ANNA UNIVERSITY
CHENNAI - 600 025

UNIVERSITY DEPARTMENTS

REGULATIONS 2012
CURRICULA AND SYLLABI FOR
I TO VIII SEMESTERS

B.E. BIOMEDICAL ENGINEERING
(FULL TIME)
## SEMESTER I

<table>
<thead>
<tr>
<th>CODE No.</th>
<th>COURSE TITLE</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>
</tr>
<tr>
<td>HS8151</td>
<td>Technical English - I</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>MA8151</td>
<td>Mathematics I</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>PH8151</td>
<td>Engineering Physics</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CY8151</td>
<td>Engineering Chemistry</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>GE8151</td>
<td>Computing Techniques</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>GE8152</td>
<td>Engineering Graphics</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td><strong>PRACTICAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PH8161</td>
<td>Physics Laboratory</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>CY8161</td>
<td>Chemistry Laboratory</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>GE8161</td>
<td>Computer Practices Laboratory</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>GE8162</td>
<td>Engineering Practices Laboratory</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td>17</td>
<td>2</td>
<td>13</td>
<td>27</td>
</tr>
</tbody>
</table>

**TOTAL HOURS:** 27
### SEMESTER II

<table>
<thead>
<tr>
<th>CODE No.</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>THEORY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HS8251</td>
<td>Technical English – II</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>MA8251</td>
<td>Mathematics II</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>BM8201</td>
<td>Anatomy &amp; Physiology</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>BM8202</td>
<td>Electron Devices and Circuits</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>BM8203</td>
<td>Medical Physics</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>EC8251</td>
<td>Circuit Theory</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td><strong>PRACTICAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BM8211</td>
<td>Circuit Analysis Laboratory</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>BM8212</td>
<td>Electron Devices and Circuits Laboratory</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td>18</td>
<td>4</td>
<td>6</td>
<td>26</td>
</tr>
</tbody>
</table>

### SEMESTER III

<table>
<thead>
<tr>
<th>CODE No.</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>THEORY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MA8357</td>
<td>Transform Techniques and Partial Differential Equation</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>GE8351</td>
<td>Environmental Science and Engineering</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>BM8301</td>
<td>Fundamentals of Biochemistry</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>BM8302</td>
<td>Sensors and Measurements</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>EC8353</td>
<td>Signals and Systems</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>EE8306</td>
<td>Basics of Electrical Engineering</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>PRACTICAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BM8311</td>
<td>Biochemistry and Human Physiology Laboratory</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>BM8312</td>
<td>Sensors and Measurements Laboratory</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td>18</td>
<td>1</td>
<td>6</td>
<td>23</td>
</tr>
</tbody>
</table>
# SEMESTER IV

<table>
<thead>
<tr>
<th>CODE No.</th>
<th>COURSE TITLE</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>
</tr>
<tr>
<td>MA8355</td>
<td>Probability and Random Processes</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>BM8401</td>
<td>Biomedical Instrumentation and Measurements</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>BM8402</td>
<td>Pathology and Microbiology</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>EC8351</td>
<td>Digital Electronics and System Design</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>EC8452</td>
<td>Operational Amplifiers and Analog Integrated Circuits</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td><strong>PRACTICAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BM8411</td>
<td>Bio Medical Instrumentation Laboratory</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>BM8412</td>
<td>Integrated Circuits Laboratory</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>BM8413</td>
<td>Pathology and Microbiology Laboratory</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td>15</td>
<td>1</td>
<td>9</td>
<td>22</td>
</tr>
</tbody>
</table>

# SEMESTER V

<table>
<thead>
<tr>
<th>CODE No.</th>
<th>COURSE TITLE</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>
</tr>
<tr>
<td>BM8501</td>
<td>Analog and Digital Communication</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>BM8502</td>
<td>Control System for Bio Medical Engineering</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>BM8503</td>
<td>Diagnostic and Therapeutic Equipment I</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>EC8503</td>
<td>Microprocessor and Micro controllers</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>EC8551</td>
<td>Discrete Time Signal Processing</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>E1</td>
<td>Elective –I</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td><strong>PRACTICAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HS8561</td>
<td>Employability Skills</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>EC8511</td>
<td>Micro controller and Interfacing Laboratory</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>EC8561</td>
<td>Digital Signal Processing Laboratory</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td>18</td>
<td>2</td>
<td>8</td>
<td>25</td>
</tr>
<tr>
<td>CODE No.</td>
<td>COURSE TITLE</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>
</tr>
<tr>
<td></td>
<td><strong>THEORY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BM8601</td>
<td>Bio Mechanics</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>BM8602</td>
<td>Diagnostic and Therapeutic Equipment II</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>BM8603</td>
<td>Hospital Management</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>BM8604</td>
<td>Radiological Equipment</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>E2</td>
<td>Elective –II</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>E3</td>
<td>Elective –III</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>PRACTICAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BM8611</td>
<td>Diagnostic &amp; Therapeutic Equipment Laboratory</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>BM8612</td>
<td>Medical Electronics System Design Laboratory</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td>18</td>
<td>0</td>
<td>6</td>
<td>22</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CODE No.</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>THEORY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BM8701</td>
<td>Medical Informatics</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>BM8702</td>
<td>Pattern Recognition and Neural Networks</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>BM8751</td>
<td>Principles of Digital Image Processing</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>E4</td>
<td>Elective IV</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>E5</td>
<td>Elective V</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>E6</td>
<td>Elective VI</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>PRACTICAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BM8711</td>
<td>Hospital Training</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>BM8712</td>
<td>Medical Image Processing Lab</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td>18</td>
<td>0</td>
<td>7</td>
<td>22</td>
</tr>
</tbody>
</table>
### SEMESTER VIII

<table>
<thead>
<tr>
<th>CODE No.</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>E7</td>
<td>Elective VII</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>E8</td>
<td>Elective VIII</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

#### PRACTICAL

<table>
<thead>
<tr>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>BM8811 Project Work</td>
<td>0</td>
<td>0</td>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>6</td>
<td>0</td>
<td>12</td>
<td>12</td>
</tr>
</tbody>
</table>

**TOTAL NO OF CREDITS: 179**

### ELECTIVES

<table>
<thead>
<tr>
<th>CODE No.</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>BM8001</td>
<td>Advanced Bio analytical and Therapeutic Techniques</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>BM8002</td>
<td>Advanced Microprocessors</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>BM8003</td>
<td>Bio Materials and Artificial Organs</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>BM8004</td>
<td>Bio MEMS</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>BM8005</td>
<td>Bio Signal Processing</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>BM8006</td>
<td>Biomaterials and Characterization</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>BM8007</td>
<td>Biometric Systems</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>BM8008</td>
<td>Brain Computer Interface and Applications</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>BM8009</td>
<td>Computer Hardware and Interfacing</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>EC8011</td>
<td>Embedded and Real - Time Systems</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>BM8011</td>
<td>Medical Optics</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>BM8012</td>
<td>Neural Engineering</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>BM8013</td>
<td>Physiological Modeling</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>BM8014</td>
<td>Principles of Tissue Engineering</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>BM8015</td>
<td>Rehabilitation Engineering</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>GE8751</td>
<td>Engineering Ethics and Human Values</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
<td>Credits</td>
<td>Practical</td>
<td>Theory</td>
<td>Total</td>
</tr>
<tr>
<td>------------</td>
<td>-------------------------------------------------------</td>
<td>---------</td>
<td>----------</td>
<td>--------</td>
<td>-------</td>
</tr>
<tr>
<td>MG8654</td>
<td>Total Quality Management</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CS8251</td>
<td>Data Structures and Object Oriented Programming in C++</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>EC8071</td>
<td>Cryptography and Network Security</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>EC8072</td>
<td>Electro Magnetic Interference and Compatibility</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>EC8073</td>
<td>Foundations of Nano-Electronics</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>EC8074</td>
<td>Multimedia Compression and Communication</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>EC8075</td>
<td>Robotics</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>EC8076</td>
<td>Soft Computing and Applications</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>EC8451</td>
<td>Computer Architecture and Organization</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>EC8651</td>
<td>Digital VLSI</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CS8075</td>
<td>Foundation Skills in Integrated Product Development</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>GE8072</td>
<td>Disaster Management</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>GE8073</td>
<td>Human Rights</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>
OBJECTIVES

• To enable all students of engineering and technology develop their basic communication skills in English.
• To give special emphasis to the development of speaking skills amongst the students of engineering and technology students.
• To ensure that students use the electronic media such as interne and supplement the learning materials used in the classroom.
• To inculcate the habit of reading for pleasure.

