Merging Technique, Thresholding Techniques, Applications of image processing.

TOTAL: 45 PERIODS

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

- Learn how images are formed, sampled, quantized and represented digitally
- Understand and analyze the different image transform techniques
- Understand how the images are enhanced to improve subjective perception to spatial domain and frequency domain.
- Apply image restoration techniques
Analyze the fundamental concepts of Morphological Image Processing and Segmentation techniques.

REFERENCES:

<table>
<thead>
<tr>
<th>COs/POs &amp; PSOs</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td></td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MC5021  COMPILER OPTIMIZATION TECHNIQUES  L T P C  3 0 0 3

OBJECTIVES:
- To understand the optimization techniques used in compiler design.
- To be aware of the various computer architectures that support parallelism.
- To become familiar with the theoretical background needed for code optimization.
- To understand the techniques used for identifying parallelism in a sequential program.
- To learn the various optimization algorithms.

UNIT I   INTRODUCTION  9
UNIT II INSTRUCTION-LEVEL PARALLELISM 9

UNIT III OPTIMIZING FOR PARALLELISM AND LOCALITY-THEORY 9
Basic Concepts – Matrix-Multiply: An Example - Iteration Spaces - Affine Array Indexes – Data Reuse Array data dependence Analysis.

UNIT IV OPTIMIZING FOR PARALLELISM AND LOCALITY APPLICATION 9

UNIT V INTERPROCEDURAL ANALYSIS 9

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course the students should be able to:
• Identify the various sources of optimization
• identify the constraints and architectures of parallel execution of instructions
• identify the sources of optimization of parallel execution of instructions
• apply the process of optimization using various techniques
• Implement optimization techniques

REFERENCES:

<table>
<thead>
<tr>
<th>CO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO 10</th>
<th>PO 11</th>
<th>PO 12</th>
<th>PSO 1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO 1</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 2</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 3</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 4</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 5</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
OBJECTIVES:

- To learn the technologies of the .NET framework.
- To cover all segments of programming in C# starting from the language basis, 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  9

UNIT II  C# ADVANCED FEATURES  9

UNIT III  BASE CLASS LIBRARIES AND DATA MANIPULATION  9

UNIT IV  WINDOW AND WEB BASED APPLICATIONS  9

UNIT V  .NET COMPACT FRAMEWORK  9

TOTAL: 45 PERIODS

OUTCOMES:

Up 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 application using ASP.NET.
- Create mobile application using .NET compact framework.
REFERENCES:

<table>
<thead>
<tr>
<th>CO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO 10</th>
<th>PO 11</th>
<th>PO 12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO 1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 3</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 4</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 5</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MC5023 WIRELESS NETWORKING L T P C
3 0 0 3

OBJECTIVES:
The student should be made:
- To understand the concept about Wireless networks, protocol stack and standards
- To understand and analyse the network layer solutions for Wireless networks
- To study about fundamentals of 3G Services, its protocols and applications
- To learn about evolution of 4G Networks, its architecture and applications
- To explore the architecture of 5G, 5G Modulation Schemes and to analyse the concept of MIMO and other research areas in 5G

UNIT I WIRELESS LAN 9

UNIT II MOBILE NETWORK LAYER 9

52
UNIT III  3G OVERVIEW

UNIT IV  4G NETWORKS

UNIT V  5G NETWORKS

TOTAL: 45 PERIODS

OUTCOMES: outcomes to be changed with respect to contents
At the end of the course, the student should be able to:
- Conversant with the latest 3G/4G networks and its architecture
- Design and implement wireless network environment for any application using latest wireless protocols and standards
- Ability to select the suitable network depending on the availability and requirement
- Implement different type of applications for smart phones and mobile devices with latest network strategies

REFERENCES:
MC5024 WEB DESIGN  
3 0 0 3

OBJECTIVES:
• To understand the concepts and architecture of the World Wide Web.
• To understand and practice markup languages
• To understand and practice embedded dynamic scripting on client-side Internet Programming
• To understand and practice web development techniques on client-side.
• The objective is to enable the students to understand the Organizational Behaviour, and Organizational Change and dynamic of groups.

UNIT I  INTRODUCTION TO WWW

UNIT II  UI DESIGN
HTML Documents-Understanding markup languages-Structure of HTML Documents-Markup Tags-Basic markup tags-Working with Text-Working with Images-Hyperlinks -Images-Tables-List-SVG-Advanced HTML- Iframes-HTMl5 Video and Audio tags Cascading Style Sheet: Need for CSS - Importance of separating document structuring and styling-Basic CSS selectors and properties-CSS properties for text (Color, font, weight, align, etc.) and working with colors-Selecting with classes, IDs, tags-CSS Specificity-Ways of linking CSS to HTML-CSS Pseudo selectors-Understanding the box model - Margins, padding and border – Inline and block elements -Structuring pages using Semantic Tags

UNIT III  WEB PAGE LAYOUTS WITH CSS3
Positioning with CSS – Positions, Floats, z-index-Layouts with Flexbox –Responsive web design with media queries-Advanced CSS Effects – Gradients, opacity, box-shadow-CSS3 Animations – Transforms and Transitions-CSS Frameworks – Bootstrap

UNIT IV  JAVA SCRIPT
Basic JavaScript syntax-JavaScript Objects and JSON-Understanding the DOM-JavaScript Events and Input validation-Modifying CSS of elements using JavaScript-JavaScript Local Storage and Session Storage-Cross domain data transfer with AJAX-Using JQuery to add interactivity-JQuery Selectors-JQuery Events-Modifying CSS with JQuery -Adding and removing elements with JQuery-AJAX with JQuery-Animations with JQuery (hide, show, animate, fade methods, Slide Method)
UNIT V  SERVER-SIDE PROGRAMMING WITH PHP

PHP basic syntax-PHP Variables and basic data structures-Using PHP to manage form submissions-File Handling -Cookies and Sessions with PHP-Working with WAMP and PHPMYADMIN-Establishing connectivity with MySQL using PHP

TOTAL: 45 PERIODS

OUTCOMES:
- Create a basic website using HTML and Cascading Style Sheets.
- Create websites with complex layouts
- Add interactivity to websites using simple scripts
- Design rich client presentation using AJAX.
- Add business logic to websites using PHP and databases

REFERENCES:
4. Keith J Grant; “CSS in Depth”, Manning Publications. 1st edition, 2018

<table>
<thead>
<tr>
<th>CO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO 1</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>CO 2</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>CO 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>CO 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>CO 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

