DEPARTMENT OF INFORMATION SCIENCE AND ENGINEERING
MASTER OF TECHNOLOGY
in
Computer Network Engineering

VISION

The Department will provide quality and value-based education to produce innovative world-class computing engineers and will enhance quality research for the betterment of society

MISSION

- To impart high quality training, education and competence in information science domain through best-in-class faculty and facilities
- To produce globally acceptable information science graduates who can contribute professionally to the industry and research activities by offering courses on emerging technologies.
- To provide platforms to work effectively and innovatively in multi-disciplinary domain.

PROGRAM EDUCATIONAL OBJECTIVES

PEO – 1: Graduates will have an understanding of computer networks and related skills necessary for successful careers.
PEO – 2: Graduate will be able to engage in higher studies or conduct research.

PROGRAM SPECIFIC OUTCOMES

PSO – 2: Professional Skills: Ability to demonstrate professional competence in communication skills, projects and involve in life-long learning
PROGRAM OUTCOMES

PO – 1: An ability to independently carry out research / investigation and development work to solve practical problems in computer networks.

PO – 2: An ability to write and present a substantial technical report/document.

PO – 3: An ability to demonstrate a degree of mastery over the area with respect to Computer networking.

PO – 4: An ability to use and apply software tools in networking, handling project management with social and economic factors into consideration.

PO – 5: An ability to demonstrate in life-long learning and assess outcome, based on knowledge and engineering skills in computer networks.
**CORE – Theory**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMT1C01</td>
<td>Applied Engineering Mathematics</td>
<td>(4-0-0) 4</td>
</tr>
<tr>
<td>MCN1C02</td>
<td>Wireless Adhoc Network</td>
<td>(4-2-0) 5</td>
</tr>
<tr>
<td>MCN1C03</td>
<td>Advances in Computer Networks</td>
<td>(4-0-0) 4</td>
</tr>
<tr>
<td>MCN1C04</td>
<td>Information and Network Security</td>
<td>(4-2-0) 5</td>
</tr>
<tr>
<td>MCN1CRM</td>
<td>Research Methodology</td>
<td>(2-0-0) 2</td>
</tr>
<tr>
<td>MCN2C01</td>
<td>Cyber Crime and Digital forensic</td>
<td>(4-2-0) 5</td>
</tr>
<tr>
<td>MCN2C02</td>
<td>Cloud Computing</td>
<td>(4-2-0) 5</td>
</tr>
<tr>
<td>MCN2C03</td>
<td>Protocol Engineering</td>
<td>(4-0-0) 4</td>
</tr>
<tr>
<td>MCN2C04</td>
<td>Network Management</td>
<td>(3-0-2) 4</td>
</tr>
</tbody>
</table>

**CORE – Lab**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCN1L01</td>
<td>Advance Computer Networks lab</td>
<td>(0-0-2) 1</td>
</tr>
<tr>
<td>MCN2L01</td>
<td>Cryptography and Network security lab</td>
<td>(0-0-2) 1</td>
</tr>
</tbody>
</table>

**DEPT. ELECTIVE – 1**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCN1E101</td>
<td>Multi core Architecture and programming</td>
<td>(3-0-0) 3</td>
</tr>
<tr>
<td>MCN1E102</td>
<td>Multimedia Communications</td>
<td>(3-0-0) 3</td>
</tr>
<tr>
<td>MCN1E103</td>
<td>Intrusion Detection and Prevention Systems</td>
<td>(3-0-0) 3</td>
</tr>
<tr>
<td>MCN1E104</td>
<td>Client server Programming</td>
<td>(3-0-0) 3</td>
</tr>
<tr>
<td>MCN1E105</td>
<td>Information Storage</td>
<td>(3-0-0) 3</td>
</tr>
</tbody>
</table>

**DEPT. ELECTIVE – 2**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCN1E201</td>
<td>System Modeling and Simulation</td>
<td>(3-0-0) 3</td>
</tr>
<tr>
<td>MCN1E202</td>
<td>Principles of Information Security</td>
<td>(3-0-0) 3</td>
</tr>
<tr>
<td>MCN1E203</td>
<td>Distributed systems</td>
<td>(3-0-0) 3</td>
</tr>
<tr>
<td>MCN1E204</td>
<td>Artificial Intelligence</td>
<td>(3-0-0) 3</td>
</tr>
<tr>
<td>MCN1E205</td>
<td>Wireless Sensor Networks</td>
<td>(3-0-0) 3</td>
</tr>
</tbody>
</table>

**DEPT. ELECTIVE – 3**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCN2E301</td>
<td>Optical Network</td>
<td>(3-0-0) 3</td>
</tr>
<tr>
<td>MCN2E302</td>
<td>Computer System performance Analysis</td>
<td>(3-0-0) 3</td>
</tr>
<tr>
<td>MCN2E303</td>
<td>Web Engineering</td>
<td>(3-0-0) 3</td>
</tr>
<tr>
<td>MCN2E304</td>
<td>Advances in Storage Area Network</td>
<td>(3-0-0) 3</td>
</tr>
<tr>
<td>MCN2E305</td>
<td>Real Time Systems</td>
<td>(3-0-0) 3</td>
</tr>
<tr>
<td>MCN2E306</td>
<td>Social Networks</td>
<td>(3-0-0) 3</td>
</tr>
</tbody>
</table>

**DEPT. ELECTIVE – 4**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCN2E401</td>
<td>Big Data Analytics</td>
<td>(3-0-0) 3</td>
</tr>
<tr>
<td>MCN2E402</td>
<td>Computer forensics</td>
<td>(3-0-0) 3</td>
</tr>
<tr>
<td>MCN2E403</td>
<td>Human Computer Interface</td>
<td>(3-0-0) 3</td>
</tr>
<tr>
<td>MCN2E404</td>
<td>Information retrieval systems</td>
<td>(3-0-0) 3</td>
</tr>
<tr>
<td>MCN2E405</td>
<td>Advanced Digital Communication</td>
<td>(3-0-0) 3</td>
</tr>
</tbody>
</table>
INDUSTRY DRIVEN ELECTIVE

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCN2I01</td>
<td>Internet of Things</td>
<td>(2-0-0) 2</td>
</tr>
<tr>
<td>MCN2I02</td>
<td>Introduction to Machine Learning</td>
<td>(2-0-0) 2</td>
</tr>
</tbody>
</table>

MOOC ELECTIVE

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCN3Mxx</td>
<td>Management Department (12 Weeks)</td>
<td>(3-0-0) 3</td>
</tr>
<tr>
<td>MCN3Mxx</td>
<td>Open Elective (Other Department) (8 Weeks)</td>
<td>(2-0-0) 2</td>
</tr>
</tbody>
</table>

PROJECT & SEMINAR

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCN3C01</td>
<td>Seminar</td>
<td>(0-0-2) 1</td>
</tr>
<tr>
<td>MCN3C02</td>
<td>Internship</td>
<td>(0-0-10)5</td>
</tr>
<tr>
<td>MCN3C03</td>
<td>Project Phase-I</td>
<td>(0-0-14)8</td>
</tr>
<tr>
<td>MCN4C01</td>
<td>Project Phase – 2</td>
<td>(0-0-30)15</td>
</tr>
</tbody>
</table>

SUGGESTED PLAN OF STUDY FOR REGULAR STUDENTS
(88 Credits)

<table>
<thead>
<tr>
<th>Semester</th>
<th>Sl. No.</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>AMT1C01</td>
<td>MCN2C01</td>
<td>MCN3Mxx</td>
<td>MCN4C01</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>MCN1C02</td>
<td>MCN2C02</td>
<td>MCN3Mxx</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>MCN1C03</td>
<td>MCN2C03</td>
<td>MCN3C01</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>MCN1C04</td>
<td>MCN2C04</td>
<td>MCN3C02</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>MCN1E1XX</td>
<td>MCN2E3XX</td>
<td>MCN3C03</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>MCN1E2XX</td>
<td>MCN2E4XX</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>7</td>
<td>MCN1CRM</td>
<td>MCN2IXX</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>8</td>
<td>MCN1L01</td>
<td>MCN2L01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Cr.</td>
<td></td>
<td>27</td>
<td>27</td>
<td>19</td>
<td>15</td>
</tr>
</tbody>
</table>

DEGREE REQUIREMENT

<table>
<thead>
<tr>
<th>Category</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering Science Core</td>
<td>04</td>
</tr>
<tr>
<td>Department Core</td>
<td>42</td>
</tr>
<tr>
<td>Department Elective</td>
<td>12</td>
</tr>
<tr>
<td>Industry Driven Elective</td>
<td>02</td>
</tr>
<tr>
<td>MOOC &amp; Open Elective</td>
<td>05</td>
</tr>
<tr>
<td>Project Phase 1 &amp; 2</td>
<td>23</td>
</tr>
<tr>
<td>Total</td>
<td>88</td>
</tr>
</tbody>
</table>
Course Numbering Scheme

Use Respective Department Code

Teaching Dept. Code

Semester

Type of Course

Sl. No. of Course type

<table>
<thead>
<tr>
<th>MCN</th>
<th>1</th>
<th>C</th>
<th>01</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCN</td>
<td>1</td>
<td>L</td>
<td>01</td>
</tr>
<tr>
<td>MCN</td>
<td>1</td>
<td>E</td>
<td>XX</td>
</tr>
</tbody>
</table>

Sl. No. of Course type

Teaching Dept. Code

Semester

Type of Course
### SCHEME OF TEACHING AND EXAMINATION

**M. TECH COMPUTER NETWORK ENGINEERING**

**DEPARTMENT OF INFORMATION SCIENCE AND ENGINEERING**

#### SCHEME OF TEACHING AND EXAMINATION

**I SEMESTER M. Tech.**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Code</th>
<th>Subject</th>
<th>Dept./Board</th>
<th>Hrs/week</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L</td>
<td>T</td>
</tr>
<tr>
<td>1</td>
<td>AMT1C01</td>
<td>Applied Engineering Mathematics</td>
<td>Mathematics</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>MCN1C02</td>
<td>Wireless Adhoc Network</td>
<td>ISE</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>MCN1C03</td>
<td>Advances in Computer Networks</td>
<td>ISE</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>MCN1C04</td>
<td>Information and Network Security</td>
<td>ISE</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>MCN1E1XX</td>
<td>Department Elective-1</td>
<td>ISE</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>MCN1E2XX</td>
<td>Department Elective-2</td>
<td>ISE</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>MCN1CRM</td>
<td>Research Methodology</td>
<td>ISE</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>MCN1L01</td>
<td>Advance Computer Networks lab</td>
<td>ISE</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Teaching Hours/Week</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>L</td>
<td>T</td>
</tr>
</tbody>
</table>