UNIT I
Listening - Introducing learners to GIE - Types of listening - Listening to audio (verbal & sounds); Speaking - Speaking about one’s place, important festivals etc. – Introducing oneself, one’s family / friend; Reading - Skimming a reading passage – Scanning for specific information - Note-making; Writing - Free writing on any given topic (My favourite place / Hobbies / School life, etc.) - Sentence completion - Autobiographical writing (writing about one’s leisure time activities, hometown, etc.); Grammar - Prepositions - Reference words- Wh-questions - Tenses (Simple); Vocabulary - Word formation - Word expansion (root words / etymology); E-materials - Interactive exercises for Grammar & Vocabulary - Reading comprehension exercises - Listening to audio files and answering questions.

UNIT II
Listening - Listening and responding to video lectures / talks; Speaking - Describing a simple process (filling a form, etc.) - Asking & answering questions - Telephone skills – Telephone etiquette; Reading – Critical reading - Finding key information in a given text - Sifting facts from opinions; Writing - Biographical writing (place, people) - Lab descriptions (general/ specific description of laboratory experiments) - Definitions - Recommendations; Grammar - Use of imperatives - Subject-verb agreement; Vocabulary - Compound words - Word Association; E-materials - Interactive exercises for Grammar and Vocabulary - Listening exercises with sample telephone conversations / lectures – Picture-based activities.

UNIT III
Listening - Listening to specific task - focused audio tracks; Speaking - Role-play – Simulation - Group interaction - Speaking in formal situations (teachers, officials, foreigners); Reading - Reading and interpreting visual material; Writing - Jumbled
sentences - Coherence and cohesion in writing - Channel conversion (flowchart into process) - Types of paragraph (cause & effect / compare & contrast / narrative / analytical) - Informal writing (letter/email/blogs) - Paraphrasing; Grammar - Tenses (Past) - Use of sequence words - Adjectives; Vocabulary - Different forms and uses of words, Cause and effect words; E-materials - Interactive exercises for Grammar and Vocabulary - Excerpts from films related to the theme and follow up exercises - Pictures of flow charts and tables for interpretations.

UNIT IV
Listening - Watching videos / documentaries and responding to questions based on them; Speaking - Responding to questions - Different forms of interviews - Speaking at different types of interviews; Reading - Making inference from the reading passage - Predicting the content of a reading passage; Writing - Interpreting visual materials (line graphs, pie charts etc.) - Essay writing – Different types of essays; Grammar - Adverbs – Tenses – future time reference; Vocabulary - Single word substitutes - Use of abbreviations & acronyms; E-materials - Interactive exercises for Grammar and Vocabulary - Sample interviews - film scenes - dialogue writing.

UNIT V
Listening - Listening to different accents, Listening to Speeches / Presentations, Listening to broadcast & telecast from Radio & TV; Speaking - Giving impromptu talks, Making presentations on given topics; Reading - Email communication - Reading the attachment files having a poem/joke/proverb - Sending their responses through email Writing - Creative writing, Poster making; Grammar - Direct and indirect speech; Vocabulary - Lexical items (fixed / semi fixed expressions); E-materials - Interactive exercises for Grammar & Vocabulary - Sending emails with attachment – Audio / video excerpts of different accents, - Interpreting posters

OUTCOMES:
Learners should be able to:
- Speak clearly, confidently, comprehensibly, and communicate with one or many listeners using appropriate communicative strategies.
- Write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.
- Read different genres of texts adopting various reading strategies.
- Listen/view and comprehend different spoken discourses/excerpts in different accents.

TEXT BOOKS:
REFERENCE BOOKS:

EXTENSIVE READERS:

WEBSITE RESOURCES:
• www.uefap.com
• www.eslcafe.com
• www.listen-to-english.com
• www.owl.english.purdue.edu
• www.chompchomp.com

MA8151 MATHEMATICS – I (Common to all branches of B.E. / B.Tech. Programmes in I Semester) 3 1 0 4

OBJECTIVES:
• To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
• To make the student knowledgeable in the area of infinite series and their convergence so that he/ she will be familiar with limitations of using infinite series approximations for solutions arising in mathematical modeling.
• To familiarize the student with functions of several variables. This is needed in many branches of engineering.
• To introduce the concepts of improper integrals, Gamma, Beta and Error functions which are needed in engineering applications.
• To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.
UNIT I MATRICES 9+3

UNIT II INFINITE SERIES 9+3

UNIT III FUNCTIONS OF SEVERAL VARIABLES 9+3

UNIT IV IMPROPER INTEGRALS 9+3

UNIT V MULTIPLE INTEGRALS 9+3

TOTAL : 60 PERIODS

OUTCOMES:
• This course equips students to have basic knowledge and understanding in one fields of materials, integral and differential calculus.

TEXT BOOKS:

REFERENCES:

Attended
DIRECTOR
Centre For Academic Courses
Anna University, Chennai-600 025.
OBJECTIVES:
To introduce the basic physics concepts relevant to different branches of Engineering and Technology.

UNIT I  PROPERTIES OF MATTER  9

UNIT II  ACOUSTICS AND ULTRASONICS  9

UNIT III  THERMAL PHYSICS  9

UNIT IV  APPLIED OPTICS  9
UNIT V  SOLID STATE PHYSICS

Nature of bonding - growth of single crystals (qualitative) - crystal systems - crystal planes and directions - expressions for interplanar distance - coordination number and packing factor for simple structures: SC, BCC, FCC and HCP - structure and significance of NaCl, ZnS, diamond and graphite - crystal imperfections: point defects, dislocations and stacking faults - unit cell, Bravais space lattices - miller indices.

OUTCOMES:
The students will have knowledge on the basics of physics related to properties of matter, Optics, acoustics etc., and they will apply these fundamental principles to solve practical problems related to materials used for engineering applications

TEXT BOOKS:

REFERENCES:

UNIT I  CHEMICAL THERMODYNAMICS

Second law: Entropy - entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Clausius inequality. Free energy and work function: Helmholtz and Gibbs free energy functions; Criteria of spontaneity; Gibbs-Helmholtz equation; Clausius- Clapeyron equation; Maxwell relations – Van’t Hoff isotherm and isochore. Chemical potential; Gibbs-Duhem equation – variation of chemical potential with temperature and pressure.
UNIT II POLYMER CHEMISTRY

Introduction: Classification of polymers – Natural and Synthetic; Thermoplastic and Thermosetting. Functionality – Degree of polymerisation. Types and mechanism of polymerisation: Addition (Free Radical, cationic, anionic and living); condensation and copolymerisation. Properties of polymers: Tg, Tacticity, Molecular weight – weight average, number average and polydispersity index. Techniques of polymerisation: Bulk, emulsion, solution and suspension.

UNIT III KINETICS AND CATALYSIS


UNIT IV PHOTOCHEMISTRY AND SPECTROSCOPY


UNIT V NANO CHEMISTRY


OUTCOMES:
• The knowledge gained on polymer chemistry, thermodynamics, spectroscopy, Kinetics and Catalysis and nano materials will provide a strong platform to understand the concepts on these subjects for further learning.

TEXT BOOKS:

REFERENCE BOOKS:
GE8151 COMPUTING TECHNIQUES

OBJECTIVES:
The students should be made to:
- Learn the organization of a digital computer.
- Be exposed to the number systems.
- Learn to think logically and write pseudo code or draw flow charts for problems.
- Be exposed to the syntax of C.
- Be familiar with programming in C.
- Learn to use arrays, strings, functions, pointers, structures and unions in C.

UNIT I INTRODUCTION

UNIT II C PROGRAMMING BASICS

UNIT III ARRAYS AND STRINGS

UNIT IV FUNCTIONS AND POINTERS

UNIT V STRUCTURES AND UNIONS
Introduction – need for structure data type – structure definition – Structure declaration – Structure within a structure - Union - Programs using structures and Unions – Storage classes, Pre-processor directives.