MC5025  NETWORK PROGRAMMING AND SECURITY  L T P C
3 0 0 3

OBJECTIVES:
- To understand the basics of Network Programming
- To be familiar with building network applications
- To design and implement client server Applications using TCP and UDP Sockets
- To expose with various socket options
- To get aware of Network security for Network Programming
UNIT I  INTRODUCTION
TCP/IP Layer Model – Multicast, broadcast and Any cast - Socket address Structures – Byte ordering functions – address conversion functions – Elementary TCP Sockets – socket, connect, bind, listen, accept, read, write , close functions – Iterative Server – Concurrent Server

UNIT II  ELEMENTARY TCP SOCKETS
TCP Echo Server – TCP Echo Client – Posix Signal handling – Server with multiple clients – boundary conditions: Server process Crashes, Server host Crashes, Server Crashes and reboots, Server Shutdown

UNIT III  SOCKET OPTIONS AND MULTIPLEXING

UNIT IV  ELEMENTARY UDP SOCKETS

UNIT V  NETWORK SECURITY

TOTAL: 45 PERIODS

REFERENCE BOOKS:

OUTCOMES:
Upon completion of the course, the student will be able to
• Design and implement the client/server programs using variety of protocols
• Understand the key protocols which support Internet
• Demonstrate advanced knowledge of programming interfaces for network communication
Use the basic tools for design and testing of network programs in Unix environment.

Identify some of the factors driving the need for network security.

<table>
<thead>
<tr>
<th>CO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO 1</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>√</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 2</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 3</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 4</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>√</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 5</td>
<td></td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MC5026 MICROSERVICES AND DEVOPS

OBJECTIVES:
- To introduce Microservices and Containers.
- To understand the key concepts and principles of DevOps.
- To be familiar with most common DevOps tools.
- To explain the business benefits of DevOps and continuous delivery.
- To recall specific DevOps methodologies and frameworks.

UNIT I INTRODUCTION TO MICROSERVICES
Definition of Microservices – Characteristics – Microservices and Containers – Interacting with Other Services – Monitoring and Securing the Services – Containerized Services – Deploying on Cloud.

UNIT II MICROSERVICES ARCHITECTURE
Monolithic architecture- Microservice architectural style- Benefits - Drawbacks of Microservice architectural style - decomposing monolithic applications into Microservices.

UNIT III BASICS OF DEVOPS

UNIT IV MICROSERVICES IN DEVOPS ENVIRONMENT

UNIT V VELOCITY AND CONTINUOUS DELIVERY

TOTAL: 45 PERIODS

OUTCOMES:
At the end of this course, the students will be able to:
- Understand the Microservices and containers.
● apply Microservices in DevOps
● Understand about DevOps and the common tools used in DevOps.
● Develop and integrate projects using DevOps
● Deploy and monitor projects using DevOps.

REFERENCES:

<table>
<thead>
<tr>
<th>Mapping of COs with POs and PSOs</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</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>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td></td>
<td></td>
<td></td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>√</td>
<td></td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MC5027 SOCIAL NETWORK ANALYTICS L T P C 3 0 0 3

OBJECTIVES:

● To gain knowledge about social networks, its structure and their data sources.
● To study about the knowledge representation technologies for social network analysis.
● To analyse the data left behind in social networks.
● To gain knowledge about the community maintained social media resources.
● To learn about the visualization of social networks.

UNIT I INTRODUCTION TO SEMANTIC WEB
UNIT II KNOWLEDGE REPRESENTATION ON THE SEMANTIC WEB
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.

UNIT III SOCIAL NETWORK MINING
Detecting Communities in Social Network – Evaluating Communities – Methods for Community Detection – Applications of Community Mining Algorithms – Tools for detecting communities – Application: Mining Facebook - Exploring Facebook's social Graph API – Analyzing social graph connections

UNIT IV COMMUNITY MAINTAINED SOCIAL MEDIA RESOURCES
Community Maintained Resources – Supporting technologies for community maintained resources– User motivations–Location based social interaction – location technology– mobile location sharing – Social Information Sharing and social filtering – Automated recommender system.

UNIT V VISUALIZATION OF SOCIAL NETWORKS

TOTAL: 45 PERIODS

OUTCOMES:
Up on completion of the course, the students will be able to:
- Explain the basic principles behind network analysis algorithms.
- Model and represent knowledge for social semantic Web.
- Use extraction and mining tools for analyzing Social networks.
- Discuss about community maintained social media resources.
- Develop personalized visualization for Social networks.

REFERENCES:

<table>
<thead>
<tr>
<th>CO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO 1</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✔</td>
</tr>
<tr>
<td>CO 2</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
MC5028 BIO INSPIRED COMPUTING L T P C 3 0 0 3

OBJECTIVES:
- To Learn bio-inspired theorem and algorithms
- To Understand random walk and simulated annealing
- To Learn genetic algorithm and differential evolution
- To Learn swarm optimization and ant colony for feature selection
- To understand bio-inspired application in various fields

UNIT I INTRODUCTION 9

UNIT II RANDOM WALK AND ANEALING 9

UNIT III GENETIC ALOGORITHMS AND DIFFERENTIAL EVOLUTION 9

UNIT IV SWARM OPTIMIZATION AND FIREFLY ALGORITHM 9

UNIT V APPLICATIONS OF BIO INSPIRED COMPUTING 9

OUTCOMES:
Upon completion of the course, the students should be able to
- Implement and apply bio-inspired algorithms
- Explain random walk and simulated annealing
- Implement and apply genetic algorithms

TOTAL: 45 PERIODS
• Explain swarm intelligence and ant colony for feature selection
• Apply bio-inspired techniques in various fields.

REFERENCES:
5. Yang , Cui, Xiao, Gandomi, Karamanoglu, "Swarm Intelligence and Bio-Inspired Computing", Elsevier First Edition 2013

<table>
<thead>
<tr>
<th>CO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO 10</th>
<th>PO 11</th>
<th>PO 12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO 1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 3</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 4</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 5</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MC5029 INFORMATION RETRIEVAL TECHNIQUES L T P C 3 0 0 3

OBJECTIVES:
• To understand the basics of information retrieval with pertinence to modeling, query operations and indexing
• To get an understanding of machine learning techniques for text classification and clustering.
• To understand the various applications of information retrieval giving emphasis to multimedia IR, web search
• To understand the concepts of digital libraries

UNIT I INTRODUCTION: MOTIVATION 9

UNIT II MODELING 9
UNIT III INDEXING 9
Static and Dynamic Inverted Indices – Index Construction and Index Compression.