#### Department Elective-1

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Code</th>
<th>Subject</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MCN1E01</td>
<td>Multi core Architecture and programming</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>MCN1E02</td>
<td>Multimedia Communications</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>MCN1E03</td>
<td>Intrusion Detection and Prevention Systems</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>MCN1E04</td>
<td>Client server Programming</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>MCN1E05</td>
<td>Information Storage</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>
### SCHEME OF TEACHING AND EXAMINATION

#### II SEMESTER M.Tech

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Code</th>
<th>Subject</th>
<th>Dept./Board</th>
<th>Hrs/week</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L  T  P</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>MCN1E201</td>
<td>System Modeling and Simulation</td>
<td>ISE</td>
<td>4  2  0</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>MCN1E202</td>
<td>Principles of Information Security</td>
<td>ISE</td>
<td>3  0  0</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>MCN1E203</td>
<td>Distributed systems</td>
<td>ISE</td>
<td>3  0  0</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>MCN1E204</td>
<td>Artificial Intelligence</td>
<td>ISE</td>
<td>3  0  0</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>MCN1E205</td>
<td>Wireless Sensor Networks</td>
<td>ISE</td>
<td>3  0  0</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Code</th>
<th>Subject</th>
<th>Dept./Board</th>
<th>Hrs/week</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L  T  P</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>MCN2C01</td>
<td>Cyber Crime and Digital forensic</td>
<td>ISE</td>
<td>4  2  0</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>MCN2C02</td>
<td>Cloud Computing</td>
<td>ISE</td>
<td>4  2  0</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>MCN2C03</td>
<td>Protocol Engineering</td>
<td>ISE</td>
<td>4  0  0</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>MCN2C04</td>
<td>Network Management</td>
<td>ISE</td>
<td>3  0  2</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>MCN2E3XX</td>
<td>Department Elective-3</td>
<td>ISE</td>
<td>3  0  0</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>MCN2E4XX</td>
<td>Department Elective-4</td>
<td>ISE</td>
<td>3  0  0</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>MCN2IXX</td>
<td>Industry Driven Elective</td>
<td>ISE</td>
<td>2  0  0</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>MCN2L01</td>
<td>Cryptography and Network security lab</td>
<td>ISE</td>
<td>0  0  2</td>
<td>1</td>
</tr>
</tbody>
</table>

**Total** 31 27
<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Teaching Hours/Week</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>L  T  P</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Department Elective – 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>MCN2E301</td>
<td>Optical Network</td>
<td>3  0  0</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>MCN2E302</td>
<td>Computer System performance Analysis</td>
<td>3  0  0</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>MCN2E303</td>
<td>Web Engineering</td>
<td>3  0  0</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>MCN2E304</td>
<td>Advances in Storage Area Network</td>
<td>3  0  0</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>MCN2E305</td>
<td>Real Time Systems</td>
<td>3  0  0</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>MCN2E306</td>
<td>Social Networks</td>
<td>3  0  0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Department Elective – 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>MCN2E401</td>
<td>Big Data Analytics</td>
<td>3  0  0</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>MCN2E402</td>
<td>Computer forensics</td>
<td>3  0  0</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>MCN2E403</td>
<td>Human Computer Interface</td>
<td>3  0  0</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>MCN2E404</td>
<td>Information retrieval systems</td>
<td>3  0  0</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>MCN2E405</td>
<td>Advanced Digital Communication</td>
<td>3  0  0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Industry Driven Electives</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>MCN2I01</td>
<td>Internet of Things</td>
<td>2  0  0</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>MCN2I02</td>
<td>Introduction to Machine Learning</td>
<td>2  0  0</td>
<td>2</td>
</tr>
</tbody>
</table>
### SCHEME OF TEACHING AND EXAMINATION
#### III SEMESTER M.Tech.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MCN3Mxx</td>
<td>Management Department (12 Weeks)</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>MCN3Mxx</td>
<td>Open Elective (Other Department) (8 Weeks)</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>MCN3C01</td>
<td>Seminar</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>MCN3C02</td>
<td>Internship</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>MCN3C03</td>
<td>Project Phase-I</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total Credits</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>19</strong></td>
</tr>
</tbody>
</table>

### SCHEME OF TEACHING AND EXAMINATION
#### IV SEMESTER M.Tech.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MCN4C01</td>
<td>Project Phase-2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total Credits</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>15</strong></td>
</tr>
</tbody>
</table>
APPLIED ENGINEERING MATHEMATICS (4-0-0) (Core)

Sub Code: AMT1C01

CIE: 50 Marks

Hrs / Week: 04

SEE: 50% Marks

SEE Hrs: 03 Hours

Max Marks: 100

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

1. Construct the matrix, digraphs of relations and explain some results on different types of relations and solve problems associated with equivalence relations.

2. Identify different types of functions, compute composition and inverse of a function and solve problems using pigeon-hole principle.

3. Apply Euclidean algorithm, Chinese remainder, Fermat’s and Wilsons theorems to solve the problems in Number Theory.

4. Solve problems associated with discrete & continuous probability distributions.

5. Compute measures of central tendency, dispersion, skewness and kurtosis for a given statistical data.

6. Solve problems on joint distribution, Markov chain using transition probability matrix and also problems on queuing theory.

Module 1

Relations

Binary relations, Matrix and Digraph representation of a relation, Operations on binary relations, Properties of relations, Equivalence relations

Self Learning Exercise: Composition of relations.

Module 2

Functions

Function, Types of functions, Composition of functions, Invertible functions, Recursive function, The Pigeonhole-principle

Self Learning Exercise: Hash function.

Module 3

Number Theory

Euclidean Algorithm, Chinese Remainder theorem, Generalized Chinese Remainder theorem, Fermat's little theorem, Euler’s theorem (no proof), Pseudo primes, Fermat’s pseudo primes


Module 4

Probability

Random variables – Discrete and continuous random variables, Binomial, Poisson’s, Exponential and Normal Distributions

Self Learning Exercise: Basic probability upto Baye’s Theorem.

Module 5

Statistics

Moments, Skewness – test of skewness, uses of skewness, measure of skewness by Karl pearson’s, Bowley’s methods and skewness based on third moment, Kurtosis

Self Learning Exercise: Measures of central tendency, Measures of dispersion
Module 6

Joint Distribution and Markov Chains

9 Hours

Concept of joint probability: Joint probability distribution, (discrete) Independent random variables, Expectation, Covariance, Correlation Coefficient. Probability vectors, Stochastic matrices, Regular stochastic matrices, Markov chains, Transition Probability Matrix. Concept of a queue, the M/G/I and M/M/I queuing systems

Self Learning Exercise: Continuous joint probability distributions.

Books for Reference:
4. Probability and Statistics – Schaum Series (All latest editions)
WIRELESS ADHOC NETWORK (4-2-0) (Core)

Sub Code: MCN1C02
Hrs / Week: 06
SEE Hrs: 03 Hours
CIE:50 Marks
SEE: 50% Marks
Max Marks: 100

Course Outcomes:

On successful completion of the course, the students will be able to:
1. Explain wireless sensor networks and MAC Protocols.
2. Discuss the working of routing protocols.
3. Apply the knowledge of Multicast Routing in Ad hoc Wireless Networks.
5. Describe the necessary of QoS and QoS Protocols.
6. Discuss Energy Management issues.

Module-1
10 Hours
Self Learning Exercise: MAC Protocols that Use Directional Antennas

Module-2
10 Hours
Self Learning Exercise: Power-Aware Routing Protocols

Module-3
9 Hours
Module-4


Module-5


Self Learning Exercise: Casestudy on QoS.

Module-6


TUTORIALCOMPONENT:

Note: Standard Network Parameters and supporting protocols may be assumed for simulation. Any suitable network simulator may be used. (Preferably NS2 or NS3 Simulator)

1. Develop unicast routing protocols using any suitable Network Simulator for (Mobile Ad hoc Networks) MANET to find the best route using the any one of routing protocols from each category from table-driven (e.g., link state or DSDV) on demand (e.g., DSR, AODV, TORA), hybrid (e.g., ZRP, contact-based architectures) and hierarchical (e.g., cluster based.) The efficient path/route should be established for source and destination data transmission using routing protocols. Understand the advantages and disadvantages of each routing protocol types by observing the performance metrics of the routing protocol. In that way the best application/environment suitable routing protocol can be identified in each category.

2. Develop multicast routing protocols using any suitable Network Simulator for MANET in which session nodes are connecting through either tree(MAODV, MCEDAR) or mesh (ODMRP, CAMP, FGMP) structure. Analyze the performance metrics of multicast routing protocols with unicast routing protocols.
3. Develop MAC Protocol using any suitable Network Simulator for MANETs to send the packet without any contention through wireless link using the following MAC protocols; (CSMA/CA (802.11), MACA, MACAW, PAMAS, SMAC). Analyze its performance with increasing node density and mobility.

4. Analyze the performance of TCP connection when it is used for wireless networks. You will find performance of TCP decreases dramatically when a TCP connection traverses a wireless link on which packets may be lost due to wireless transmission errors. Make use of Active Queue Management Technique to control congestion on Wireless Networks. Evaluate the performance of FIFO, RED and WFQ over wireless networks using suitable Network Simulator.

5. Simulate MANET environment using suitable Network Simulator and test with various mobility model such as Random way point, group mobility, highway model, Manhattan model, hybrid models) (Spatial correlation, temporal correlation, relative speed, link durations). Analyze throughput, PDR and delay with respect to different mobility models.