TOTAL :45 PERIODS
OUTCOMES:
At the end of the course, the student should be able to:
- Design C Programs for problems.
- Write and execute C programs for simple applications

TEXTBOOKS:

REFERENCES:

GE8152  ENGINEERING GRAPHICS  L T P C  2 0 3 4

OBJECTIVES:
To develop in students, graphic skills for communication of concepts, ideas and design of engineering products and expose them to existing national standards related to technical drawings.

CONCEPTS AND CONVENTIONS (NOT FOR EXAMINATION)  1
Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I  PLANE CURVES AND FREE HAND SKETCHING  14
Basic Geometrical constructions, Curves used in engineering practices
Visualization concepts and Free Hand sketching
Visualization principles – Representation of Three Dimensional objects – Layout of views-
Free hand sketching of multiple views from pictorial views of objects

UNIT II  PROJECTION OF POINTS, LINES AND PLANE SURFACES  14
Orthographic projection- principles-Principal planes-First angle projection-Projection of points.
Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and trapezoidal method and traces
Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III  PROJECTION OF SOLIDS
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method and auxiliary plane method.

UNIT IV  PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES
Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes

UNIT V  ISOMETRIC AND PERSPECTIVE PROJECTIONS
Principles of isometric projection – isometric scale – Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones - combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method and vanishing point method.

COMPUTER AIDED DRAFTING (DEMONSTRATION ONLY)
Introduction to drafting packages and demonstration of their use.

OUTCOMES:
On Completion of the course the student will be able to:
- Perform free hand sketching of basic geometrical constructions and multiple views of objects.
- Do orthographic projection of lines and plane surfaces.
- Draw projections and solids and development of surfaces.
- Prepare isometric and perspective sections of simple solids.
- Demonstrate computer aided drafting

TEXT BOOK:

REFERENCES:

**PUBLICATION OF BUREAU OF INDIAN STANDARDS:**

**SPECIAL POINTS APPLICABLE TO UNIVERSITY EXAMINATIONS ON ENGINEERING GRAPHICS:**
1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day.

**PH8161 PHYSICS LABORATORY**

(common to all branches of B.E./B.Tech. Programmes) 0 0 2 1

**OBJECTIVES:**
To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics and properties of matter.

1. Torsional pendulum – Determination of rigidity modulus of wire and moment of inertia of disc
2. Non–uniform bending – Determination of young’s modulus
3. Lee’s disc – Determination of thermal conductivity of a bad conductor
4. Potentiometer – Determination of thermo e.m.f. of thermocouple
5. Air wedge – Determination of thickness of a thin sheet of paper
6. i. Optical fibre – Determination of Numerical Aperture and acceptance angle
   ii. Compact disc – Determination of width of the groove using laser
7. Acoustic grating – Determination of velocity of ultrasonic waves in liquids
8. Post office box – Determination of Band gap of a semiconductor
9. Spectrometer – Determination of wavelength using grating
10. Viscosity of liquids – Determination of co-efficient of viscosity of a liquid by Poiseuille’s flow

**TOTAL: 30 PERIODS**
OUTCOMES:
The hands on exercises undergone by the students will help them to apply physics principles of optics and thermal physics to evaluate engineering properties of materials.

CY8161 CHEMISTRY LABORATORY  
(Common to all branches of Engineering and Technology) 0 0 2 1

OBJECTIVES:

- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
- To acquaint the students with the determination of molecular weight of a polymer by vacometry.

1. Estimation of HCl using Na COas primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler’s method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by lodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1,10- phenanthroline/thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
14. Determination of CMC.
15. Phase change in a solid.

TOTAL: 30 PERIODS

OUTCOMES:
The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

REFERENCE BOOKS:

OBJECTIVES:
The student should be made to:
- Be familiar with the use of Office software.
- Be exposed to presentation and visualization tools.
- Be exposed to problem solving techniques and flow charts.
- Be familiar with programming in C.
- Learn to use Arrays, strings, functions, structures and unions.

LIST OF EXPERIMENTS:
1. Search, generate, manipulate data using MS office/ Open Office
2. Presentation and Visualization – graphs, charts, 2D, 3D
3. Problem formulation, Problem Solving and Flowcharts
4. C Programming using Simple statements and expressions
5. Scientific problem solving using decision making and looping.
6. Simple programming for one dimensional and two dimensional arrays.
7. Solving problems using String functions
8. Programs with user defined functions
9. Program using Recursive Function and conversion from given program to flow chart.
10. Program using structures and unions.

OUTCOMES:
At the end of the course, the student should be able to:
- Apply good programming design methods for program development.
- Design and implement C programs for simple applications.
- Develop recursive programs.

OBJECTIVES:
To provide exposure to the students with hands-on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUP – A (CIVIL & ELECTRICAL)
1. CIVIL ENGINEERING PRACTICE

PLUMBING
- Basic pipe connections involving the fittings like valves, taps, coupling, unions, reducers, elbows and other components used in household fittings. Preparation of plumbing line sketches.
- Laying pipe connection to the suction side of a pump – inlet.
- Laying pipe connection to the delivery side of a pump – outlet.
- Practice in mixed pipe connections: Metal, plastic and flexible pipes used in household appliances.

WOOD WORK
- Sawing, planning and making common joints: T-Joint, Mortise and Tenon joint, Dovetail joint.

STUDY
- Study of joints in door panels, wooden furniture
- Study of common industrial trusses using models.

2. ELECTRICAL ENGINEERING PRACTICE
- Basic household wiring using switches, fuse, indicator – lamp etc.,
- Preparation of wiring diagrams
- Stair case light wiring
- Tube – light wiring
- Study of iron-box, fan with regulator, emergency lamp

GROUP – B (MECHANICAL AND ELECTRONICS)

3. MECHANICAL ENGINEERING PRACTICE

WELDING
- Arc welding of butt joints, lap joints, tee joints
- Gas welding Practice.
- Basic Machining
- Simple turning, drilling and tapping operations.
- Machine assembly Practice.
- Study and assembling the following:
  - Centrifugal pump, mixies and air conditioners.
  - Demonstration on
    (a) Smithy operations like the production of hexagonal bolt.
    (b) Foundry operation like mould preparation for grooved pulley.

4. ELECTRONIC ENGINEERING PRACTICE
- Soldering simple electronic circuits and checking continuity.
- Assembling electronic components on a small PCB and testing.
- Study of Telephone, FM radio, low-voltage power supplies.

TOTAL: 45 PERIODS
OUTCOMES:
- Ability to fabricate carpentry components and pipe connections including plumbing works.
- Ability to use welding equipments to join the structures.
- Ability to fabricate electrical and electronics circuits.

HS8251 TECHNICAL ENGLISH II L T P C
(For all branches of B.E / B.Tech programmes) 3 1 0 4

OBJECTIVES
- To make the students acquire listening and speaking skills meant for both formal and informal contexts
- To help them develop their reading skills by exposing them to different types of reading strategies
- To equip them with writing skills needed for academic as well as workplace situations
- To make them acquire language skills at their own pace by using e-materials and language lab component

UNIT I
Listening - Listening to informal conversations and participating; Speaking - Opening a conversation (greetings, comments on something, weather) - Turn taking - Closing a conversation (excuses, general wish, positive comment, thanks); Reading - Developing analytical skills, Deductive and inductive reasoning - Extensive reading; Writing - Effective use of SMS for sending short notes and messages - Using ‘emoticons’ as symbols in email messages; Grammar - Regular & irregular verbs - Active and passive voice; Vocabulary - Homonyms (e.g. ‘can’) - Homophones (e.g. ‘some’, ‘sum’); E-materials - Interactive exercise on Grammar and vocabulary – blogging; Language Lab - Listening to different types of conversation and answering questions.