UNIT IV CLASSIFICATION AND CLUSTERING 9
Text Classification and Naïve Bayes – Vector Space Classification – Support vector machines and Machine learning on documents. Flat Clustering – Hierarchical Clustering – Matrix decompositions and latent semantic indexing – Fusion and Meta learning

UNIT V SEARCHING THE WEB 9

TOTAL: 45 PERIODS

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

- Build an Information Retrieval system using the available tools.
- Identify and design the various components of an Information Retrieval system.
- Model an information retrieval system
- Apply machine learning techniques to text classification and clustering which is used for efficient Information Retrieval.
- Design an efficient search engine and analyze the Web content structure.

REFERENCES:

<table>
<thead>
<tr>
<th>CO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO 10</th>
<th>PO 11</th>
<th>PO 12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO 1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO 2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO 3</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO 4</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO 5</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>
OBJECTIVES:
- Understand software architectural requirements and drivers
- Be exposed to architectural styles and views
- Be familiar with architectures for emerging technologies

UNIT I  INTRODUCTION AND ARCHITECTURAL DRIVERS  9

UNIT II  QUALITY ATTRIBUTE WORKSHOP  9
Quality Attribute Workshop – Documenting Quality Attributes – Six part scenarios – Case studies.

UNIT III  ARCHITECTURAL VIEWS  9

UNIT IV  ARCHITECTURAL STYLES  9
Introduction – Data flow styles – Call-return styles – Shared Information styles – Event styles – Case studies for each style.

UNIT V  DOCUMENTING THE ARCHITECTURE  9
Good practices – Documenting the Views using UML – Merits and Demerits of using visual languages – Need for formal languages – Architectural Description Languages – ACME – Case studies. Special topics: SOA and Web services – Cloud Computing – Adaptive structures

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to
- Explain influence of software architecture on business and technical activities
- Summarize quality attribute workshop
- Identify key architectural structures
- Use styles and views to specify architecture
- Design document for a given architecture

REFERENCES:
OBJECTIVES:
- To learn the security issues network layer and transport layer.
- To be exposed to security issues of the application layer.
- To be familiar with forensics tools.
- To analyze and validate forensics data.
- To perform digital forensic analysis based on the investigator's position.

UNIT I  INTRODUCTION

UNIT II  ANTI-FORENSICS & LEGAL

UNIT III  EVIDENCE COLLECTION

UNIT IV  COMPUTER FORENSICS
UNIT V NETWORK FORENSICS & MOBILE DEVICE FORENSICS


TOTAL: 45 PERIODS

OUTCOME:
Upon Completion of the course, the students will be able to

- Explain digital forensic process and role of forensic examiner.
- Explore Legal amendments.
- Demonstrate evidence collection
- Explore computer forensics, network forensics and mobile device forensics.
- Make Use forensics tools.

REFERENCES:

Mapping of COs with POs and PSOs

<table>
<thead>
<tr>
<th>COs/POs &amp; PSOs</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</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>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MC5032 DATA MINING AND DATA WAREHOUSING TECHNIQUES L T P C

OBJECTIVES:
- To gain knowledge on data mining and the need for pre-processing.
- To characterize the kinds of patterns that can be discovered by association rule mining.
- To implement classification techniques on large datasets.
- To analyze various clustering techniques in real world applications.
To get exposed to the concepts of data warehousing architecture and implementation.

UNIT I DATA MINING & DATA PREPROCESSING
9

UNIT II ASSOCIATION RULE MINING AND CLASSIFICATION BASICS
9
Introduction to Association rules — Association Rule Mining — Mining Frequent Itemsets with and without Candidate Generation — Mining Various Kinds of Association Rules — Classification versus Prediction — Data Preparation for Classification and Prediction.

UNIT III CLASSIFICATION AND PREDICTION TECHNIQUES
9
Classification by Decision Tree — Bayesian Classification — Rule Based Classification — Bayesian Belief Networks — Classification by Back Propagation — Support Vector Machines — K-Nearest Neighbor Algorithm — Linear Regression, Nonlinear Regression, Other Regression-Based Methods

UNIT IV CLUSTERING TECHNIQUES
9

UNIT V DATA WAREHOUSE
9

OUTCOMES:
On completion of the course, the students will be able to:
1. Identify data mining techniques in building intelligent model.
2. Illustrate association mining techniques on transactional databases.
3. Apply classification and clustering techniques in real world applications.
4. Evaluate various mining techniques on complex data objects.
5. Design, create and maintain data warehouses.

REFERENCES:
MC5033 DATA VISUALIZATION TECHNIQUES L T P C 3 0 0 3

OBJECTIVES:
- To understand the categories of data quality principles.
- To describe data through visual representation.
- To provide basic knowledge about how large datasets are represented into visual graphics and easily understand about the complex relationships within the data.
- To design effective visualization techniques for any different problems.

UNIT I INTRODUCTION 9

UNIT II VISUALIZATION FOUNDATIONS 9

UNIT III DESIGNING EFFECTIVE VISUALIZATION 9
Steps in Designing Visualization – problems in Designing Effective Visualization – Comparing and evaluating visualization techniques – Visualization Systems.

UNIT IV INFORMATION DASHBOARD DESIGN 9

UNIT V VISUALIZATION SYSTEMS 9

TOTAL: 45 PERIODS

OUTCOME:
On completion of the course the student should be able to:
- Describe principles of visual perception
- Apply visualization techniques for various data analysis tasks – numerical data
- Apply visualization techniques for various data analysis tasks – Non numerical data
- Design effective visualization techniques for different problems
- Design information dashboard.
REFERENCES:

<table>
<thead>
<tr>
<th>Mapping of COs with POs and PSOs</th>
</tr>
</thead>
<tbody>
<tr>
<td>COs/POs &amp; PSOs</td>
</tr>
<tr>
<td>CO1</td>
</tr>
<tr>
<td>CO2</td>
</tr>
<tr>
<td>CO3</td>
</tr>
<tr>
<td>CO4</td>
</tr>
<tr>
<td>CO5</td>
</tr>
</tbody>
</table>

MC5034 OPERATIONS RESEARCH L T P C 3 0 0 3

OBJECTIVES:
- To provide the concept and an understanding of basic concepts in Operations Research techniques for Analysis and Modeling in Computer Applications.
- To understand, develop and solve mathematical models of linear programming problems.
- To understand, develop and solve mathematical models of Transport and assignment problems.
- To understand network modeling for planning and scheduling the project activities.