Text Book:

References:
 ADVANCES IN COMPUTER NETWORKS (4-0-0) (Core)

Sub Code: MCN1C03
Hrs / Week: 04
SEE Hrs: 03 Hours

CIE: 50 Marks
SEE: 50% Marks
Max Marks: 100

Course Outcomes:
On successful completion of the course, the students will be able to:
1. Describe the effect of performance in network
2. Explain the network addressing and subnetting in design of networks.
3. Differentiate between RIP and OSPF
4. Discuss the performance of sliding window protocol
5. Compare FIFO and fair queueing
6. Distinguish DEC bit and RED.

Module-1 Foundation
9 Hours
Building a Network, Requirements, Perspectives, Scalable Connectivity, Cost-Effective Resource sharing, Support for Common Services, Manageability, Protocol layering, Performance, Bandwidth and Latency, Delay X Bandwidth Product, Perspectives on Connecting, Classes of Links, Reliable Transmission, Stop-and-Wait, Sliding Window
Self Learning Exercise: Concurrent Logical Channels.

Module 2: Internetworking- I
9 Hours
Switching and Bridging, Datagrams, Virtual Circuit Switching, Source Routing, Bridges and LAN Switches, Basic Internetworking (IP), What is an Internetwork? Service Model, Global Addresses, Datagram Forwarding in IP, subnetting and classless addressing, Address Translation(ARP), Host Configuration(DHCP), Error Reporting (ICMP).
Self Learning Exercise: Virtual Networks and Tunnels.

Module-3 Internetworking- II
10 Hours
Network as a Graph, Distance Vector(RIP), Link State(OSPF), Metrics, The Global Internet, Routing Areas, Routing among Autonomous systems(BGP), IP Version 6(IPv6), Mobility
Self Learning Exercise: Mobile IP

Module-4 End-to-End Protocols
10 Hours
Simple Demultiplexer (UDP), Reliable Byte Stream(TCP), End-to-End Issues, Segment Format, Connecting Establishment and Termination, Sliding Window Revisited, Triggering Transmission, Adaptive Retransmission, Record Boundaries.
Self Learning Exercise: TCP Extensions

Module-5 Queuing
7 Hours
Queueing Disciplines, FIFO, Fair Queuing, TCP Congestion Control, Additive Increase / Multiplicative Decrease, Slow Start, Fast Retransmit
Self Learning Exercise: Fast Recovery.
Module -6 Congestion Control and Resource Allocation

7 Hours

Congestion-Avoidance Mechanisms, DEC bit, Random Early Detection (RED), Source-Based Congestion Avoidance. The Domain Name System (DNS), Electronic Mail (SMTP, POP, IMAP, MIME), World Wide Web (HTTP)

Self Learning Exercise: Network Management (SNMP)

Text books:


References:


INFORMATION AND NETWORK SECURITY (4-2-0) (Core)

Sub Code: MCN1C04
Hrs / Week: 06
SEE Hrs: 03 Hours
CIE:50 Marks
SEE: 50% Marks
Max Marks: 100

Course Outcomes:
On successful completion of the course, the students will be able to:
1. Explain classical encryption technique.
2. Discuss various data encryption.
3. Describe the various Public-Key Cryptosystems.
4. Explain Key Management and distribution methods.
5. Discuss Wireless Network security.

Module -1 8 Hours
Classical Encryption Techniques:
Symmetric Cipher Model, Substitution Techniques, Transposition techniques, Steganography.
Block Ciphers and the data encryption standard: Traditional block Cipher structure, The Data Encryption Standard, A DES example, The strength of DES.
Self Learning Exercise: Block cipher design principles

Module -2 8 Hours
Block Cipher Operation: Multiple Encryption and Triple DES, Electronic Codebook, Cipher Block Chaining Mode, Cipher Feedback Mode.
Self Learning Exercise: Output Feedback Mode, Counter Mode.

Module -3 9 Hours
Other Public-Key Cryptosystems: Elgamal Cryptographic Systems, Elliptic Curve Arithmetic, Elliptic Curve Cryptography,
Self Learning Exercise: Pseudorandom number generation based on an asymmetric cipher.

Module -4 10 Hours
Message Authentication Codes: Message Authentication Requirements, MACs Based on Hash Functions: HMAC.
Digital Signatures: Digital Signatures, Elgamal Digital Signature Scheme.
Key Management and Distribution: Symmetric key distribution using Symmetric encryption, Symmetric key distribution using asymmetric encryption, Distribution of public keys.
User Authentication: Remote user Authentication principles, Kerberos.
Self Learning Exercise: X.509 Certificates, Public-Key Infrastructure
Module-5  9 Hours
Self Learning Exercise: Cloud Security as a Service.

Module-6  8 Hours
Self Learning Exercise: Encapsulating Security Payload

Tutorial Component:
Module-1:
- Encrypt and decrypt a file with composite data using the following Traditional symmetric key Ciphers: Caesar Cipher, Playfair Cipher, Hill Cipher, Vigenere Cipher, Rail fence and Row-Column transformation cipher.
- For a given input with alpha-numeric data, encrypt using Data Encryption Standard (DES) algorithm and Decrypt using DES
Module-2:
- Consider an alpha-numeric data, encrypt it using Advanced Encryption Standard (AES) algorithm and Decrypt using AES
Module-3:
- Implement RSA and ElGamal cryptosystems to sign and verify a given message.
Module-4:
- Implement the Diffie-Hellman key exchange algorithm
- Implement SHA algorithm

Text Books:

References:

E-Books:
1. Cryptography And Network Security Principles And Practice
   http://almuhammadi.com/sultan/crypto_books/Koblitz.2ndEd.pdf

MOOC:
   https://swayam.gov.in/ndl_no20_cs21/preview
2. Cryptography 1, by Stanford
   https://www.coursera.org/learn/crypto
RESEARCH METHODOLOGY (2:0:0) (Core)

Sub code: MCN1CRM    CIE: 50 Marks
Hrs/week: 02   SEE: 50 Marks
SEEHrs: 02  Max. Marks:50

Course Outcomes:
On Successful completion of the course, the students will be able to:
1. Explain the basic framework of research process, research design and techniques
2. Discuss the processes of quantitative data collection, analysis, interpretation and presentation
3. Describe the components of scholarly writing and ethical issues in research

MODULE1: 10 Hrs
OVERVIEW OF RESEARCH:
Introduction to research, Objectives and motivations for research, Significance of research, Research Methods v/s Methodology, Types of research, Quantitative Research Methods, Variables, Conjecture, Hypothesis. Research Process, Steps in research process, Criteria of good Research, Importance of literature review in defining a problem - Survey of literature - Primary and secondary sources - Reviews, - web as a source - searching the web - Identifying gap areas from literature review - Development of working hypothesis. Research problem-definition, selection and formulation of a research problem selection, criteria of a good research problem. Introduction to research design, Characteristics of good research design.

Self Learning Exercise: Developing a research plan, Department/program specific research problem discussions

MODULE2: 12 Hrs
DATA COLLECTION, PROCESSING AND ANALYSIS:
Sources of data, collection of data, Primary and secondary Data, Collection of Data through various methods, Measurement and scaling, Sources of error in measurement. Modeling, Mathematical Models for research (brief introduction only)
Sampling: Concepts of Statistical Population, Sample, Sampling Frame, Sampling Error, Sample Size, Probability and Non Probability sampling- types and criteria for selection, Hypothesis Testing, Level of Significance and Confidence Interval, Type I and Type II errors, t-test, z-test, Correlation, Regression Analysis (brief introduction only)

Self Learning Exercise: Tools for data processing, Graphical representation of Data.
MODULE3: REPORT WRITING AND ETHICS IN RESEARCH:
Writing Research Report: Format and style. Review of related literature its implications at various stages of research. (Formulation of research problem, hypothesis, interpretation and discussion of results. Major findings, Conclusions and suggestions.) Layout of a Research Paper, Research proposal, Citation of references, Reference Management Software like Zotero/Mendeley, Software for paper formatting like LaTeX/MS Office, effective technical presentation in seminars/workshops/symposiums (oral/paper/poster), article indexing
Significance of ethical conduct in research, Ethical issues related to publishing, Plagiarism & latest regulations. Software for detection of Plagiarism

Self Learning Exercise: Intellectual property rights, importance and protection, copyrights, patents, Impact factor of Journals

TEXT BOOKS:

REFERENCE BOOKS:
Course Outcomes:
The students will be able to:

- CO1: Implement basic computer network algorithms
- CO2: Implementation of client server applications using Socket Programming
- CO3: Simulate basic protocols using simulators.

PART A: Implement the following using C/C++:
1. Write a program to transfer the contents of a requested file from server to the client using TCP/IP Sockets (using TCP/IP Socket programming).
2. Write a program to archive Traffic management at Flow level by implementing Closed Loop Control technique. (Leaky Bucket Algorithm)
3. Write a program to implement dynamic routing strategy in finding optimal path for data transmission. (Bellman Ford algorithm).
4. Write a program to implement Link State Routing (Dijkstra Algorithm).
5. Write a program for implementing the error detection technique while data transfer in unreliable network code using CRC (16-bits) Technique.
6. Write a program for providing security for transfer of data in the network. (RSA Algorithm)
7. Write a program for encrypting 64 bit playing text using DES Algorithm.

PART B: Simulation Programs using OPNET/NS2 or any other equivalent software
1. Simulate a 3 node point to point network with duplex links between them. Set the Queue size and vary the bandwidth and find the number of packets dropped.
2. Simulate a four node point-to-point network, and connect the links as follows: n0->n2, n1->n2 and n2->n3. Apply TCP agent changing the parameters and determine the number of packets sent/received by TCP/UDP
3. Simulate the different types of internet traffic such as FTP and TELNET over network and analyze the throughput.
DEPARTMENT ELECTIVE-1
MULTI CORE ARCHITECTURE AND PROGRAMMING (3-0-0) (Elective)

Sub Code: MCN1E101
Hrs / Week: 03
SEE Hrs: 03 Hours

CIE: 50 Marks
SEE: 50% Marks
Max Marks: 100

Course Outcomes:
On successful completion of the course, the students will be able to:
1. Explain the recent trends in the field of Computer Architecture and identify performance related parameters.
2. Discuss on system overview of threading.
3. Describe the fundamental concepts of Parallel Programming.
4. Discuss the threading and parallel programming constructs.
5. Use OpenMP for threading.