UNIT II
Listening - Listening to situation based dialogues; Speaking - Conversation practice in real life situations, asking for directions (using polite expressions), giving directions (using imperative sentences), Purchasing goods from a shop, Discussing various aspects of a film (they have already seen) or a book (they have already read); Reading - Reading a short story or an article from newspaper, Critical reading, Comprehension skills; Writing - Writing a review / summary of a story / article, Personal letter (Inviting your friend to a function, congratulating someone for his success, thanking one’s friend / relatives); Grammar - modal verbs, Purpose expressions; Vocabulary - Phrasal verbs and their meanings, Using phrasal verbs in sentences; E-materials - Interactive exercise on Grammar and vocabulary, Extensive reading activity (reading stories / novels from links), Posting reviews in blogs - Language Lab - Dialogues (Fill up exercises), Recording students' dialogues.
UNIT III
Listening - Listening to the conversation - Understanding the structure of conversations; Speaking - Conversation skills with a sense of stress, intonation, pronunciation and meaning - Seeking information – expressing feelings (affection, anger, regret etc.); Reading - Speed reading – reading passages with the time limit - Skimming; Writing - Minutes of meeting – format and practice in the preparation of minutes - Writing summary after reading the articles from the journals - Format for the journal articles – elements of technical articles (abstract, introduction, methodology, results, discussion, conclusion, appendices, references) - Writing strategies; Grammar - Conditional clauses - Cause and effect expressions; Vocabulary - Words used as nouns and verbs without any change in the spelling (e.g. ‘rock’, ‘train’, ‘ring’); E-materials - Interactive exercise on Grammar & vocabulary - Speed Reading practice exercises; Language Lab - Intonation practice using EFLU materials – Attending a meeting and writing minutes.

UNIT IV
Listening - Listening to a telephone conversation, Viewing a model interview (face-to-face, telephonic and video conferencing) and observing the practices; Speaking - Role play practice in telephone skills - listening and responding, -asking questions, -note taking – passing on messages, Role play and mock interview for grasping the interview skills; Reading - Reading the job advertisements and the profile of the company concerned – scanning; Writing - Applying for a job – cover letter - résumé preparation - vision, mission and goals of the candidate; Grammar - Numerical expressions - Connectives (discourse markers); Vocabulary - Idioms and their meanings – using idioms in sentences; E-materials - Interactive exercises on Grammar & Vocabulary - Different forms of résumés- Filling up a résumé / cover letter; Language Lab - Telephonic interview – recording the responses - e-résumé writing.

UNIT V
Listening - Viewing a model group discussion and reviewing the performance of each participant - Identifying the characteristics of a good listener; Speaking - Group discussion skills – initiating the discussion – exchanging suggestions and proposals – expressing dissent/agreement – assertiveness in expressing opinions – mind mapping technique; Reading - Note making skills – making notes from books, or any form of written materials - Intensive reading Writing - Types of reports – Feasibility / Project report – report format – recommendations / suggestions – interpretation of data (using charts for effective presentation); Grammar - Use of clauses; Vocabulary – Collocation; E-materials - Interactive grammar and vocabulary exercises - Sample GD - Pictures for discussion, Interactive grammar and vocabulary exercises - Pictures for discussion; Language Lab - Different models of group discussion

TOTAL :60 PERIODS

OUTCOMES:
Learners should be able to
- Speak convincingly, express their opinions clearly, initiate a discussion, negotiate, argue using appropriate communicative strategies.
- Write effectively and persuasively and produce different types of writing such as narration, description, exposition and argument as well as creative, critical, analytical and evaluative writing.
- Read different genres of texts, infer implied meanings and critically analyse and evaluate them for ideas as well as for method of presentation.
• Listen/view and comprehend different spoken excerpts critically and infer unspoken and implied meanings.

TEXT BOOKS:

REFERENCES:

EXTENSIVE READERS:

WEB RESOURCES
• www.esl-lab.com
• www.englishgrammar.org
• www.englishclub.com
• www.mindtools.com
• www.esl.about.com

MA8251 MATHEMATICS II L T P C (Common to all branches of B.E. / B.Tech. Programmes in II Semester ) 3 1 0 4

OBJECTIVES:
• To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
• To acquaint the student with the concepts of vector calculus needed for problems in all engineering disciplines.
• To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow the of electric current.
• To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

UNIT I  DIFFERENTIAL EQUATIONS  9+3
Method of variation of parameters – Method of undetermined coefficients –Homogenous equation of Euler’s and Legendre’s type – System of simultaneous linear differential equations with constant coefficients.

UNIT II  VECTOR CALCULUS  9+3
Gradient and directional derivative – Divergence and Curl – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral and volume integral - Green’s, Gauss divergence and Stoke’s theorems – Verification and application in evaluating line, surface and volume integrals.

UNIT III  ANALYTIC FUNCTION  9+3
Analytic functions – Necessary and sufficient conditions for analyticity - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions w= z+ c, az, 1/z, z²- Bilinear transformation.

UNIT IV  COMPLEX INTEGRATION  9+3
Line integral - Cauchy’s integral theorem – Cauchy’s integral formula – Taylor’s and Laurent’s series – Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour with no pole on real axis

UNIT V  LAPLACE TRANSFORMS  9+3

OUTCOMES:
The subject helps the students to develop the fundamentals and basic concepts in vector calculus, ODE, Laplace transform and complex functions. Students will be able to solve problems related to engineering applications by using these techniques

TEXT BOOKS:

REFERENCES:

BM8201 ANATOMY AND PHYSIOLOGY

OBJECTIVES:
The student should be made to:
- Know basic structural and functional elements of human body.
- Learn organs and structures involving in system formation and functions.
- Understand all systems in the human body.

UNIT I  BASIC ELEMENTS OF HUMAN BODY

UNIT II  SKELETAL AND RESPIRATORY SYSTEM

UNIT III  CIRCULATORY SYSTEM

UNIT IV  URINARY AND SPECIAL SENSORY SYSTEM

UNIT V  NERVOUS SYSTEM

TOTAL: 45 PERIODS
OUTCOMES:
The student will have knowledge to:
• Describe basic structural and functional elements of human body.
• Explain organs and structures involving in system formation and functions.
• Identify all systems in the human body.

TEXT BOOKS:
2. Gillian Pocock, Christopher D. Richards, The human Body – An introduction for Biomedical and Health Sciences, Oxford University Press, USA, 2009

REFERENCE BOOKS:
1. Review of Medical Physiology, 22nd edition,William F.Ganong Mc Graw Hill New Delhi,

BM8202 ELECTRON DEVICES AND CIRCUITS L T P C 3 1 0 4

OBJECTIVES:
The student should be made to:
• Be familiar with the structure of basic electronic devices.
• Be exposed to the operation and applications of electronic devices

UNIT I PN JUNCTION DEVICES 9+3
PN junction diode –structure, operation and V-I characteristics, diffusion and transient capacitance - Rectifiers – Half Wave and Full Wave Rectifier,– Display devices- LED, Laser diodes, Zener diode-characteristics-Zener Reverse characteristics – Zener as regulator

UNIT II TRANSISTORS 9+3
BJT, JFET, MOSFET- structure, operation, characteristics and Biasing UJT, Thyristor and IGBT -Structure and characteristics.

UNIT III AMPLIFIERS 9+3
BJT small signal model – Analysis of CE, CB, CC amplifiers- Gain and frequency response –MOSFET small signal model– Analysis of CS and Source follower – Gain and frequency response- High frequency analysis.

UNIT IV MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER 9+3
BIMOS cascade amplifier, Differential amplifier – Common mode and Difference mode analysis
– FET input stages – Single tuned amplifiers – Gain and frequency response – Neutralization methods, power amplifiers – Types (Qualitative analysis).

UNIT V FEEDBACK AMPLIFIERS AND OSCILLATORS


OUTCOMES:
Upon Completion of the course, the students will be able to:
• Explain the structure of basic electronic devices.
• Design applications using basic electronic devices

TEXT BOOKS:

REFERENCES:

BM8203 MEDICAL PHYSICS

OBJECTIVES:
• To Study effects of sound and light in human body
• To study effects of radiation in matter and how isotopes are produced

UNIT I NON IONIZING RADIATION AND ITS MEDICAL APPLICATION


UNIT II SOUND IN MEDICINE

Physics of sound, Normal sound levels – ultrasound fundamentals – Generation of ultrasound (Ultrasound Transducer) - Interaction of Ultrasound with matter; Cavitations, Reflection, Transmission-Scanning systems – Artefacts- Ultrasound- Doppler-Double Doppler shift- Clinical Applications
UNIT III  PRINCIPLES OF RADIOACTIVE NUCLIDES
Radioactive Decay – Spontaneous Emission – Isometric Transition – Gamma ray emission, alpha, beta, Positron decay, electron capture, Sources of Radioisotopes Natural and Artificial radioactivity, Radionuclide used in Medicine and Technology, Decay series, Production of radionuclides – Cyclotron produced Radionuclide- Reactor produced Radio-nuclide-fission and electron Capture reaction, radionuclide Generator-Milking process (Technetium generator)

UNIT IV  INTERACTION OF RADIATION WITH MATTER

UNIT V  BASIC RADIATION QUANTITIES
Introduction - exposure- Inverse square law-KERMA-Kerma and absorbed dose - stopping power - relationship between the dosimetric quantities - Bremsstrahlung radiation, Bragg’s curve- concept of LD 50- Stochastic and Non-stochastic effects, Different radiation Unit, Roentgen, gray, Sievert.