UNIT I LINEAR PROGRAMMING MODELS
Formulation of LPP, Graphical solution of LPP. Simplex Method, Artificial variables: big-M method, degeneracy and unbound solutions.

UNIT II TRANSPORTATION AND ASSIGNMENT MODELS

UNIT III SCHEDULING BY PERT AND CPM
Introduction - Rules to frame a Network - Fulkerson’s Rule to numbering of events - Activity, Times - Critical Path Computation - Slack and Float - PERT- Steps and computing variance, Merits and demerits of PERT, CPM- Time estimating & Limitations, Comparison between PERT & CPM.
UNIT IV QUEUEING MODELS

Characteristics of Queueing Models—Poisson Queues—(M / M / 1):(FIFO / ∞ / ∞), (M / M / 1):(FIFO / N / ∞), (M / M / C):(FIFO / ∞ / ∞), (M / M / C):(FIFO / N / ∞) models.

UNIT V GAME THEORY

Competitive game, rectangular game, saddle point, minimax (maximin) method of optimal strategies—value of the game. Solution of games with saddle points, dominance principle. Rectangular games without saddle point—mixed strategy for 2 X 2 games.

TOTAL: 45 PERIODS

OUTCOMES:
Upon Completion of the course, the students will be able to
- Understand and apply linear programming to solve operational problems with constraints
- Apply transportation and assignment models to find optimal solutions
- To prepare project scheduling using PERT and CPM
- Identify and analyze appropriate queueing models to reduce the waiting time in queue.
- To choose the best strategy using decision-making methods under game theory.

REFERENCES:

Mapping of COs with POs and PSOs

<table>
<thead>
<tr>
<th>COs/POs &amp; PSOs</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</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>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MC5035 PROFESSIONAL ETHICS IN IT

OBJECTIVES:
- To understand the concepts of computer ethics in work environment.
- To understand the threats in computing environment
- To understand the intricacies of accessibility issues
To ensure safe exits when designing the software projects

UNIT I
INTRODUCTION TO ETHICS
Definition of Ethics- Right, Good, Just- The Rational Basis of Ethics -Theories of Right: Intuitionist vs. End-Based vs. Duty-Based -Rights, Duties, Obligations -Theory of Value -Conflicting Principles and Priorities -The Importance of Integrity -The Difference Between Morals, Ethics, and Laws -Ethics in the Business World - Corporate Social Responsibility -Creating an Ethical Work Environment -Including Ethical Considerations in Decision Making

UNIT II
ETHICS IN INFORMATION TECHNOLOGY, INTERNET CRIME

UNIT III
FREEDOM OF EXPRESSION, PRIVACY

UNIT IV
FREEDOM OF EXPRESSION, INTELLECTUAL PROPERTY RIGHTS

UNIT V
SOCIAL NETWORKING ETHICS AND ETIQUETTES

TOTAL: 45 PERIODS

OUTCOMES:
Upon Completion of the course, the students will be able to

- Helps to examine situations and to internalize the need for applying ethical principles, values to tackle with various situations.
- Develop a responsible attitude towards the use of computer as well as the technology.
- Able to envision the societal impact on the products/projects they develop in their career
- Understanding the code of ethics and standards of computer professionals.
- Analyze the professional responsibility and empowering access to information in the workplace.

REFERENCES:

<table>
<thead>
<tr>
<th>CO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MC5036 MARKETING MANAGEMENT L T P C
3 0 0 3

OBJECTIVE:
- To provide basic knowledge of concepts, principles, tools and techniques of Marketing.
- To provide an exposure to the students pertaining to marketing strategies, which they are expected to possess when they enter the industry as practitioners.
- To give them an understanding of the various marketing Strategies used in consumer and industrial marketing.

UNIT I INTRODUCTION TO MARKETING MANAGEMENT 9
UNIT II  MARKETING ENVIRONMENT  9

UNIT III  CONSUMER AND BUSINESS BUYER BEHAVIOUR  9

UNIT IV  SEGMENTATION, TARGETING AND POSITIONING  9

UNIT V  INTERNATIONAL MARKETING MANAGEMENT & RECENT TRENDS  9
Introduction - Nature of International Marketing - International Marketing Concept – International Market Entry Strategies - Approaches to International Marketing - Cause related marketing - Ethics in marketing –Online marketing trends.

TOTAL: 45 PERIODS

OUTCOMES:
- Knowledge of basic understanding in solving marketing related problems.
- Awareness of marketing management process, strategies and the marketing mix elements.
- Clear understanding of functional area of marketing
- Demonstrating conceptual knowledge and analytical skills in analyzing the marketing environment.
- Develop skills in recent trends in global marketing.

REFERENCES:

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

72
OBJECTIVE:
- The objective is to enable the students to understand the Organizational Behavior, and Organizational Change and dynamic of groups.

UNIT I ORGANISATIONAL BEHAVIOUR
Organization Behaviour – Definition – Scope and Application in Management – Contributions of Other Disciplines to OB. Emerging Issues in Organizational Behaviour- Organizational behaviour models

UNIT II INDIVIDUAL PROCESSES

UNIT III LEADERSHIP AND POWER

UNIT IV GROUP DYNAMICS

UNIT V ORGANISATIONAL CHANGE AND DEVELOPMENT

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course should be able to:
- Students will have a better understanding of human behavior in organization.
- They will know the framework for managing individual and group performance.
- Characteristics of attitudes and components of attitudes — A brief discussion
- List the determinants of personality
- List the characteristics of various leadership styles.

REFERENCES:

<table>
<thead>
<tr>
<th>CO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO 1</td>
<td></td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 2</td>
<td></td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MC5038 BUSINESS DATA ANALYTICS L T P C 3 0 0 3

OBJECTIVES:
- To understand the basics of business analytics and its life cycle.
- To gain knowledge about fundamental business analytics.
- To learn modeling for uncertainty and statistical inference.
- To understand analytics using Hadoop and Map Reduce frameworks.
- To acquire insight on other analytical frameworks.