Module-1
Introduction to Multi-core Architecture: Motivation for Concurrency in software, Parallel Computing Platforms, Parallel Computing in Microprocessors, Differentiating Multi-core Architectures from Hyper-Threading Technology, Multi-threading on Single-Core versus Multi-Core Platforms Understanding Performance, Amdahl’s Law

Module-2
System Overview of Threading: Defining Threads, System View of Threads, Threading above the Operating System, Threads inside the OS, Threads inside the Hardware, What Happens When a Thread Is Created, Application Programming Models and Threading, Virtual Environment: VMs and Platforms, Runtime Virtualization.
Self Learning Exercise: System Virtualization.

Module-3
Self Learning Exercise: Other Alternatives of Error Diffusion.

Module-4
Threading APIs: Threading APIs for Microsoft Windows, Win32/MFC Thread APIs, Threading APIs for Microsoft. NET Framework, Creating Threads, Managing Threads, Thread Pools, Thread Synchronization, POSIX Threads, Creating Threads, Managing Threads,
Self Learning Exercise: Thread Synchronization, Signaling.

Module-5
Open MP: A Portable Solution for Threading: Challenges in Threading a Loop, Loop-carried Dependence, Data-race Conditions, Managing Shared and Private Data, Loop Scheduling and

**Self Learning Exercise:** OpenMP Environment.

**Text Book**

**Reference Books**

**E-Books:**
1. Multicore Programming, Increased Performance through Software Multi-threading
   https://mcai.github.io/resources/ebooks/Multi-Core_Programming.pdf
2. Multicore and GPU Programming: An Integrated Approach
M.Tech. Computer Network Engineering

MULTIMEDIA COMMUNICATIONS (3-0-0) (Elective)

Sub Code: MCN1E102
Hrs / Week: 03
SEE Hrs: 03 Hours

CIE: 50 Marks
SEE: 50% Marks
Max Marks: 100

Course Outcomes:
On successful completion of the course, the students will be able to:
1. Explain the Multimedia Communication Models
2. Describe Multimedia Framework for Standardization (2 & 3)
3. Explain different Multimedia Applications and Services
4. Discuss middleware layer for multimedia

Module-1
Introduction to Multimedia Communications: Introduction, Human communication model, Evolution and convergence, Technology framework
Self Learning Exercise: Standardization framework.

Module-2
Framework for Multimedia Standardization: Introduction, Standardization activities, Standards to build a new global information infrastructure, Standardization processes on multimedia communications
Self Learning Exercise: ITU-Tmediacom2004

Module -3
Framework for multimedia, ISO/IEC MPEG-21 multimedia framework
Self Learning Exercise: IETF multimedia Internet standards.

Module -4
Application Layer: Introduction, ITU applications, MPEG applications, Mobile servers and applications.
Self Learning Exercise: Universal multimedia access.

Module-5
Middleware Layer: Introduction to middleware for multimedia, Media coding, Media Streaming,
Self Learning Exercise: Infrastructure for multimedia content distribution.

Dept. of IS&E, NIE, Mysuru
Text Books:

Reference Books:
Sub Code: MCN1E103  
CIE:50 Marks

Hrs / Week: 03  
SEE: 50% Marks

SEE Hrs: 03 Hours  
Max Marks: 100

**Course Outcomes:**
On successful completion of the course, the students will be able to:

1. Explain intrusion detection and prevention concepts.
2. Analyze network protocol abuses.
3. Use of TCP dump for traffic analysis.
4. Explain Tiered Architectures.
5. Explain IDS and IPS Internals

**Module – 1**

**Understanding Intrusion Detection:**
Intrusion-Detection and Intrusion-Prevention Basics-Why IDSs and IPSs are Important – IDSand IPS Analysis Schemes- IDSIPS

**Self Learning Exercise:** IDS and IPS Pros and Cons

**Module - 2**

**Unauthorized Activity I:**
General IDS Limitations -Network Protocol Abuses: ARP, IP, UDP,TCP

**Self Learning Exercise:** ICMP.

**Module - 3**

**Tcpdump:**
Tcp dump Command Line Options-Tcp dump Output Format-Tcp dump Expressions-Bulk Capture-How Many Bytes Were Transferred in That Connection?-Tcp dump as Intrusion Detection?

**Self Learning Exercise:**Tcpslice, Tcpflow,and Tcpjoin.

**Module –4**

**Architecture:**IDS and IPS Architecture- Tiered Architectures.

**Self Learning Exercise:**Future IDS

**Module - 5**

**IDS AND IPS INTERNALS:**
Information Flow in IDS and IPS-Detection of Exploits-Malicious Code Detection-Output Routines

**Self Learning Exercise:**Defending IDS/IPS.
Text Book:

References:
M.Tech. Computer Network Engineering

CLIENT SERVER PROGRAMMING (3-0-0) (Elective)

Sub Code: MCN1E104
CIE: 50 Marks

Hrs / Week: 03
SEE: 50% Marks

SEE Hrs: 03 Hours
Max Marks: 100

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

1. Analyze the requirements of the client and server environment.
2. Explain socket interface in network programming.
3. Demonstrate client/server system technologies.
4. Develop client software.
5. Explain the server software design.

Module 1 7 Hours
The Client Server Model and Software Design, Concurrent Processing in Client-Server
Software: Introduction, Motivation, Terminology and Concepts, Introduction, Concurrency in
Networks, Concurrency in Servers, Terminology and Concepts, An example of Concurrent Process
Creation, Executing New Code, Context Switching and Protocol Software Design
Self Learning Exercise: Concurrency and Asynchronous I/O.

Module 2 7 Hours
Program Interface to Protocols, the Socket Interface: Introduction, Loosely Specified Protocol
Software Interface, Interface Functionality, Conceptual Interface Specification, System Calls, Two
Basic Approaches to Network Communication, The Basic I/O Functions available in UNIX, Using
UNIX I/O with TCP/IP, Introduction, Berkley Sockets, Specifying a Protocol Interface, The Socket
Abstraction, Specifying an Endpoint Address, A Generic Address Structure, Major System Calls used
with Sockets, Utility Routines for Integer Conversion, Using Socket Calls in a Program.
Self Learning Exercise: Symbolic Constants for Socket Call Parameters.

Module 3 7 Hours
Algorithms and Issues in Client Software Design: Introduction, Learning Algorithms instead of
Details, Client Architecture, Identifying the Location of a Server, Parsing an Address Argument,
Looking up a Domain Name, Looking up a well-known Port by name, Port Numbers and Network
Byte Order, Looking up a Protocol by Name, The TCP Client Algorithm, Allocating a Socket,
Choosing a Local Protocol Port Number, A fundamental Problem in choosing a Local IP Address,
Connecting a TCP Socket to a Server, Communicating with the Server using TCP, Reading a response
from a TCP Connection, Closing a TCP Connection, Programming a UDP Client, Connected and
Unconnected UDP Socket, Using Connect with UDP, Communicating with a Server using UDP,
Closing a Socket that uses UDP.
Self Learning Exercise: Partial Close for UDP and A Warning about UDP Unreliability.
Module 4  9 Hours
Self Learning Exercise: A UDP Client for the ECHO Service.

Module 5  9 Hours
Self Learning Exercise: Cleaning up Errant Processes.

INFORMATION STORAGE (3-0-0) (Elective)

Sub Code: MCN1E105  CIE: 50 Marks
Hrs / Week: 03  SEE: 50% Marks
SEE Hrs: 03 Hours  Max Marks: 100

Course Outcomes:
On successful completion of the course, the students will be able to:
1. Explain the design of storage infrastructure.
2. Discuss efficient storage provisioning technique and RAID.
3. Identify different components of FC SAN and fabric logintypes.
4. Describe IP SAN and NAS.
5. Discuss object-Based and Unified Storage

Module 1  7 Hours
Introduction to Information Storage: Information Storage, Evolution of Storage Architecture, Data Center Infrastructure.
Data Center Environment: Application, Database Management System (DBMS), Host (Compute), Connectivity, Storage, Disk Drive Components, Disk Drive Performance, Host Access to Data, Direct-Attached Storage, Storage Design Based on Application Requirements and Disk Performance, Disk Native Command Queuing.

Module 2:  8 Hours
Data Protection: RAID, RAID Implementation Methods, RAID Array Components, RAID Techniques, RAID Levels, RAID Impact on Disk Performance, RAID Comparison, Hot Spares.
Self Learning Exercise: Types of Intelligent Storage System.

Module 3:  8 Hours
Fibre Channel Storage Area Networks: Fibre Channel: Overview, The SAN and Its Evolution, Components of FC SAN, FC Connectivity, Switched Fabric Ports, Fibre Channel Architecture, Fabric Services, Switched Fabric Login Types, Zoning, FC SAN Topologies.
Self Learning Exercise: Virtualization in SAN.

Module 4:  8 Hours
IP SAN and FCoE: iSCSI, FCIP, FCoE.
Self Learning Exercise: File-Level Virtualization.
Module 5: 8 Hours
Self Learning Exercise: BC Technology Solutions

Text Books:

Reference Books:
1. Storage Networks Explained, Wiley India, 2003. Ulf Troppens, Rainer Erkens and Wolfgang Muller
DEPARTMENT ELECTIVE-2
SYSTEM MODELING AND SIMULATION (3-0-0) (Elective)

Sub Code: MCN1E201 CIE:50 Marks
Hrs / Week: 03 SEE: 50% Marks
SEE Hrs: 03 Hours Max Marks: 100

Course Outcomes:
On successful completion of the course, the students will be able to:
1. Identify situations where one should use simulation and where not to.
2. Analyze various probability distribution functions.
3. Illustrate random number generators.
5. Evaluate simulation models.

Module-1 8 Hours
Introduction, General Principles: When simulation is the appropriate tool and when it is not appropriate; Advantages and disadvantages of Simulation; Areas of application; Some recent applications of Simulation; Systems and system environment; Components of a system; Discrete and continuous systems; Model of a system; Types of Models; Discrete-Event System Simulation; Steps in a Simulation Study, Concepts in Discrete-Event Simulation,
Self Learning Exercise: List processing.