TOTAL: 45 PERIODS.

OUTCOMES:
At the end of the course, the student should be able to:
- Analyze mechanics involved with various physiological systems.
- Perform derivation of mathematical models related to blood vessels

TEXT BOOKS:

REFERENCES:
3. J.P.Woodcock,Ultrasonic,Medical Physics Handbook series 1,Adam Hilger,Bristol,2002

EC8251 CIRCUIT THEORY

OBJECTIVES:
- To introduce the basic concepts of DC and AC circuits behavior
- To study the transient and steady state response of the circuits subjected to step and sinusoidal excitations.
- To introduce different methods of circuit analysis using Network theorems, duality and topology.
• To introduce the phenomenon of resonance in coupled circuits.

UNIT I  DC CIRCUIT ANALYSIS
Basic Components and electric Circuits, Charge, current, Voltage and Power, Voltage and Current Sources, Ohms Laws, Voltage and Current laws, Kirchoff’s Current Law, Kirchoff’s voltage law. The single Node – Pair Circuit, series and Parallel Connected Independent Sources, Resistors in Series and Parallel, voltage and current division, Basic Nodal and Mesh analysis, Nodal analysis, Mesh analysis.

UNIT II  NETWORK THEOREM AND DUALITY
Useful Circuit Analysis techniques, Linearity and superposition, Thevenin and Norton Equivalent Circuits, Maximum Power Transfer, Delta-Wye Conversion. Duals, Dual circuits.

UNIT III  SINUSOIDAL STEADY STATE ANALYSIS

UNIT IV  TRANSIENTS AND RESONANCE IN RLC CIRCUITS

UNIT V  COUPLED CIRCUITS AND TOPOLOGY
Magnetically Coupled Circuits, mutual Inductance, the Linear Transformer, the Ideal Transformer, An introduction to Network Topology, Trees and General Nodal analysis, Links and Loop analysis.

OUTCOMES:
• Ability to analyze electrical circuits
• Ability to apply circuit theorems
• Ability to analyze AC and DC Circuits

TEXT BOOKS:

REFERENCES:

TOTAL : L:45, T:15 : 60 PERIODS
OBJECTIVES:
The student should be made to:

- Be familiar with Thevinin & Norton theorem KVL & KCL, and Super Position Theorems
- Be exposed to series and parallel resonance circuits.

LIST OF EXPERIMENTS:
1. Verification of ohm’s law.
2. Verification of kirchoff’s laws.
3. Verification of thevenin’s theorem.
4. Verification of reciprocity theorem.
5. Verification of superposition theorem.
6. Verification of maximum power transfer theorem.
7. Frequency Response of series resonance circuit.
10. Frequency Response of single tuned coupled circuits.

LABORATORY REQUIREMENTS
Resistors, Capacitors, Inductors  –  sufficient quantities
Bread Boards  –  15 Nos
CRO (30MHz)  –  10 Nos.
Function Generators (3MHz)  –  10 Nos.
Dual Regulated Power Supplies (0 – 30V)  –  10 Nos.
Ammeter  –  10 Nos.
Voltmeters  –  10 Nos.

OUTCOMES:
At the end of the course, the student should be able to:

- Design RL and RC circuits
- Verify Thevinin & Norton theorem KVL & KCL, and Super Position Theorems
- Learn the characteristics of series and parallel resonance circuits.
OBJECTIVES:
The student should be made to:
- Be exposed to the characteristics of basic electronic devices
- Be exposed to the characteristics of Amplifiers.

LIST OF EXPERIMENTS:
1. PN Junction Diode Characteristics
2. Zener Diode Characteristics
3. Half Wave and Full Wave Rectifier
4. Zener Regulator
5. CE Transistor Characteristics
6. UJT Characteristics
7. FET Characteristics
8. Characteristics of Thyristor.
9. Frequency Response of CE Amplifier
10. Design and Analysis of Feedback Amplifiers
11. Design and Analysis of Differential Amplifier
12. Design of RC Oscillators
13. Design of LC Oscillators

OUTCOMES:
At the end of the course, the student should be able to:
- Learn the characteristics of basic electronic devices
- Learn the characteristics of Amplifiers.

LABORATORY REQUIREMENTS
BC 107, BC 148, 2N2646, BFW10 – 25 each
1N4007, Zener diodes – 25 each
Resistors, Capacitors, Inductors – sufficient quantities
Bread Boards – 15 Nos
CRO (30MHz) – 10 Nos.
Function Generators (3MHz) – 10 Nos.
Dual Regulated Power Supplies (0 – 30V) – 10 Nos.

OBJECTIVES:
- To introduce the effective mathematical tools for the solutions of partial differential
equations that model physical processes;
• To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems;
• To acquaint the student with Fourier transform techniques used in wide variety of situations in which the functions used are not periodic;
• To develop Z- transform techniques which will perform the same task for discrete time systems as Laplace Transform, a valuable aid in analysis of continuous time systems.

UNIT I  PARTIAL DIFFERENTIAL EQUATIONS  
Formation – Solutions of first order equations – Standard types and Equations reducible to standard types – Singular solutions – Lagrange’s Linear equation – Integral surface passing through a given curve – Classification of Partial Differential Equations – Solution of linear equations of higher order with constant coefficients – Linear non-homogeneous PDE.

UNIT II  FOURIER SERIES  
Dirichlet’s conditions – General Fourier series – Odd and even functions – Half-range Sine and Cosine series – Complex form of Fourier series – Parseval’s identity – Harmonic Analysis.

UNIT III  APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATION  
Method of separation of Variables – Solutions of one dimensional wave equation and one-dimensional heat equation – Steady state solution of two-dimensional heat equation – Fourier series solutions in Cartesian coordinates.

UNIT IV  FOURIER TRANSFORM  

UNIT V  Z – TRANSFORM AND DIFFERENCE EQUATIONS  

TOTAL : 60 PERIODS

OUTCOMES:
• The understanding of the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.

TEXT BOOK:

REFERENCES:
GE8351  ENVIRONMENTAL SCIENCE AND ENGINEERING  L T P C  3 0 0 3

OBJECTIVES:
To the study of nature and the facts about environment.
- To find and implement scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth’s interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I  ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY  14
Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.
Field study of common plants, insects, birds
Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II  ENVIRONMENTAL POLLUTION  8
Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – soil waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management:
floods, earthquake, cyclone and landslides.
Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III  NATURAL RESOURCES
Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.
Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT-IV  SOCIAL ISSUES AND THE ENVIRONMENT

UNIT-V  HUMAN POPULATION AND THE ENVIRONMENT

TOTAL : 45 PERIODS

OUTCOMES:
Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.
• Public awareness of environment at infant stage.
• Ignorance and incomplete knowledge has lead to misconceptions.
• Development and improvement in standard of living has lead to serious environmental disasters.

TEXT BOOKS:

REFERENCE BOOKS:

BM8301 FUNDAMENTALS OF BIOCHEMISTRY L T P C 3 0 0 3

OBJECTIVES:
• To get a clear idea of biomolecules and their functions.
• To know the significance of biomolecules in biological systems.
• To understand the metabolic pathways in normal and pathological conditions.
• To broaden students perspectives in Biochemistry.

UNIT I INTRODUCTION TO BIOCHEMISTRY
Introduction to Biochemistry, water as a biological solvent, weak acid and bases, pH, buffers, Henderson-Hasselbalch equation, physiological buffers, fitness of the aqueous environment for living organism. Principle of viscosity, surface tension, adsorption, diffusion, osmosis and their applications in biological systems.