UNIT I OVERVIEW OF BUSINESS ANALYTICS

UNIT II ESSENTIALS OF BUSINESS ANALYTICS
UNIT III  MODELING UNCERTAINTY AND STATISTICAL INFERENCE  9
Modeling Uncertainty: Events and Probabilities – Conditional Probability – Random
Variables – Discrete Probability Distributions – Continuous Probability Distribution –
Statistical Inference: Data Sampling – Selecting a Sample – Point Estimation – Sampling

UNIT IV  ANALYTICS USING HADOOP AND MAPREDUCE FRAMEWORK  9
Introducing Hadoop – RDBMS versus Hadoop – Hadoop Overview – HDFS (Hadoop
Distributed File System) – Processing Data with Hadoop – Introduction to MapReduce –
Features of MapReduce – Algorithms Using Map-Reduce: Matrix-Vector Multiplication,
Relational Algebra Operations, Grouping and Aggregation – Extensions to MapReduce

UNIT V  OTHER DATA ANALYTICAL FRAMEWORKS  9
Overview of Application development Languages for Hadoop – PigLatin – Hive – Hive Query
Language (HQL) – Introduction to Pentaho, JAQL – Introduction to Apache: Sqoop, Drill and
Spark, Cloudera Impala – Introduction to NoSQL Databases – Hbase and MongoDB.

TOTAL: 45 PERIODS

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

- Identify the real world business problems and model with analytical solutions.
- Solve analytical problem with relevant mathematics background knowledge.
- Convert any real world decision making problem to hypothesis and apply suitable
  statistical testing.
- Write and Demonstrate simple applications involving analytics using Hadoop and
  MapReduce
- Use open source frameworks for modeling and storing data.

REFERENCES:
1. U. Dinesh Kumar, “Business Analytics: The Science of Data-Driven Decision
3. Jeffrey D. Camm, James J. Cochran, Michael J. Fry, Jeffrey W. Ohlmann, David R.
   2016.
MC5039 CRYPTOCURRENCY AND BLOCK CHAIN TECHNOLOGIES

Objectives:
- To understand the basics of Blockchain
- To understand the basics of Cryptocurrency
- To understand the working of digital tokens and wallets
- To understand the working of contracts
- To understand the working of block chain platforms

UNIT I OVERVIEW OF BLOCKCHAIN: 9
Why Blockchain - The Structure of Blockchain - Data Structure of Blockchain - Data Distribution in Blockchain - Block Validation. **Block Validators:** Proof of Work – Proof of Stake - Proof of Activity - Proof of Elapsed Time - Proof of Burn.

UNIT II CRYPTOCURRENCY 9

UNIT III HYPERLEDGER 9
Introduction. **Digital Tokens:** Overview - Initial Coin Offering – OmiseGO – EOS – Tether. **MetaMask:** Wallet Seed - MetaMask Transactions. **Mist:** Overview - Mist wallet. **Truffle:** Features of Truffle – Development Truffle boxes - Community truffle box.

UNIT IV SOLIDITY 9
Smart Contracts - Contract and Interfaces - **Hyperledger Fabric:** Introduction - Fabric v/s Ethereum - HyperledgerIroha - Features of Iroha. **Hyperledger Sawtooth:** Components of sawtooth - Proof of Elapsed time.

UNIT V BLOCKCHAIN PLATFORMS 9
Multichain - HydraChain. **Future Blockchain:** IOTA – Corda - Chain Core. **Blockchain Framework:** CoCo Framework – Tierion – BigchainDB.

TOTAL:45 PERIODS
OUTCOME:
Upon Completion of the course, the students will be able to

- describe the Basics of Block chain Technology concepts and its applications
- know about the implementation of Crypto currency
- identify the different ways to achieve Block chain Technology
- Illustrate how to design and build smart contracts using various platforms
- understand about the future of Block chain technology

REFERENCES:

MOOC Website references (Example website references are only given; it’s not an exhaustive list)
1. www.coursera.org
   a. Blockchain
   b. Blockchain and cryptocurrency explained
   c. Blockchain revolution
   d. Bitcoin and Cryptocurrency technologies
   e. Blockchain basics
   f. Introduction to Blockchain
   g. Introduction to Blockchain technologies
   h. Blockchain foundations and use cases
2. www.udemy.com
   a. Build a blockchain and cryptocurrency from scratch
   b. The Basics of Blockchain
   c. Blockchain advanced level
   d. Learn Blockchain technology and cryptocurrency in Java
   e. Full Cryptocurrency courses: Ethereum, bitcoin and blockchain

<table>
<thead>
<tr>
<th>COs/POs &amp; PSOs</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</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>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

77
OBJECTIVES:
The student should be made:
- To understand the theme underlying IPv6 Structure and addressing methods
- To understand and analyse the protocols for IPv6 Implementation
- To identify and provide solutions for QoS and Security Issues with IPv6
- To learn about Software Defined concepts, architectures, protocols and applications
- To explore the significance of Network Function Virtualization

UNIT I IPv6 STRUCTURE AND ADDRESSING

UNIT II IPv6 NETWORKING

UNIT III QoS, PROVISIONING AND SECURITY WITH IPv6

UNIT IV SOFTWARE DEFINED NETWORKING

UNIT V NETWORK FUNCTION VIRTUALIZATION

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
- Understand the fundamentals of IPv6 and IPv6 Protocols
- Analyze the need for separation of data and control plane
- Understand the functionality of NFV
- Be Conversant with the latest networks and its architecture
- Gain an in-depth coverage of various networking technologies
REFERENCES:

<table>
<thead>
<tr>
<th>CO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</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>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</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>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MC5041 SOFT COMPUTING TECHNIQUES L T P C 3 0 0 3

OBJECTIVES:
- To gain knowledge of soft computing theories and its fundamentals.
- To design a soft computing system required to address a computational task.
- To learn and apply artificial neural networks, fuzzy sets and fuzzy logic and genetic algorithms in problem solving and use of heuristics based on human experience.
- To introduce the ideas of fuzzy sets, fuzzy logic and 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 while seeking global optimum in self-learning situations.

UNIT I FUZZY COMPUTING 9
UNIT II  FUNDAMENTALS OF NEURAL NETWORKS  9

UNIT III  BACKPROPAGATION NETWORKS  9

UNIT IV  COMPETITIVE NEURAL NETWORKS  9

UNIT V  GENETIC ALGORITHM  9

TOTAL: 45 PERIODS

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

- Identify and describe soft computing techniques and their roles in building intelligent machines.
- Recognize the feasibility of applying a soft computing methodology for a particular problem.
- Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
- Apply genetic algorithms to optimization problems.
- Design neural networks to pattern classification and regression problems using soft computing approach.