Module-2 8 Hours
Statistical Models in Simulation, Queuing Models Review of terminology and concepts; Useful statistical models; discrete distributions; Continuous distributions; Poisson process; Empirical distributions, Characteristics of queuing systems; Queuing notation; Long-run measures of performance of queuing systems; Steady-state behavior of M/G/1 queue;
Self Learning Exercise: Networks of queues.

Module-3 8 Hours
Random-Number Generation, Random-Variate Generation: Properties of random numbers; Generation of pseudo-random numbers; Techniques for generating random numbers; Tests for Random Numbers Random- Variate Generation: Inverse transform technique; Acceptance-Rejection technique;
Self Learning Exercise: Special properties.
Module-4  8 Hours

**Input Modeling:** Data Collection; Identifying the distribution with data; Parameter estimation; Goodness of Fit Tests; Fitting a non-stationary Poisson process; Selecting input models without data; Multivariate

**Self Learning Exercise:** Time-Series input models.

Module-5  7 Hours

**Verification, Calibration, and Validation of Simulation Models:** Model building, verification, and validation; Verification of simulation models; Calibration and validation of models.

**Self Learning Exercise:** Optimization via Simulation

**TEXT BOOKS:**


**Reference Books:**

PRINCIPALS OF INFORMATION SECURITY (3-0-0) (Elective)

Sub Code: MCN1E202
Hrs / Week: 03
SEE Hrs: 03 Hours

CIE: 50 Marks
SEE: 50% Marks
Max Marks: 100

Course Outcomes:
On successful completion of the course, the students will be able to:
1. Explain fundamentals of Information Security and its planning.
2. Describe various security technologies essential for Information security.
3. Describe the methods and models of Information Security Maintenance.
4. Discuss underlying foundation, architecture and implementation of modern cryptosystems.
5. Explain the elements critical to implement information security.

Module-1 8 Hours
Self Learning Exercise:The Information Security Blue Print.

Module-2 8 Hours
Intrusion Detection, Access control and Other Security Tools: Introduction; Intrusion Detection Systems (IDS); Honey Pots, Honey Nets, and Padded cell systems; Scanning and Analysis Tools;
Self Learning Exercise:Biometric Access Controls.

Module-3 8 Hours
Digital Forensics: The Digital Forensics Team, Affidavits and Search Warrants, Digital Forensics Methodology
Self Learning Exercise:Evidentiary Procedures.

Module-4 8 Hours
Cryptography: Cipher Methods: Substitution Cipher, Transposition Cipher, Hash Functions.

Dept. of IS&E, NIE, Mysuru
Module-5  
7 Hours


Text Books:

Reference Books:

E-Books:
   http://almuhammadi.com/sultan/sec_books/Whitman.pdf

MOOC:
1. Information Security concepts and secure design principles  
   https://www.udemy.com/course/information-security-concepts-and-secure-design-principles/
2. Basic Principles of Information Security and Cyber attacks  
DISTRIBUTED SYSTEMS (3-0-0) (Elective)

Sub Code: MCN1E203
Hrs / Week: 03
SEE Hrs: 03 Hours

CIE:50 Marks
SEE: 50% Marks
Max Marks: 100

Course Outcomes:
On successful completion of the course, the students will be able to:
1. Describe the principles and concepts involved in designing distributed systems
2. Explain the general properties of networked communication necessary for distributed systems on the Internet
3. Discuss the characteristics of protocols for communication between processes in a distributed system and external data representation.
4. Explain RPC
5. Discuss how OS support distributed system

Module-1
9 Hours
Self Learning Exercise: Two variants of the interaction model.

Module-2
9 Hours
Networking and Internetworking: Introduction, Networking issues for distributed systems, Types of Networks, Network principles
Self Learning Exercise: The IP protocol in Internet protocols

Module-3:
7 Hours
Inter-process Communication: Introduction, The API for the Internet protocols, External data representation and marshalling, Client - Server communication.
Self Learning Exercise: Case study: Inter-process communication in UNIX.

Module-4:
7 Hours
Distributed Objects and Remote Invocation: Introduction, Communication between distributed objects, Remote procedure call.
Self Learning Exercise: Roles for observers in distributed event notification

Module-5
7 Hours
Self Learning Exercise: Monolithic kernels and microkernels in operating system architecture.
Text Books:

REFERENCE BOOKS:
ARTIFICIAL INTELLIGENCE (3-0-0) (Elective)

Sub Code: MCN1E204  CIE: 50 Marks
Hrs / Week: 03  SEE: 50% Marks
SEE Hrs: 03 Hours  Max Marks: 100

Course Outcomes:
On successful completion of the course, the students will be able to:
1. Discuss Artificial Intelligence and its application.
2. Categorize the properties of task environment.
3. Explain various strategies in formulation problems.
4. Compare various search techniques used in AI.
5. Compute optimal decisions in games.

Module 1  7 Hours
Introduction, Definition of AI. The foundations of Artificial Intelligence. The history of artificial intelligence. Applications of AI.
Self Learning Exercise: State of the art in AI.

Module 2  8 Hours
Intelligent agent, Agents and environments, behavior. The concept of rationality. The nature of environments. The structure of agents.
Self Learning Exercise: How the components of agent’s program work?

Module 3  8 Hours
Solving problems by searching problem solving agents, example problems, searching for solutions, uninformed search strategies, Informed (heuristic) search strategies, Heuristic functions.
Self Learning Exercise: Learning heuristics from experience.

Module 4  8 Hours
Beyond classical search Local search algorithms and optimization problems – this climbing search, simulated annealing, local beam search, genetic algorithms, local search in continuous spaces, searching with nondeterministic action searching with partial observations. Online search agents and unknown environments
Self Learning Exercise: Learning in online search.

Module 5  8 Hours
Adversarial search Games, optimal decision in games, Alpha-beta pruning, imperfect real-time decision.
Self Learning Exercise: Stochastic games.
Textbook:

MOOC’s : https://www.edx.org/course/artificial-intelligence-ucberkeleyx-cs188-1x
WIRELESS SENSOR NETWORKS (3-0-0) (Elective)

Sub Code: MCN1E205                  CIE: 50 Marks
Hrs / Week: 03                      SEE: 50% Marks
SEE Hrs: 03 Hours                   Max Marks: 100

Course Outcomes:
On successful completion of the course, the students will be able to:
1. Explain the sensor networks for various application setups.
2. Describe the design space and conduct trade-off analysis between performance and resources.
3. Explain appropriate data dissemination protocols and model link cost.
4. Discuss suitable medium access protocols and radio hardware.
5. Explain prototype sensor networks using commercial components.

Module-1 8 Hours
Self Learning Exercise: Another Taxonomy of WSN Technology.

Module-2 7 Hours

Module-3 7 Hours
Self Learning Exercise: IEEE 802.15.4 SLC: LR-WPANs Standard Case Study.

Module-4 9 Hours
Self Learning Exercise: Routing Strategies in WSNs.
Module-5  
8 Hours
Transport Control and Middleware for Wireless Sensor Networks


Self Learning Exercise: Existing Middleware.

Text Books:


Reference Books:

1. Ian F. Akyildiz, Mehmet Can Vuran ”Wireless Sensor Networks”, Wiley2010

E-Reference:

II SEMESTER M. Tech.
CYBER CRIME AND DIGITAL FORENSIC (4-2-0) (Core)

Sub Code: MCN2C01
Hrs / Week: 06
SEE Hrs: 03 Hours

Dept. of IS&E, NIE, Mysuru

Course Outcomes:
On successful completion of the course, the students will be able to:
1. Identify the need for computer forensics
2. Analyze the computer forensics technology
3. Describe the process of data recovery
4. Explain legal aspects of collecting and preserving computer evidence
5. Describe computer image verification and authentication
6. Outline the reconstruction of past events.

Module –1 9 Hours
Computer forensics fundamentals
Introduction: what is computer forensics?, Use of computer forensics in law enforcement, Computer forensics assistance to human resources/employment proceedings, Computer forensics services, Benefits of professional forensics methodology
Self Learning Exercise: Steps taken by computer forensics specialists, who can use computer forensic evidence?

Module-2 8 Hours
Types of computer forensics technology
Types of military computer forensic technology, Types of law enforcement, Computer forensic technology, Types of business computer forensic technology, Occurrence of cybercrime, Cyber detectives, Fighting cyber-crime with risk management techniques, Computer forensics investigative services
Self Learning Exercise: Forensic process improvement.

Module-3 9 Hours
Data recovery
Introduction of Data recovery, Data The data-recovery solution back-up and recovery, the role of back-up in data recovery,
Self Learning Exercise: Computer data recovery solution
Module-4
Evidence collection and data seizure
Self Learning Exercise: Preserving computer forensic evidence.

Module-5
Computer image verification and authentication
Special needs of evidential authentication, Practical consideration, Practical implementation, Electronic document discovery: a powerful new litigation tool, Time travel,
Self Learning Exercise: Forensics identification and analysis of technical surveillance devices.

Module-6
Reconstruction past events
How to become a digital detective, Useable file formats, Unusable file formats, Converting files, Network forensics scenario, A technical approach, Destruction of e-mail, Damaging computer evidence, Documenting the intrusion on destruction of data
Self Learning Exercise: System testing.

Text Books:

Reference Books:
CLOUD COMPUTING (4-2-0) (Core)

Sub Code: MCN2C02  
Hrs / Week: 06  
SEE Hrs: 03 Hours

CIE:50 Marks  
SEE: 50% Marks  
Max Marks: 100

Course Outcomes:
On successful completion of the course, the students will be able to:
1. Explain the open source platforms for private cloud.
2. Illustrate Cloud computing applications and paradigms.
3. Describe importance of virtualization.
4. Explain knowledge in cloud resource virtualization and scheduling.
5. Discuss the security of virtualization and the security risks posed by cloud paradigm.
6. Use the different services provided by cloud application and build private cloud.

Module-1
Introduction, Cloud Infrastructure: Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Open-source software platforms for private clouds, Cloud storage diversity and vendor lock-in, Energy use and ecological impact, Service level agreements, User experience. Exercises
Self Learning Exercise: Software licensing.