UNIT II CARBOHYDRATES

UNIT III LIPIDS
Classification of lipids - simple, compound and derived lipids. Nomenclature of fatty acid, physical and chemical properties of fat. Saponification number, Reichert- Meissl number and iodine number. Metabolic pathways: synthesis and degradation of fatty acid (beta oxidation),
hormonal regulation of fatty acid metabolism, ketogenesis, structural architecture and significance of biological membrane.

UNIT IV  NUCLEIC ACID & PROTEIN

UNIT V  ENZYME AND ITS KINETICS

TOTAL: 45 PERIODS

Outcomes:
At the end of the course the student is able to
- Know about biomolecules such as Carbohydrates, Lipids, Nucleic Acid & Protein and its functions
- Understand the significance of biomolecules in biological systems

TEXT BOOKS:

REFERENCES:
1. Understanding Enzymes by Trevor palmer. Published by Ellis Horwood LTD.

BM8302  SENSORS AND MEASUREMENTS  L T P C
3 0 0 3

OBJECTIVES:
The student should be made to:
- Understand the purpose of measurement, the methods of measurements, errors associated with measurements.

38
• Know the principle of transduction, classifications and the characteristics of different transducers and study its Biomedical applications.
• Know the different display and recording devices.

UNIT I SCIENCE OF MEASUREMENT
UNIT II DISPLACEMENT, PRESSURE, TEMPERATURE SENSORS

Strain Gauge: Gauge factor, sensing elements, configuration, unbounded strain gage, biomedical applications; strain gauge as displacement & pressure transducers: Capacitive transducer, Inductive transducer, LVDT, Passive types: RTD materials & range, relative resistance vs. temperature characteristics, thermistor characteristics, biomedical applications of Temperature sensors. Active type: Thermocouple – characteristics.

UNIT III PHOTOELECTRIC AND PIEZO ELECTRIC SENSORS

Phototube, scintillation counter, Photo Multiplier Tube (PMT), photovoltaic, Photo conductive cells, photo diodes, phototransistor, comparison of photoelectric transducers, spectro-photometric applications of photo electric transducers. Piezoelectric active transducer and biomedical applications as pressure & Ultrasound transducer.

UNIT IV SIGNAL CONDITIONING & SIGNAL ANALYSER


UNIT V DISPLAY AND RECORDING DEVICES

Digital voltmeter – Multi meter – CRO – block diagram, CRT – vertical & horizontal deflection system, DSO, LCD monitor, PMMC writing systems, servo recorders, photographic recorder, magnetic tape recorder, Inkjet recorder, thermal recorder.

TOTAL : 45 PERIODS

OUTCOMES:
Upon completion of the course, the student should be able to:
• Describe the purpose and methods of measurements
• Explain different display and recording devices for various applications.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To understand the basic properties of signal & systems and the various methods of classification
- To learn Laplace Transform & Fourier transform and their properties
- To know Z transform & DTFT and their properties
- To characterize LTI systems in the Time domain and various Transform domains

UNIT I  CLASSIFICATION OF SIGNALS AND SYSTEMS  9
Continuous time signals (CT signals)- Discrete time signals (DT signals) – Step, Ramp, Pulse, Impulse, Exponential - classification of CT and DT signals –periodic and aperiodic signals, random signals, Energy & Power signals - CT systems and DT systems, Classification of systems.

UNIT II  ANALYSIS OF CONTINUOUS TIME SIGNALS  9
Fourier series analysis- Spectrum of Continuous Time (CT) signals- Fourier and Laplace transforms in Signal Analysis.

UNIT III  LINEAR TIME INvariant –CONTINUOUS TIME SYSTEMS  9
Differential Equation-Block diagram representation-impulse response, Convolution integrals- Fourier and Laplace transforms in Analysis.

UNIT IV  ANALYSIS OF DISCRETE TIME SIGNALS  9
Baseband Sampling of CT signals- Aliasing, DTFT and properties, Z-transform & properties.

UNIT V  LINEAR TIME INvariant –DISCRETE TIME SYSTEMS  9
Difference Equations-Block diagram representation-Impulse response-Convolution sum-DTFT and Z Transform analysis of Recursive & Non-Recursive systems.

TOTAL: 45 PERIODS

OUTCOMES:
Upon the completion of the course, students will be able to:
- Analyze the properties of signals & systems
- Apply Laplace transform, Fourier transform, Z transform and DTFT in signal analysis
- Analyze continuous time LTI systems using Fourier and Laplace Transforms
- Analyze discrete time LTI systems using Z transform and DTFT
TEXT BOOKS:

REFERENCES:

EE8306 BASICS OF ELECTRICAL ENGINEERING

OBJECTIVES:
The student should be made to Understand:
- Magnetic circuits, principle and application of transformers
- Principle of operation of DC motors and AC Machines
- Principle of fractional-kW motors and their applications.

UNIT I INDUCTION THEORY 9
Magnetic effects of electric current- Magnetic circuits- Magnetic materials and B-H relationship – Electromagnetic induction and force – Hysteresis and eddy current losses

UNIT II TRANSFORMER 9

UNIT III DC MACHINES 9

UNIT IV INDUCTION MACHINES AND SYNCHRONOUS MACHINES 9


UNIT V     FRACTIONAL KILOWATT MOTORS

OUTCOMES:
At the end of the course, the student should be able to:
- Describe principles and applications of transformers.
- Explain the working of DC Motors, fractional kW motors, AC machines.

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCE:

BM8311 BIOCHEMISTRY AND HUMAN PHYSIOLOGY LABORATORY

OBJECTIVES:
To provide practice on:
- Estimation and quantification of biomolecules.
- Separation of macromolecules.

LIST OF EXPERIMENTS:
1. General tests for carbohydrates, proteins and lipids.
2. Preparation of serum and plasma from blood.
3. Estimation of blood glucose.
4. Estimation of creatinine
5. Estimation of urea
6. Estimation of cholesterol
7. Assay of SGOT/SGPT
8. Separation of proteins by SDS electrophoresis
9. Separation of amino acids by thin layer chromatography
10. Separation of DNA by agarose gel electrophoresis
11. ESR, PCV, MCH, MCV ,MCHC , total count of RBCs and hemoglobin estimation
12. Differential count of different WBCs and blood group identification.
14. Ishihara chart for color blindness and snellen”s chart for myopia and hyperopia - by letters reading and ophthalmoscope to view retina
15. Weber’s and Rinne “s test for auditory conduction.

TOTAL: 45 PERIODS

LABORATORY REQUIREMENTS FOR 30 STUDENTS
Spectrophotometer 1 No
Colorimeter 2 Nos.
pH meter 1 No
Weighing balance 1 No
Refrigerator 1 No
Vortex Shaker 2 Nos.
SDS gel electrophoresis 1 No
TLC, ready TLC plates 1 No
Wintrobe’s tube 2 Nos.
Centrifuge Normal 1 No
Centrifuge Cooling 1 No
Microslides 2 packets
Lancet 5 boxes
Microscope 1 No
Neubaur’s Chamber 2 Nos.
Heparinized Syringe 1box
Haemoglobinometer 1 No
Capillary tubes 1box
Ophthalmoscope (direct & Indirect) 1 No
Tuning fork (256Hz to 512Hz) 5 Nos.
Blood grouping kit 1 No

OUTCOMES:
Upon completion of the course, students will be able to:
• Do estimation and interpret the changes in biomolecules.
• Separate and analyze the importance of macromolecules.

BM8312 SENSORS AND MEASUREMENTS LABORATORY L T P C
0 0 3 2
OBJECTIVES:
- To study the characteristics of sensors signal conditioning circuits and display devices

LIST OF EXPERIMENTS:
1. Characteristics of strain guages.
2. Displacement measurement using LVDT.
3. Characteristics of temperature sensors – thermistor and RTD.
4. Characteristics of thermocouple
5. Characteristics of Light sensors-LDR, PhotoDiode, Photo Transistor
7. Wheatstone Bridge and Kelvin’s Bridge for Measurement of Resistance.
9. Study of Medical Oscilloscope.