REFERENCES:
Mapping of COs with POs and PSOs

<table>
<thead>
<tr>
<th>COs/POs &amp; PSOs</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSOCO1</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>

MC5042 DEEP LEARNING

OBJECTIVES:
- To understand how to represent the high-dimensional data, such as images, text and data.
- To explain convolution neural network
- To introduce major deep learning algorithms and their applications to solve real world problems.
- To explore about optimization and generalization in Deep learning
- To understand about deep reinforcement learning

UNIT I NEURAL NETWORK

UNIT II CONVOLUTION NEURAL NETWORK
Introduction- Filter and Feature Maps - Full Description of CNN-Max Pooling- Full Architectural Description of CNN- Image Preprocessing Pipeline Enable More Robust Models- Accelerating Training with Batch Normalization- Visualizing Learning with Convolution Network- Leveraging and Learning Convolution Filters - Predefined Convolutional Filters Network (PCFNet)- Transfer Learning with Convolutional Neural Networks.

UNIT III DEEP NETWORKS

UNIT IV OPTIMIZATION AND GENERALIZATION
UNIT V  DEEP REINFORCEMENT LEARNING

Markov Decision Processes-Explore versus Exploit-Policy versus Value Learning-Pole-Cart with Policy Gradients-Q Learning and Deep Q Networks-Improving and Moving Beyond DQN

TOTAL: 45 PERIODS

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

- Describe the fundamental concepts of Neural Networks
- Apply Convolution Neural Network techniques to solve problems in image processing
- Summarize the characteristics of deep Learning
- Comprehend the Optimization and Generalization in Deep Learning
- Interpret the concepts of Deep Reinforcement Learning to solve real world problems.

REFERENCES

<table>
<thead>
<tr>
<th>COs/POs &amp; PSOs</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSOCO1</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>

MC5043  BIG DATA PROCESSING  L T P C
3 0 0 3

OBJECTIVES:
- To know the fundamental concepts of big data and analytics.
- To explore tools and practices for working with big data
- To learn about stream computing.
- To know about the research that requires the integration of large amounts of data.

UNIT I  INTRODUCTION TO BIG DATA

Evolution of Big data – Best Practices for Big data Analytics – Big data characteristics – Validating – The Promotion of the Value of Big Data – Big Data Use Cases- Characteristics of Big Data Applications – Perception and Quantification of Value -Understanding Big Data
Storage – A General Overview of High-Performance Architecture – HDFS – MapReduce and YARN – Map Reduce Programming Model

UNIT II CLUSTERING AND CLASSIFICATION

UNIT III ASSOCIATION AND RECOMMENDATION SYSTEM

UNIT IV STREAM MEMORY

UNIT V NOSQL DATA MANAGEMENT FOR BIG DATA AND VISUALIZATION

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to:
- Work with big data tools and its analysis techniques
- Analyze data by utilizing clustering and classification algorithms
- Learn and apply different mining algorithms and recommendation systems for large volumes of data
- Perform analytics on data streams
- Learn NoSQL databases and management.

REFERENCES:

MOOC REFERENCES:
2. www.coursera.org: Big Data Essentials: HDFS, MapReduce and Spark RDD
3. www.udemy.com: Big Data and Hadop: Interactive Intense Course

<table>
<thead>
<tr>
<th>CO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO 1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO 2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO 3</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO 4</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO 5</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

MC5044 NATURAL LANGUAGE PROCESSING L T P C 3 0 0 3

OBJECTIVES:
- To learn the fundamentals of natural language processing
- To understand word level and syntactic analysis.
- To understand the role of semantics of sentences and pragmatics
- To get knowledge about the machine translation.

UNIT I INTRODUCTION OF BASIC TEXT PROCESSING 9

UNIT II LANGUAGE MODELLING AND SMOOTHING 9

UNIT III SYNTAX, PARSING, SEMANTICS 9
Syntax – Parsing – CKY-PCFGs – Inside and outside probabilities - Dependency grammar and parsing – Transition based Parsing – Formulation – Learning. MST Based Parsing -

**UNIT IV  **  **TOPIC MODELS AND INFORMATION EXTRACTION**  
9

**UNIT V  **  **TEXT SUMMARIZATION & TEXT CLASSIFICATION**  
9
Optimization Based models for summarization – Evaluation- Text classification – sentiment analysis - Affective lexicon -Learning affective lexicons - computing with affective lexicons

TOTAL: 45 PERIODS

**OUTCOMES:**
Upon completion of the course, the students will be able to:
- To tag a given text with basic Language features
- To design an innovative application using NLP components
- To implement a rule based system to tackle morphology/syntax of a language
- To design a tag set to be used for statistical processing for real-time applications
- To apply NLG and machine translation

**REFERENCES:**

<table>
<thead>
<tr>
<th>COs/POs &amp; PSOs</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSOCO1</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>CO2</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>CO3</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>CO4</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>CO5</td>
<td>2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>
OBJECTIVES:
- To introduce Mathematical Logic and their rules for validating arguments and programmes.
- To introduce counting principles for solving combinatorial problems.
- To give exposure to Graph models and their utility in connectivity problems.
- To introduce abstract notion of Algebraic structures for studying cryptographic and its related areas.
- To introduce Boolean algebra as a special algebraic structure for understanding logical circuit problems.

UNIT I LOGIC AND PROOFS

UNIT II COMBINATORICS

UNIT III GRAPHS
- 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

UNIT V LATTICES AND BOOLEAN ALGEBRA

TOTAL: 45 PERIODS

REFERENCE BOOKS:

OUTCOMES:
Upon completion of the module the student should able to:
- Apply Mathematical Logic to validate logical arguments and programmes.
• Apply combinatorial counting principles to solve application problems.
• Apply graph model and graph techniques for solving network other connectivity related problems.
• Apply algebraic ideas in developing cryptograph techniques for solving network security problems.
• Apply Boolean laws in developing and simplifying logical circuits.

BX5001 PROBLEM SOLVING AND PROGRAMMING IN C

OBJECTIVES:
• To understand the basic concepts of problem solving approaches and to develop the algorithms
• Apply the techniques of structured (functional) decomposition to break a program into smaller pieces and describe the mechanics of parameter passing.
• To design, implements, test, and apply the basic C programming concepts.

UNIT I INTRODUCTION TO COMPUTER PROBLEM SOLVING

UNIT II PROGRAMMING AND ALGORITHMS
Programs and Programming – building blocks for simple programs -pseudo code representation – flow charts - Programming Languages - compiler –Interpreter, Loader and Linker - Program execution – Classification of Programming Language - Structured Programming Concept – Illustrated Problems: Algorithm to check whether a given number is Armstrong number or not- Find factorial of a number.