Module-2
Self Learning Exercise: Cloud computing for Biology research, Social computing, digital content and cloud computing.

Module-3
Self Learning Exercise: The dark side of virtualization, Exercises and problems.
Module-4  
Cloud Resource Management and Scheduling: 9 Hours  
Policies and mechanisms for resource management, Application of control theory to task scheduling on a cloud, Stability of a two-level resource allocation architecture, Feedback control based on dynamic thresholds, Coordination of specialized autonomic performance managers, A utility-based model for cloud-based Web services, Resourcing bundling: Combinatorial auctions for cloud resources, Scheduling algorithms for computing clouds, Fair queuing, Start-time fair queuing, Borrowed virtual time, Cloud scheduling subject to deadlines, Scheduling Map Reduce applications subject to  

Module-5  
Cloud Security, Cloud Application Development: 8 Hours  
Cloud security risks, Security: The top concern for cloud users, Privacy and privacy impact assessment, Trust, Operating system security, Virtual machine Security, Security of virtualization, Security risks posed by shared images, Security risks posed by a management OS, A trusted virtual machine monitor, Amazon web services: EC2 instances, Connecting clients to cloud instances through firewalls, Security rules for application and transport layer protocols in EC2, How to launch an EC2 Linux instance and connect to it  
Self Learning Exercise: How to use S3 in java.

Module-6  
Cloud-based simulation of a distributed trust algorithm, A trust management service, A cloud service for adaptive data streaming,  
Self Learning Exercise: Cloud based optimal FPGA synthesis.

Text Book:

References:

E-BOOKS:
1. Dr. Tim Chou’s book on cloud computing- https://docs.google.com/viewer?a=v&pid=sites&srcid=ZGVmYXVsdGRvbWFpbnxjbG91ZGNgvXB1dGluZ2NsYXNzGd4OjJjNhMjMTdjNjDdkZGE0N2Y&pli=1

MOOC’s: https://www.coursera.org/course/cloudcomputing
PROTOCOL ENGINEERING (4-0-0) (Core)

Sub Code: MCN2C03 CIE:50 Marks
Hrs / Week: 04 SEE: 50% Marks
SEE Hrs: 03 Hours Max Marks: 100

Course Outcomes:
On successful completion of the course, the students will be able to:
1. Explain the concept of protocol engineering.
2. Identify the components of protocol using communicating finite statemachine.
3. Design SDL based specification of a protocol.
4. Apply different types of protocol verification techniques and tools.
5. Compare different types of protocol testing methods.
6. Discuss different methods to build correct protocol specification.

Module-1. 9 Hours
Self Learning Exercise: Negative Acknowledgments

Module-2. 9 Hours

Module-3. 8 Hours
Self Learning Exercise: RSVP specification.
Module-4. 9 Hours
Self Learning Exercise: Protocol validation approaches

Module-5 8 Hours
Self Learning Exercise: Scalability testing

Module-6 9 Hours
Self Learning Exercise: Method and principles in protocol implementation

Text Books:

Reference Books:
NETWORK MANAGEMENT (3-0-2) (Core)

Sub Code: MCN2C04
Hrs / Week: 05
SEE Hrs: 03 Hours

CIE: 50 Marks
SEE: 50% Marks
Max Marks: 100

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

1. Describe the importance of Network topology.
2. Differentiate between organization model and information model
3. Analyze management information base with managed objects
4. Compare RMON1 groups and functions
5. Explain the broadband network management
6. Use different network tools for managing networks.

Module-1 9 Hours

Self Learning Exercise: Current Status and Future of Network Management.

Module-2 8 Hours
Basic Foundations: Standards, Models, and Language: Network Management Standards, Network Management Model, Organization Model, Information Model – Management Information Trees, Managed Object Perspectives, Communication Model; ASN.1-Terminology, Symbols, and Conventions, Objects and Data Types, Object Names, An Example of ASN.1 from ISO 8824; Encoding Structure; Macros

Self Learning Exercise: Functional Model concepts
Module-3  
9 Hours  
**Self Learning Exercise:** Functional Model for SNMP V1

Module-4  
9 Hours  
**SNMP Management – RMON:** Remote Monitoring, RMON SMI and MIB, RMON1-RMON1 Textual Conventions, RMON1 Groups and Functions, Relationship Between Control and Data Tables, RMON1 Common and Ethernet Groups, RMON Token Ring Extension Groups, RMON2 – The RMON2 Management Information Base  
**Self Learning Exercise:** RMON2 Conformance Specifications.

Module-5  
8 Hours  
**Self Learning Exercise:** ADS Configuration Profiles.

Module-6  
9 Hours  
**Self Learning Exercise:** Policy-Based Management, Service Level Management.

**Text Books:**

**Reference Books:**
CRYPTOGRAPHY AND NETWORK SECURITY LAB (0-0-2) (Core)

Sub Code: MCN2L01
Hrs / Week: 02
SEE Hrs: 03 Hours

CIE: 25 Marks
SEE: 50% Marks
Max Marks: 50

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

1. Implementing the cryptographic algorithms
2. Analyze the time required encryption/decryption process

Lab Set
1. Design and Implement your own cipher using any programming language
2. Implement following classical encryption techniques: Hill Cipher, Transposition Cipher, Playfair Cipher. Also develop a code to break the Hill Cipher
3. Implementation of Data Encryption Standard
4. Implementation of Advanced Encryption Algorithm (Rijndael’s Algorithm)
5. Design an experiment to estimate the amount of time to
   a. Generate key pair (RSA)
   b. Encrypt n bit message (RSA)
   c. Decrypt n bit message (RSA) As function of key size, experiment with different n-bit messages. Summarize your conclusion.
6. Implementation of Diffie-Hellman Key Exchange Algorithm
7. Implementation of Digital Signature Algorithm
8. Implementation of MD5 hashing technique
9. Implementation of email security using PGP (create yourself a 1024-bit PGP key. Use your name and email address for your key label. Use PGP to verify the signature on this assignment.)
DEPARTMENT ELECTIVE-3
OPTICAL NETWORK (3-0-0) (Elective)

Sub Code: MCN2E301
Hrs / Week: 03
SEE Hrs: 03 Hours

Course Outcomes:
On successful completion of the course, the students will be able to:
1. Explain different generations of digital transport networks
2. Describe the timing and synchronization in digital networks
3. Describe architecture of OTN
4. Describe the WDM
5. Explain the concept of label switching and its importance in OTN

Module-1 8 Hours
Introduction, Telecommunications Infrastructure, Characteristics of Optical Fiber: Three generations of Digital Transport Networks; A brief introduction to WDM and TDM; The Optical Marketplace; Key Optical Nodes; Other Key Terms; Evolution of Optical Systems; Key attributes of Optical Fiber. The Local Connections; The Backbone Connections; The Digital Multiplexing Hierarchy; The Digital Signaling Hierarchies; T1 / DS1 and T3 / DS3; The Layered Protocol Model in the Transport Network; considerations for Interworking Layer1, Layer 2, and Layer 3 Networks, The Basics; The Wavelength; The Basic Components; Structure of the Fiber; Fiber Types; Key Performance Properties of Fiber; Attenuation; Amplifier Spontaneous Emission; Chromatic Dispersion.
Self Learning Exercise: Wireless Optical Systems, Lasers

Module-2 8 Hours
Timing and Synchronization, SONET and SDH: Timing and Synchronization in Digital Networks; Effect of a Timing error; The Clocking Signal; Types of Timing in Networks; Timing Variations; Methods of Clock Exchange; Distribution of Timing Using SONET and DS1; Timing Downstream Devices; Synchronization Status Messages and Timing Loops, The SONET Multiplexing Hierarchy; SONET and SDH Multiplexing Structure; The SONET / SDH Frame Structure; SONET and SDH Functional Components; SONET and SDH Problem Detection; Locating and Adjusting Payload with Pointers; Virtual Tributaries in more detail; Virtual Tributaries in Virtual Containers; The Overhead Bytes.
Self Learning Exercise: Building Integrated Timing Supply, SONET and SDH Concatenation

Module-3 8 Hours
Architecture of Optical Transport Networks, WDM, Network Topologies and Protection Schemes: The Digital Wrapper; Control Planes; In-Band and Out-Band Control Signaling; Importance of Multiplexing and Multiplexing Hierarchies; Current Digital Transport Hierarchy;
SONET Multiplexing Hierarchy; SDH Multiplexing Hierarchy; Key Indexes and Other Terms; The New Optical Transport and Digital Transport Hierarchy; The OTN Layered Model; Encapsulation and Decapsulation Operations;

**Self Learning Exercise:** Generic Framing Procedure.

---

**Module-4**

7 Hours

**The WDM Operation; DWDM, TDM and WDM Topologies**; Relationship of WDM to SONET / SDH; EDF; WDM Amplifiers; Add-Drop Multiplexers; WDM Cross-Connects; Wavelength Continuity Property; Examples of DWDM Wavelength Plan; Higher Dispersion for DWDM; Tunable DWDM Lasers, The Non-Negotiable Requirement Robust Networks; Diversity in the Network; Line and Path Protection Switching; Types of Topologies; Working and Protection Fibers; Point-to-Point Topology; BLSR; Protection Switching on Four-Fiber BLSR; Meshed Topologies; PONs; Ethernet in the Wide Area Backbone,

**Self Learning Exercise:** Metro Optical Networking.

---

**Module-5**

8 Hours

**MPLS and Optical Networks, Architecture of IP and MPLS-Based OTNs:** Label Switching; FEC; Types of MPLS Nodes; Label Distribution and Binding; Label Switching and Traffic Forwarding; MPLS Support of VPNs; MPLS Traffic Engineering; Multiprotocol Lambda Switching; MPLS and Optical TE Similarities; Possibilities for the MPIS Network; Control and Data Planes Interworking, IP, MPLS, and Optical Control Planes; Interworking the three Control Planes; Management of the Planes; A Framework for the IP over Optical Networks; An Opposing View; Generalized MPLS use in Optical Networks; Bi-Directional LSPs in Optical Networks; GMPLS Extensions for G.709;

**Self Learning Exercise:** GMPLS with SONET and SDH.

---

**Text Books:**


**Reference Books:**

M.Tech. Computer Network Engineering

COMPUTER SYSTEM PERFORMANCE ANALYSIS (3-0-0) (Elective)

Sub Code: MCN2E302  CIE:50 Marks
Hrs / Week: 03       SEE: 50% Marks
SEE Hrs: 03 Hours    Max Marks: 100

Course Outcomes:
On successful completion of the course, the students will be able to:
1. Describe the mathematical foundations needed for performance evaluation of computer systems
2. Explain the metrics used for performance evaluation
3. Describe the analytical modeling of computer systems
4. Explain Capacity Planning and Benchmarking
5. Describe the concept of design and analysis in computer system.