TOTAL: 45 PERIODS

LABORATORY REQUIREMENTS FOR A BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strain guage Trainer Kit</td>
<td>1 No</td>
</tr>
<tr>
<td>Loads for measurement</td>
<td>1 set</td>
</tr>
<tr>
<td>LVDT trainer kit</td>
<td>1 No</td>
</tr>
<tr>
<td>LVDT sensor</td>
<td>1 No</td>
</tr>
<tr>
<td>Thermocouple trainer kit</td>
<td>1 No</td>
</tr>
<tr>
<td>Thermocouple</td>
<td>1 No</td>
</tr>
<tr>
<td>Thermistor Trainer kit</td>
<td>1 No</td>
</tr>
<tr>
<td>Thermistor</td>
<td>1 No</td>
</tr>
<tr>
<td>RTD Trainer Kit</td>
<td>1 No</td>
</tr>
<tr>
<td>RTD</td>
<td>1 No</td>
</tr>
<tr>
<td>Thermometer</td>
<td>3 No</td>
</tr>
<tr>
<td>Heater with water bath</td>
<td>3 No</td>
</tr>
<tr>
<td>LDR, Photo Diode, Photo Transistor trainer kit</td>
<td>1 No</td>
</tr>
<tr>
<td>Light Source with Variable power supply</td>
<td>1 No</td>
</tr>
<tr>
<td>Piezoelectric Trainer Kit</td>
<td>1 No</td>
</tr>
<tr>
<td>Piezoelectric transducer</td>
<td>1 No</td>
</tr>
<tr>
<td>Vibration excitor</td>
<td>1 No</td>
</tr>
<tr>
<td>Wheatstone Bridge</td>
<td>1 No</td>
</tr>
<tr>
<td>Kelvin’s Bridge</td>
<td>1 No</td>
</tr>
<tr>
<td>Schering Bridge</td>
<td>1 No</td>
</tr>
<tr>
<td>Maxwell Bridge trainer Kit</td>
<td>1 No</td>
</tr>
<tr>
<td>Decade resistance Box</td>
<td>3 nos</td>
</tr>
<tr>
<td>Decade Inductance Box</td>
<td>3 Nos</td>
</tr>
<tr>
<td>Decade Capacitance Box</td>
<td>3 Nos</td>
</tr>
<tr>
<td>Medical oscilloscope</td>
<td>1 No</td>
</tr>
<tr>
<td>X-Y oscilloscope</td>
<td>1 No</td>
</tr>
<tr>
<td>X-Y Recorder</td>
<td>1 No</td>
</tr>
<tr>
<td>Voltmeter</td>
<td>10 Nos</td>
</tr>
<tr>
<td>Multi meter</td>
<td>10 Nos</td>
</tr>
</tbody>
</table>
Regulated power supply 10 Nos
CRO 10 Nos
Connecting wires
Pathcards

OUTCOMES:
- Students is able to design a measurement system for various applications.
OBJECTIVES:
• To provide the necessary basic concepts in probability and random processes and apply them in random signals, linear systems etc. in communications engineering.
• The students will have an exposure of various distributions.

UNIT I  RANDOM VARIABLES  9+3
Discrete and Continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma, Weibull and Normal distributions - Functions of a random variable.

UNIT II  TWO-DIMENSIONAL RANDOM VARIABLES  9+3
Joint distributions – Marginal and Conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III  RANDOM PROCESSES  9+3
Classification – Stationary process – Markov process - Poisson process – Random telegraph process.

UNIT IV  CORRELATION AND SPECTRAL DENSITIES  9+3

UNIT V  LINEAR SYSTEMS WITH RANDOM INPUTS  9+3
Linear time invariant system – System transfer function – Linear systems with random inputs – Auto-correlation and Cross-correlation functions of input and output – White noise.

TOTAL: 60 PERIODS

OUTCOMES:
The students will have an exposure of various distribution functions and help in acquiring skills in handling situations involving more than one variable. Able to analyze the response of random inputs to linear time invariant systems.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
• The students will be exposed to electrical and non-electrical physiological measurements and bioamplifiers.

UNIT I BIOPOTENTIAL ELECTRODES 9

UNIT II BIOPOTENTIAL MEASUREMENT 9
Biosignal characteristics – frequency and amplitude ranges. ECG – Einthoven’s triangle, standard 12 lead system. EEG – 10-20 electrode system, unipolar, bipolar and average mode. EMG – unipolar and bipolar mode.

UNIT III BIOPOTENTIAL AMPLIFIER 8

UNIT IV BIOMECHANICAL MEASUREMENT 10

UNIT V BIOCHEMICAL MEASUREMENT 9
Biochemical sensors - pH, Po₂ and Pco₂, Ion selective Field Effect Transistor (ISFET), Immunologically sensitive FET (IMFET), Blood glucose sensors - Blood gas analyzers,colorimeter, flame photometer, spectrophotometer, blood cell counter, auto analyzer (simplified schematic description).

TOTAL : 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
• Perform electrical and non-electrical physiological measurements
• Explain the function of bio amplifiers.
TEXT BOOKS:

REFERENCES:

BM8402 PATHOLOGY AND MICROBIOLOGY  L T P C 3 0 0 3

OBJECTIVES:
The student should be made to:
• Gain a knowledge on the structural and functional aspects of living organisms.
• Know the etiology and remedy in treating the pathological diseases.
• Empower the importance of public health.

UNIT I  CELL DEGENERATION, REPAIR AND NEOPLASIA  9
Cell injury and Necrosis, Apoptosis, Intracellular accumulations, Pathological calcification, cellular adaptations of growth and differentiation, Inflammation and Repair including fracture healing, Neoplasia, Classification, Benign and Malignant tumours, carcinogenesis, spread of tumours. Autopsy and biopsy.

UNIT II  FLUID AND HEMODYNAMIC DERRANGEMENTS  9

UNIT III  MICROSCOPES  9

UNIT IV  MICROBIAL CULTURES  9
Morphological features and structural organization of bacteria, growth curve, identification of bacteria, culture media and its types, culture techniques and observation of culture.
UNIT V  IMMUNOLOGY

Natural and artificial immunity, opsonization, phagocytosis, inflammation, Immune deficiency syndrome, antibodies and its types, antigen and antibody reactions, immunological techniques: immunodiffusion, immuno electrophoresis, RIA and ELISA, monoclonal antibodies. Disease caused by bacteria, fungi, protozoal, virus and helminthes.

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
• Analyze structural and functional aspects of living organisms.
• Explain the function of microscope
• Discuss the importance of public health.
• Describe methods involved in treating the pathological diseases.

TEXT BOOKS:

REFERENCES:
2. Microbiology by Ananthanarayanan & Panicker
3. Microbiology .Dubey RC and Maheswari DK.

EC8351  DIGITAL ELECTRONICS AND SYSTEM DESIGN

OBJECTIVES
• To introduce Boolean algebra and its applications in digital systems
• To introduce design of various combinational digital circuits using logic gates
• To bring out the analysis and design procedures for synchronous and asynchronous sequential circuits
• To introduce the electronic circuits involved in the making of logic gates
• To introduce semiconductor memories and related technology

UNIT I  BASIC CONCEPTS AND COMBINATIONAL CIRCUITS

Number Systems – Decimal, Binary, Octal, Hexadecimal, 1s and 2s complements, Codes – Binary, BCD, 84-2-1, 2421, Excess 3, Biquinary, Gray, Alphanumeric codes, Boolean theorems, Logic gates, Universal gates, Sum of products and product of sums, Minterms and Maxterms, Karnaugh map and Tabulation methods, Problem formulation and design of combinational circuits, Code Converters
UNIT II    MSI CIRCUITS
Half and Full Adders, Half and Full Subtractors, Binary Parallel Adder, Carry Look Ahead Adder, BCD Adder, Magnitude Comparator, Decoder, Encoder, Priority Encoder, Mux/Demux, Implementation of combinational logic using standard ICs, ROM, EPROM and EEPROM, PLA and PAL.

UNIT III    SYNCRONOUS SEQUENTIAL CIRCUITS
Flip flops – SR, JK, T, D, Master/Slave FF, Triggering of FFs, Analysis and design of clocked sequential circuits Moore and Mealy Circuits and their design, state minimization, state assignment, circuit implementation, Counters, Ripple Counters, Ring Counters, Shift registers, Universal Shift Register.