UNIT III BASICS OF ‘C’, INPUT / OUTPUT & CONTROL STATEMENTS
Introduction- Identifier – Keywords - Variables – Constants – I/O Statements - Operators - Initialization –Expressions – Expression Evaluation – Lvalues and Rvalues – Type Conversion in C –Formatted input and output functions - Specifying Test Condition for Selection and Iteration - Conditional Execution - and Selection – Iteration and Repetitive Execution- go to Statement – Nested Loops- Continue and break statements. Programs to be implemented:
1. Write a program to find whether the given year is leap year or Not? (Hint: not every centurion year is a leap. For example 1700, 1800 and 1900 is not a leap year)
2. Write a program to perform the Calculator operations, namely, addition, subtraction, multiplication, division and square of a number.

UNIT IV ARRAYS, STRINGS, FUNCTIONS AND POINTERS
1. Write a program in C to get the largest element of an array using the function.
2. Display all prime numbers between two intervals using functions.
3. Reverse a sentence using recursion.
4. Write a C program to concatenate two strings.
5. Find the frequency of a character in a string.

**UNIT V USER-DEFINED DATATYPES & FILES**


1. Write a C program to Store Student Information in Structure and Display it.
2. The annual examination is conducted for 10 students for five subjects.
3. Write a program to read the data and determine the following:
   (a) Total marks obtained by each student.
   (b) The highest marks in each subject and the marks of the student who secured it.
   (c) The student who obtained the highest total marks.

**TOTAL: 75 PERIODS**

**OUTCOMES:**
- Able to design a computational solution for a given problem.
- Able to break a problem into logical modules that can be solved (programmed).
- Able to transform a problem solution into programs involving programming constructs.
- To write programs using structures, strings, arrays, pointer and files for solving complex computational problem.
- Able to introduce modularity using functions and pointers which permit ad hoc runtime polymorphism.

**REFERENCES:**

UNIT II COMBINATIONAL AND SEQUENTIAL CIRCUITS 10

UNIT III BASIC STRUCTURE OF COMPUTER 9

UNIT IV PROCESSOR DESIGN 9
Processor basics – CPU Organization – Data Path Design – Control Design – Basic concepts – Hardwired control – Micro Programmed control – Pipe control – Hazards super scale operations

UNIT V MEMORY AND I/O SYSTEMS 9
Memory technology – Memory Systems- Virtual Memory – Caches – Design Methods – Associative memories – Input /output system – Programmed I/O – DMA and interrupts – I/O devices and Interfaces

TOTAL: 45 PERIODS

OUTCOMES:
Upon Completion of the course, the students will be able to
- Simplify using laws of Boolean algebra and Karnaugh map method
- Design various combinational and sequential circuits
- Differentiate between various addressing modes
- Differentiate between the various mapping policies used in cache memories
- Discuss the various types of I/O transfers

REFERENCES:
OBJECTIVES

- To be familiar with the basic concepts and functions of Operating Systems
- To understand Processes and Threads
- To analyze Scheduling algorithms
- To gain expertise in various Memory Management schemes
- To expose with various I/O Management and File systems

UNIT I    OS OVERVIEW

- Instruction Execution
- Memory Hierarchy
- Direct Memory Access
- Types of Operating Systems
- Operating Systems Services
- Operation on Processes
- System Calls
- System Programs
- Evolution of OS
- OS Structure.

UNIT II    PROCESS SYNCHRONIZATION

- Processes
- Process Concept
- Process Synchronization
- Critical Regions
- Critical Section
- Problem
- InterProcess Communication
- Synchronization
- Hardware
- Mutex Locks
- Semaphores
- Classical problems of Synchronization
- Monitors
- Threads
- Overview
- Multithreading Models
- Threading Issues.

UNIT III   PROCESS SCHEDULING

- Process Scheduling
- Scheduling mechanisms
- Strategy selection
- Preemptive and Non preemptive strategies
- Scheduling criteria
- Scheduling Algorithms
- Multiprocessor Scheduling.

UNIT IV    STORAGE MANAGEMENT

- Main Memory
- Background-Mapping Address space to Memory space
- Swapping
- Contiguous Memory allocation
- Memory Allocation Strategies
- Paging
- Segmentation
- Virtual Memory
- Page Replacement
- Thrashing.

UNIT V     FILE SYSTEMS AND I/O SYSTEMS

- Disk structures
- Disk Scheduling and Management
- File System Interface
- File Concepts
- Access Methods
- Directory Structures
- Directory Organization
- Filesystem Mounting
- Filescheduling and Protection
- Filesystem Implementation
- Allocation Methods
- Free space
- Management
- Efficiency and Performance
- Recovery.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the student will be able to

- Deliver the main concepts, structure and functions of Operating Systems
- Implement the algorithms in Process management and solving the issues of IPC
- Analyze various Scheduling Algorithms
- Demonstrate the mapping between Physical memory and Virtual memory
- Understand the functionality of File systems in OS perspective

REFERENCE BOOKS:

OBJECTIVES:
- Be familiar with basic techniques of algorithm analysis.
- Be exposed to the concept of ADTs.
- Learn linear data structures - List, Stack and Queue.
- Learn nonlinear data structures - Tree and Graphs.
- Be exposed to sorting, searching and hashing algorithms

UNIT I INTRODUCTION

UNIT II LINEAR DATA STRUCTURES – LIST

UNIT III LINEAR DATA STRUCTURES - STACK, QUEUE

UNIT IV NON LINEAR DATA STRUCTURES - TREES AND GRAPHS

UNIT V SORTING, SEARCHING AND HASH TECHNIQUES

OUTCOMES:
Upon Completion of the course, the students will be able to
- analyze algorithms and determines their time complexity.
- understand the concepts of data types, data structures and linear structures
- apply data structures to solve various problems
- understand non-linear data structures
- apply different Sorting, Searching and Hashing algorithms.

TOTAL: 45 PERIODS
REFERENCES:

BX5005 PROGRAMMING AND DATA STRUCTURES USING C LABORATORY
 L T P C 0 0 4 2

OBJECTIVES:
To develop skills in design and implementation of data structures and their applications
- To learn and implement linear, non linear and tree data structures
- To study, implement and analyze the sorting technique.

LIST OF EXPERIMENTS
1. Array- Insertion and Deletion
2. Application using array of structures
3. Array Implementation of Stack
4. Array Implementation of Queue
5. Infix to postfix conversion
6. Singly Linked List operations
7. Polynomial manipulation- addition, subtraction
8. Binary Tree Traversal
9. Quick Sort
10. Binary Search

TOTAL: 60 PERIODS

OUTCOMES:
Upon Completion of the course, the students will be able to:
- Work with basic data structures that are suitable for the problems to be solved efficiently.
- Implement stack & queue techniques for related problems
- Implement prefix and post fix conversion
- Design and implement linear, and tree and its applications
- Design sorting technique, its algorithm design and analysis.