Module-1  8 Hours
Self Learning Exercise: Setting Performance Requirements.

Module-2  8 Hours
Workloads, Workload Selection and Characterization: Types of Workloads, addition instructions, Instruction mixes, Kernels; Synthetic programs, Application benchmarks, Popular benchmarks. Work load Selection: Services exercised, level of detail; Representativeness; Timeliness, Other considerations in workload selection. Work load characterization Techniques: Terminology; Averaging, Specifying dispersion, Single Parameter Histograms, Multi Parameter Histograms, Principle Component Analysis,
Self Learning Exercise: Markov models, Clustering.

Module-3  8 Hours
Monitors, Program Execution Monitors and Accounting Logs: Monitors: Terminology and classification; Software and hardware monitors, Software versus hardware monitors, Firmware and hybrid monitors, Distributed System Monitors, Program Execution Monitors and Accounting Logs, Program Execution Monitors, Techniques for Improving Program Performance, Accounting Logs, Analysis and Interpretation of Accounting logdata,
Self Learning Exercise: Using accounting logs to answer commonly asked questions.

Dept. of IS&E, NIE, Mysuru
Module-4 8 Hours

**Capacity Planning and Benchmarking**: Steps in capacity planning and management; Problems in Capacity Planning; Common Mistakes in Benchmarking; Benchmarking Games; Load Drivers; Remote- Terminal Emulation; Components of an RTE;

**Self Learning Exercise**: Limitations of RTEs.

Module-5 7 Hours

**Experimental Design and Analysis: Introduction**: Terminology, Common mistakes in experiments, Types of experimental designs, 2k Factorial Designs, Concepts, Computation of effects, Sign table method for computing effects; Allocation of variance;
General 2k Factorial Designs, General full factorial designs with k factors: Model, Analysis of a General Design,

**Self Learning Exercise**: Informal Methods.


**Reference Books**:

WEB ENGINEERING (3-0-0) (Elective)

Sub Code: MCN2E303  CIE: 50 Marks
Hrs / Week: 03  SEE: 50% Marks
SEE Hrs: 03 Hours  Max Marks: 100

Course Outcomes:
On successful completion of the course, the students will be able to:
1. Explain Requirement engineering for web applications.
2. Describe modeling of web applications
3. Identify different types of designs for web applications.
4. Explain Project management for web applications.
5. Discuss the characteristics of usability.

Module-1  8 Hours
Self Learning Exercise: Outlook.

Module-2  8 Hours
Self Learning Exercise: Data-Aspect Architectures.

Module-3  8 Hours
Self Learning Exercise: Test automation, Outlook.

Module-4  8 Hours
Operation and Maintenance of Web Applications: Introduction, Challenges following the launch of a web application, Content management, Usage analysis, Outlook. Web Project Management: From software project management to web project management, Challenges in
web project management, Managing web teams, Managing the development process of a web application, Outlook. The Web Application Development Process: Motivation, Fundamentals, Requirements for a web application development process, Analysis of the rational unified process.

**Self Learning Exercise:** Analysis of extreme programming, Outlook.

**Module-5**  
7 Hours

**Usability of Web Applications:** Motivation, What is usability? What characterizes the usability of web applications? Design guidelines, Web usability engineering methods, Web usability engineering trends, Outlook

**Performance of Web Applications:** Introduction, What is performance? What characterizes performance of web applications, System definition and indicators, Characterizing the work load, Analytical techniques, Representing and interpreting results.

**Self Learning Exercise:** Performance optimization methods, Outlook.

**Text Book:**
Gerti Kappel, Birgit Proll, Siegfried Reich, Werner Retschitzegeer (Editors): Web Engineering, Wiley India, 2007.

**Reference Books:**
ADVANCES IN STORAGE AREA NETWORK (3-0-0) (Elective)

Sub Code: MCN2E304  
CIE: 50 Marks

Hrs / Week: 03  
SEE: 50% Marks

SEE Hrs: 03 Hours  
Max Marks: 100

Course Outcomes:
On successful completion of the course, the students will be able to:
1. Differentiate the server centric and storage centric networks
2. Classify the different types of Hard Disks and their configurations.
3. Discuss the various I/O techniques used in SAN, and differentiate between NAS and SAN
4. Explain the concepts of storage virtualization and different forms and approaches of virtualization
5. Explain the concept of creating a storage network from existing architectures and technologies.

Module-1  
8 Hours
Self Learning Exercise: The Battle for size and access - Overview

Module-2  
8 Hours
Intelligent Disk Subsystems: Architecture of Intelligent Disk Subsystems; Hard disks and Internal I/O Channels; JBOD, Storage virtualization using RAID and different RAID levels; Caching: Acceleration of Hard Disk Access; Intelligent disk subsystems,  
Self Learning Exercise: Availability of disk subsystems.

Module-3  
8 Hours
I/O Techniques, Network Attached Storage, File System and NAS: The Physical I/O path from the CPU to the Storage System; SCSI; Fibre Channel Protocol Stack; Fibre Channel SAN; IP Storage, File System And NAS: Local File Systems; Network file Systems and file servers; Shared Disk file systems;  
Self Learning Exercise: Comparison of fibre Channel, iSCSI and NAS

Module-4  
8 Hours
Storage Virtualization: Definition of Storage virtualization; Implementation Considerations; Storage virtualization on Block or file level; Storage virtualization on various levels of the storage Network; Symmetric storage virtualization in the Network  
Self Learning Exercise: Asymmetric storage virtualization in the Network

Module-5  
8 Hours
SAN Architecture and Hardware devices: Architecture Overview, Creating a Network for storage; SAN Hardware devices; The fibre channel switch; Host Bus Adaptors; Putting the storage in SAN.  
Self Learning Exercise: Fabric operation from a Hardware perspective.
Text Book:


Reference Books:

REAL TIME SYSTEMS (3-0-0) (Elective)

Sub Code: MCN2E305  CIE: 50 Marks
Hrs / Week: 03  SEE: 50% Marks
SEE Hrs: 03 Hours  Max Marks: 100

Course Outcomes:
On successful completion of the course, the students will be able to:
2. Explain the fundamental problems of real-timesystems;
3. Apply the different approaches to real time scheduling.
4. Describe the concepts of priority scheduling.
5. Distinguish the different real time protocols

Module 1  8 Hours
Reference model of Real-Time systems: Processors and Resources, Temporal Parameters of Real-Time Work load, Periodic task model, Precedence Constraints and Data dependency, other types dependencies. Functional parameters of resources.
Self Learning Exercise: Scheduling hierarchy.

Module 2  8 Hours
Approaches to Real-Time Scheduling: Clock-Driven approach, Weighted Round-Robin approach. Priority driven approach. Dynamic Versus Static Systems, Effective Release times and deadlines, optimality of the EDF and LST algorithms, Non-Optimality of the EDF and LST algorithms

Module 3  8 Hours
Clock-driven Scheduling: Notations and assumptions, static, Timer-Driven Scheduler, General Structure Cyclic Schedulers Cyclic executives, Improving the average response time of a periodic jobs Scheduling Sporadic Jobs
Self Learning Exercise: Problem on sporadic jobs schedule.
Module 4  8 Hours
Priority-Driven Scheduling of Periodic Tasks: Static assumption, Fixed Priority Versus Dynamic Priority algorithms, Maximum Scheduling utilization, Optimality of the RM and DM algorithms, A schedulability test for fixed-Priority tasks with arbitrary response times.
Self Learning Exercise: derivation of schedulability test of RMAlgorithm.

Module 5  7 Hours
Resources and Resources Access Control: Assumptions on resources and their usage, Effects of resources contention and resources access control Non preemptive critical section, Basic Priority – Ceiling Protocol, Stack-Based priority – Ceiling Protocol, Use of priority-ceiling protocol in Dynamic-Priority Systems, Preemption-Ceiling Protocol, Model of Real-time Communication, Priority-Based Service Disciplines for switched Networks,
Self Learning Exercise: Real time protocol.

Text Book:

Reference Book:
SOCIAL NETWORKS (3:0:0) (Elective)

Subcode : MCN2E306
Hrs/week : 03
SEE Hrs : 03

CIE : 50 Marks
SEE : 50% Marks
Max. Marks : 100

Course Outcomes:
On Successful completion of the course, the students will be able to:
1. Interpret the network structure by applying the concepts of graph theory.
2. Formulate the behavioral models in various environments of social networks. (Module 2 & 3)
3. Illustrate link analysis and cascading behavior in social networks.

Module 1
Overview: Aspects of Networks, Central Themes and Topics, Central Themes and Topics.
Graph Theory and Social Networks Graphs Basic Definitions, Paths and Connectivity, Datasets: An Overview

Self Learning Exercise: Distance and Breadth-First Search Network

Module 2
Strong and Weak Ties: Triadic Closure, The Strength of Weak Ties, Tie Strength and Network, Structure in Large-Scale Data, Tie Strength, Social Media, and Passive Engagement, Closure, Structural Holes, and Social Capital

Self Learning Exercise: Advanced Material: Betweenness Measures and Graph Partitioning

Module 3
Networks in Their Surrounding Contexts
Homophily Mechanisms Underlying Homophily: Selection and Social Influence Affiliation, Tracking Link Formation in On-Line Data

Positive and Negative Relationships
Structural Balance, Characterizing the Structure of Balanced Networks, Applications of Structural Balance, A Weaker Form of Structural Balance.