BX5006 DATABASE MANAGEMENT SYSTEMS  L T P C 3 0 0 3

OBJECTIVES:
- To understand the fundamentals of data models and conceptualize and depict a database system using ER diagram.
- To make a study of SQL and relational database design.
To know about data storage techniques and query processing.
To impart knowledge in transaction processing, concurrency control techniques and recovery procedures.

UNIT I INTRODUCTION

UNIT II RELATIONAL MODEL AND QUERY EVALUATION

UNIT III DATABASE DESIGN & APPLICATION DEVELOPMENT

UNIT IV TRANSACTION PROCESSING

UNIT V FILES AND INDEXING

TOTAL: 45 PERIODS

OUTCOMES:
- Understand the basic concepts of the database and data models.
- Design a database using ER diagrams and map ER into Relations and normalize the relations.
- Acquire the knowledge of query evaluation to monitor the performance of the DBMS.
- Develop a simple database applications using normalization.
- Acquire the knowledge about different special purpose databases and to critique how they differ from traditional database systems.

REFERENCES:
OBJECTIVES:

- To provide an overview of working principles of internet, web related functionalities
- To understand and apply the fundamentals core java, packages, database connectivity for computing
- To enhance the knowledge to server side programming.
- To Understand the OOPS concept & how to apply in programming.

UNIT I  JAVA FUNDAMENTALS


UNIT II  COLLECTIONS AND ADVANCE FEATURES


UNIT III  ADVANCED JAVAPROGRAMMING


UNIT IV  OVERVIEW OF DATA RETRIEVAL & ENTERPRISE APPLICATION DEVELOPMENT


UNIT V  JAVA INTERNALS AND NETWORKING


TOTAL: 45 PERIODS

OUTCOMES:

1. Implement Java programs.
2. Make use of hierarchy of Java classes to provide a solution to a given set of requirements found in the Java API
3. Use the frameworks JSP, Hibernate, Spring
4. Design and implement server side programs using Servlets and JSP
5. Make use of networking concepts in Java

REFERENCES:

BX5008 SOFTWARE ENGINEERING L T P C 3 0 0 3

OBJECTIVES:
- To provide an insight into software life cycle and various software process models
- To estimate the resources for developing the application and to prepare the schedule
- To know the various designing concepts and notations for modeling the software.
- To prepare the test cases for the project, apply various testing techniques, strategies and metrics to evaluate the software.
- To construct software with high quality and reliability.

UNIT I INTRODUCTION 9

UNIT II SOFTWARE DESIGN 9

UNIT III SOFTWARE TESTING AND MAINTENANCE 9
UNIT IV SOFTWARE METRICS

UNIT V SCM & WEB ENGINEERING

OUTCOMES:
- Able to understand the problem domain to choose process models and to develop SRS
- Able to model software projects using appropriate design notations
- Able to measure the product and process performance using various metrics
- Able to evaluate the system with various testing techniques and strategies
- Able to analyze, design, verify, validate, implement, and maintain software systems.

REFERENCES

BX5009 BASICS OF COMPUTER NETWORKS L T P C 3 0 0 3
OBJECTIVES:
- To understand networking concepts and basic communication model
- To understand network architectures and components required for data communication.
- To analyze the function and design strategy of physical, data link, network layer and transport layer
- To acquire basic knowledge of various application protocol for internet security issues and services.

UNIT I NETWORK FUNDAMENTALS

UNIT III NETWORK LAYER

UNIT IV TRANSPORT LAYER

UNIT V APPLICATIONS AND SECURITY
Applications - DNS- SMTP – WWW –SNMP- Security –threats and services - DES- RSA.

TOTAL : 45 PERIODS

OUTCOMES:
- Able to trace the flow of information from one node to another node in the network
- Able to Identify the components required to build different types of networks
- Able to understand the functionalities needed for data communication into layers
- Able to choose the required functionality at each layer for given application
- Able to understand the working principles of various application protocols and fundamentals of security issues and services available.

REFERENCES:

BX5010 JAVA PROGRAMMING LABORATORY

OBJECTIVES:
To develop skills in design and implementation of object oriented concepts and networking applications
- To learn and implement class, interface and package
- To study, implement and analyze the client server and remote programming.

LIST OF EXPERIMENTS

97
1. Write Java programs by making use of class, interface, package, etc for the following Different types of inheritance study  
   # Uses of ‘this’ keyword  
   # Polymorphism  
   # Creation of user specific packages  
   # Creation of jar files and using them  
   # User specific exception handling  
2. Writing window based GUI applications using frames and applets such as Calculator application, Fahrenheit to Centigrade conversion etc.  
3. Application of threads examples  
4. Create an Application to search Phone Number using contact Name Using Hash Map.  
5. Create an Application which finds the Duplicates in E-mail using Set Interface.  
6. Writing an RMI application to access a remote method  
7. Writing a Servlet program with database connectivity for a web based application such as students result status checking, PNR number enquiry etc.

TOTAL: 60 PERIODS

OUTCOMES:
Upon Completion of the course, the students will be able to:

- Work with basic Object Oriented programming concepts that are suitable for the problems to be solved efficiently.
- Implement frames and applets for related problems
- Implement prefix and post fix conversion
- Design and implement Threads in Java
- Design Remote method invocation

BX5011 DATABASE PROGRAMMING LABORATORY L T P C
0 0 4 2

OBJECTIVES:

- To understand the concepts of DBMS.
- To familiarize with SQL queries.
- To write stored procedures in DBMS.
- To learn front end tools to integrate with databases.

LIST OF EXPERIMENTS:

1. Creation of base tables and views
2. Data Manipulation INSERT, DELETE and UPDATE in Tables. SELECT, Sub Queries

3. Data Control Commands

4. High level language extensions – PL/SQL or Transact SQL – Packages

5. Use of Cursors, Procedures and Functions

6. Embedded SQL or Database Connectivity

7. Oracle or SQL Server Triggers – Block Level – Form Level Triggers

8. Working with Forms, Menus and Report Writers for a application project in any domain

9. Develop a database application using Java/ Django/PHP/.NET as Front end

TOTAL: 60 PERIODS

Upon Completion of the course, the students will be able to:

- Design and Implement databases
- Formulate complex queries using SQL
- Implement procedures, Cursors and Function
- Implement Triggers
- Design and Implement applications that have GUI and access databases for backend connectivity