Self Learning Exercise: A Spatial Model of Segregation, Advanced Material: Generalizing the Definition of Structural Balance

Module 4

Cascading Behavior in Networks
Diffusion in Networks, Modeling Diffusion through a
Network, Cascades and Clusters, Diffusion, Thresholds, and the Role of Weak Ties

**Self Learning Exercise:** Extensions of the Basic Cascade Model, Knowledge, Thresholds, and Collective Action

**Module5**

*8 Hours*

**Information Cascades:** Following the Crowd Simple Herding Experiment Bayes’ Rule: A Model of Decision-Making under Uncertainty Bayes’ Rule in the Herding Experiment Simple, General Cascade, Sequential Decision-Making


**Self Learning Exercise:** Lessons from Cascades, Advanced Material: Analysis of Rich-Get-Richer Processes

**Text Books:**

1. Networks, Crowds and Markets by David Easley and Jon Kleinberg, Cambridge University Press, 2010

**Reference Books:**

DEPARTMENT ELECTIVE-4
BIG DATA ANALYTICS (3-0-0) (Elective)

Sub Code: MCN2E401  CIE:50 Marks
Hrs / Week: 03  SEE: 50% Marks
SEE Hrs: 03 Hours  Max Marks: 100

Course Outcomes:
On successful completion of the course, the students will be able to:
1. Explain the basics of Big Data
2. Use Technologies for Handling Big Data and Hadoop Ecosystem
3. Describe Map Reduce Fundamentals and HBase
4. Describe the different types of Analytics
5. Use of R programming in statistical analysis

Module 1  6 Hours
Self Learning Exercise: Business Intelligence, Preventing Fraud Using BigData Analytics

Module 2  9 Hours
Self Learning Exercise:HBase, Hive, Pig,Sqoop, Flume

Module 3  8 Hours
Self Learning Exercise: Installation of Hbase

Module 4  8 Hours
Understanding Analytics and Big Data: Comparing Reporting and Analysis, Reporting, Analysis, The Analytic Process, Types of Analytics, Basic Analytics, Advanced Analytics, Operationalized Analytics, Monetized Analytics, Characteristics of Big Data Analysis, Points to Consider during Analysis, Frame the Problem Correctly, Statistical Significance or Business
Importance?, Making Inferences versus Computing Statistics, Developing an Analytic Team, Convergence of IT and Analytics, Understanding Text Analytics

Self Learning Exercise: Skills required for an Analyst

Module 5  8 Hours

Self Learning Exercise: Installing R Studio.

Text Book:

Reference Books:
COMPUTER FORENSICS (3-0-0) (Elective)

Sub Code: MCN2E402  
CIE: 50 Marks
Hrs / Week: 03  
SEE: 50% Marks
SEE Hrs: 03 Hours  
Max Marks: 100

Course Outcomes:
On successful completion of the course, the students will be able to:
1. Identify the need for legal and corporate investigation
2. Describe the procedure for computer investigation
3. Explain the data acquisition system
4. Discuss the evidence collection process
5. Identify the tools used for forensic

Module 1  
8 Hours

Self Learning Exercise: Maintaining Professional Conduct

Module 2  
8 Hours

Self Learning Exercise: Using ProDiscover Basic to Acquire a USB Drive

Module 3  
8 Hours
Acquisition with R-Tools R-Studio, Remote Acquisition with Wet Stone Live Wire, Remote Acquisition with F-Response

**Self Learning Exercise:** Remote Acquisition with Runtime Software

**Module 4**
8 Hours

**Self Learning Exercise:** Processing and Handling Digital Evidence.

**Module 5**
7 Hours

**Self Learning Exercise:** Recommendations for a Forensic

**Text Book**

**REFERENCE BOOK**
HUMAN COMPUTER INTERFACE (3-0-0) (Elective)

Sub Code: MCN2E403
Hrs / Week: 03
SEE Hrs: 03 Hours

Course Outcomes:
On successful completion of the course, the students will be able to:
1. Describe the foundations of Human Computer Interaction
2. Explain HCI in software process
3. Describe different HCI Models.
4. Explain mobile HCI
5. Explain guidelines for user interface.

Module 1: 8 Hours
Self Learning Exercise: Paradigms

Module 2: 8 Hours
Self Learning Exercise: Universal Design

Module 3: 8 Hours
MODELS AND THEORIES: Cognitive models –Socio-Organizational issues and stake holder requirements –Communication and collaboration models
Self Learning Exercise: Hypertext, Multimedia and WWW.

Module 4: 8 Hours
Self Learning Exercise: Tools for Mobile Design

Module 5: 7 Hours
WEB INTERFACE DESIGN: Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages
Text Books:
INFORMATION RETRIEVAL SYSTEMS (3-0-0) (Elective)

Sub Code: MCN2E404
Hrs / Week: 03
CIE:50 Marks
SEE: 50% Marks
SEE Hrs: 03 Hours
Max Marks: 100

Course Outcomes:
On Successful Completion of the Course, the students will be able to:
1. Explain the process of retrieving information.
2. Describe retrieval performance and various types of queries.
3. Discuss automatic local- global analysis, document clustering and text compression techniques.
4. Describe different indexing and searching algorithms.
5. Explain the Challenges of searching the web.

Module 1:

Introduction: Motivation, Basic concepts, The retrieval process.
Self Learning Exercise: Models for browsing.

Module 2:

Query Languages: Introduction, keyword-based querying, Pattern matching, Structural queries
Self Learning Exercise: Hierarchical Structure, Query protocols.

Module 3:


Module 4:

Indexing & Searching
Introduction; Inverted Files; Other indices for text; Boolean queries; Sequential searching; Pattern matching.
Self Learning Exercise: Pattern matching using indices, Structural queries; Compression.

Module 5:

Dept. of IS&E, NIE, Mysuru
User Interfaces and Visualization: Introduction, Human-Computer interaction, The information access process, Starting points, Query specification, Context, Using relevance judgments.

Searching the Web: Introduction, Challenges, Characterizing the web Search engines, Browsing, Met searchers.

Self Learning Exercise: Searching using hyperlinks.

Text Books:

Reference Books:
ADVANCED DIGITAL COMMUNICATION (3-0-0) (Elective)

Sub Code: MCN2E405  
CIE: 50 Marks

Hrs / Week: 03  
SEE: 50% Marks

SEE Hrs: 03 Hours  
Max Marks: 100

Course Outcomes:
On successful completion of the course, the students will be able to:
1. Describe fundamentals of digital transmission
2. Compare different techniques for error Detection and Correction
3. Describe elements of DCS
4. Compare different waveform coding techniques
5. Describe Nyquest Criterion and correlative coding

Module-1  
8 Hours

Module-2  
8 Hours

Module-3  
8 Hours
Brief Review of digital communication systems: Elements of Digital communication systems; Communication channels and their characteristics;
Self Learning Exercise: Historical perspective in the development of digital communication.
Module-4  
Wave form Coding Techniques: PCM, Channel. Noise and error probability, DPCM, DM.  
Self Learning Exercise: coding speech at low bitrates, Applications

Module-5  
Base band Shaping for data transmission: Discrete PAM signals, Inter-symbol interference (ISI) Nyquist criterion for distortion-less Base band binary transmission. 
Self Learning Exercise: Correlative Coding.

TEXT BOOKS:

REFERENCE BOOKS :
INDUSTRY DRIVEN ELECTIVES
INTRODUCTION TO MACHINE LEARNING (2:0:0)

Sub Code: MCN2I02  CIE: 25 Marks
Hrs / Week: 03     SEE: 50% Marks
SEE Hrs: 02 Hours   Max Marks: 50

Course Outcomes:
On Successful completion of the course, the students will be able to:
1. Illustrate basic concepts of machine learning
2. Explain Machine Learning Process
3. Demonstrate experiments in Azure ML studio with basic Python code

Module1: 8 Hours
Introduction to Machine Learning, Understand classification Vs Regression with examples of various algorithms, Designing a Learning system, Perspective and Issues in Machine Learning, Hand on model creation in Azure ML using basic Python Programming
Self Learning Exercise: Basic Python Programming

Module2: 9 Hours
Decision Tree Learning: Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, hypothesis space search in decision tree learning, Hands on Azure ML experiments with selectivebias
Self Learning Exercise: Anomaly detection using ML

Module3: 9 Hours
Guidance on which algorithm to use for which kind of problems, Illustrating the Machine Learning Process, Hands on model creation for regression problems using Python, Hands on model creation for classification problems using Python
Self Learning Exercise: Recommender system

Text Books:

All the Microsoft e-books can be downloaded from this URL:
Reference Links:
Azure Portal: https://portal.azure.com
Azure Machine Learning Studio: https://studio.azureml.net

Client SDKs and Samples: https://www.microsoft.com/cognitive-services/en-us/sdk-sample

Azure Services running status: https://azure.microsoft.com/en-in/status/
III SEMESTER M. Tech.
SEMINAR (Core)

Sub Code: MCN3C01  CIE:50 Marks

Course Outcomes:
On Successful completion of the course, the students will be able to:
1. Recognize relevance of the topic chosen
2. Explain current real world issues by doing literature survey
3. Identify the depth of the topic
4. Prepare presentations to convey the essence of the topic clearly.
5. Justify the comments and questionnaires from audience.

INTERNSHIP (Core)

Sub Code: MCN3C02  CIE:50 Marks

Course Outcomes:
On successful completion of the course, the students will be able to:
1. Appraise the problem to be analyzed
2. Apply the knowledge of the engineering to solve the problem
3. Outline the conducted work with a report

PROJECT PHASE-I (PROJECT)

Sub Code: MCN3C03  CIE:50 Marks

Course Outcomes:
On successful completion of the course, the students will be able to:
1. Identify the different areas of interest feasible to the project.
2. Analyze the problem identified.
3. Develop the design methods to solve the identified problems.
IV SEMESTER M. Tech.
IV SEMESTER M. TECH.
PROJECT - PHASE-2 (PROJECT)

Sub Code: MCN4C01                CIE: 50 Marks
Hrs / Week: 15                    SEE: 50% Marks
SEE Hrs: 03 Hours                 Max Marks: 100

Course Outcomes:
On successful completion of the course, the students will be able to:
1. Implement the proposed design of phase-I.
2. Validate the results obtained from the implementation using various test cases.
3. Demonstrate the project work.
4. Articulate the project work.
5. Publish the project work done.