UNIT IV    ASYNCHRONOUS SEQUENTIAL CIRCUITS
Stable and Unstable states, output specifications, cycles and races, state reduction, race free assignments, Hazards, Essential Hazards, Pulse mode sequential circuits, Design of Hazard free circuits

UNIT V    LOGIC FAMILIES AND SEMICONDUCTOR MEMORIES
Logic families- TTL, MOS, CMOS, Comparison of Logic families, Basic memory cell, RAM, Memory decoding, Static and Dynamic memories.

OUTCOMES:
At the end of the course the students will be able to
- Use Boolean algebra and applied to digital systems.
- Design various combinational digital circuits using logic gates.
- Bring out the analysis and design procedures for synchronous and asynchronous sequential circuits.
- Understand electronic circuits involved in the design of logic gates.
- Understand the semiconductor memories and related technology.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To study the circuit configuration of linear integrated circuits
- To introduce practical applications of linear integrated circuits
- To introduce the concept of analog multiplier and Phase Locked Loop with applications
- To study ADC and DAC
- To introduce special function ICs and its construction

UNIT I  CIRCUIT CONFIGURATION FOR LINEAR ICS  9
Current sources, Analysis of difference amplifiers with active loads, supply and temperature independent biasing, Band gap references, Monolithic IC operational amplifiers, specifications, frequency compensation, slew rate and methods of improving slew rate.

UNIT II  APPLICATIONS OF OPERATIONAL AMPLIFIERS  9
Linear and Nonlinear Circuits using operational amplifiers and their analysis, Inverting and Non inverting Amplifiers, Differentiator, Integrator Voltage to Current converter, Instrumentation amplifier, Sine wave Oscillators, Low pass and band pass filters, comparator, Multivibrator and Schmitt trigger, Triangle wave generator, Precision rectifier, Log and Antilog amplifiers, Non-linear function generator.

UNIT III  ANALOG MULTIPLIER AND PLL  9
Analysis of four quadrant and variable Tran conductance multipliers, Voltage controlled Oscillator, Closed loop analysis of PLL, AM, PM and FSK modulators and demodulators. Frequency synthesizers, Compander ICs

UNIT IV  ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTORS  9
Analog switches, High speed sample and hold circuits and sample and hold IC’s, Types of D/A converter Current driven DAC, Switches for DAC, A/D converter, Flash, Single slope, Dual slope, Successive approximation, DM and ADM, Voltage to Time and Voltage to frequency converters.

UNIT V  SPECIAL FUNCTION ICS  9
Timers, Voltage regulators - linear and switched mode types, Switched capacitor filter, Frequency to Voltage converters, Tuned amplifiers, Power amplifiers and Isolation Amplifiers, Video amplifiers, Fiber optics ICs and Opto couplers, Sources for Noises, Op Amp noise analysis and Low noise OP-Amps.
OUTCOMES:
At the end of the course the students will be able to

- Describe practical applications of linear integrated circuits.
- Apply the concept of analog multiplier and Phase Locked Loop with applications.
- Analyze Analog to Digital Converter and Digital to Analog Converter
- Identify special function ICs and its construction

TOTAL : 45 PERIODS

TEXT BOOK:

REFERENCES:

OBJECTIVES:
- To provide hands on training on Measurement of physiological parameters, biochemical parameters measurement and biosignal analysis.

LIST OF EXPERIMENTS:
1. Design of low noise pre-amplifier for ECG.
2. Study of effect of offset potential in Bio potential recording.
3. Study of effect of contact impedance in Bio potential recording.
5. Measurement of respiration rate.
8. Measurement of blood pressure.
10. Study of characteristics of optical Isolation amplifiers.

TOTAL: 45 PERIODS.
LABORATORY REQUIREMENTS FOR A BATCH OF 30 STUDENTS

- Pulse rate measurement system using Photo transducer
- Respiration measurement system.
- Blood flow measurement system using ultrasound transducer
- Heart rate measurement system with F-V converter
- Blood pressure measurement system
- Isolation amplifier with optical isolation setup
- Spectrum Analyzer
- Function Generators
- DSOs
- Regulated Power supplies
- Bread boards
- IC 741

OUTCOMES:
Student is able to:
- Design the amplifier for Bio signal measurements
- Do recording and analysis of bio signals

BM8412 INTEGRATED CIRCUIT LABORATORY

OBJECTIVES:
The student should be made to:
- Design digital logic and circuits
- Learn the function of different ICs
- Understand the applications of operation amplifier.
- Learn the working of multivibrators
- Design circuits for generating waveforms using ICs.

LIST OF EXPERIMENTS:
1. Inverting, non-inverting amplifier and comparator
2. Integrator and Differentiator
3. Active filter – first order and second order LPF and HPF
4. Schmitt trigger using IC741
5. Instrumentation amplifier using IC741
6. Wein bridge oscillator
7. Multivibrator using IC555 Timer
8. Study of logic gates, Half adder and Full adder
9. Encoder and BCD to 7 segment decoder
10. Multiplexer and demultiplexer using digital ICs
11. Universal shift register using flipflops
12. Design of mod-N counter

TOTAL: 45 PERIODS
OUTCOMES:
At the end of the course, the student should be able to:
- Design Circuits using logic gates
- Build Circuits for different application using opamp
- Differentiate between oscillator and wave form generator

LAB REQUIREMENTS
1. Digital Trainer Kit - 15 Nos.
   (with 5 V, Variable and fixed frequency Clock, Bread Board, Four Seven Segment displays, LEDs for output display, Logic 1 and 0 Input switches)
2. Logic ICs - 50Nos each
   (7400, 7402, 7404, 7408, 7410, 7420, 7432, 7447, 7448, 7474, 7476, 7483, 7485, 7486, 7490, 7495, 74151, 741 Common Anode and cathode 7-segment displays, LEDs)
3. Resistors - 50 nos
4. capacitors - 50 nos
5. IC Power supply (5 V fixed) - 15 Nos
6. Bread Boards - 15 Nos

BM8413 PATHOLOGY AND MICROBIOLOGY LABORATORY

OBJECTIVES:
The student should be made to:
- Use Compound microscope
- Practice on chemical examinations, Cryoprocessing, Histopathological examinations etc

LIST OF EXPERIMENTS:
1. Urine physical and chemical examination (protein, reducing substances, ketones, bilirubin and blood)
2. Study of parts of compound microscope
3. Histopathological slides of benign and malignant tumours.
4. Manual paraffin tissue processing and section cutting (demonstration)
5. Cryo processing of tissue and cryosectioning (demonstration)
6. Basic staining – Hematoxylin and eosin staining.
7. Special stains – cresyl fast Blue (CFV)- Trichrome – oil red O – PAS
8. Simple stain.
10. AFB stain.
11. Slides of malarial parasites, micro filaria and leishmania donovani.
13. Bleeding time and clotting time.

TOTAL : 45 PERIODS.

LABORATORY REQUIREMENTS FOR 30 STUDENTS

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wax dispenser</td>
<td>1 No Slide</td>
</tr>
<tr>
<td>warming</td>
<td>1 No</td>
</tr>
<tr>
<td>Microtome</td>
<td>1 No</td>
</tr>
<tr>
<td>Microscope</td>
<td></td>
</tr>
<tr>
<td>Microphotographic unit</td>
<td>1 No</td>
</tr>
<tr>
<td>Slides</td>
<td></td>
</tr>
<tr>
<td>1box Coverslip</td>
<td></td>
</tr>
<tr>
<td>1box Distillation Unit</td>
<td></td>
</tr>
<tr>
<td>1 No Water bath normal</td>
<td></td>
</tr>
<tr>
<td>1 No Incubator</td>
<td></td>
</tr>
<tr>
<td>1 No Autoclave</td>
<td></td>
</tr>
<tr>
<td>1 No Oven</td>
<td></td>
</tr>
<tr>
<td>1 No</td>
<td></td>
</tr>
</tbody>
</table>

OUTCOMES:
• Student can perform practical experiments on tissue processing, cryoprocessing, staining processes etc.

BM8501  ANALOG AND DIGITAL COMMUNICATION  L T P C
3 0 0 3

OBJECTIVES:
• To study the various analog and digital modulation techniques
• To study the principles behind information theory and coding
• To study the various digital communication techniques

UNIT - I  ANALOG MODULATION
Amplitude Modulation – AM, DSBSC, SSBSC, VSB – PSD, modulators and demodulators –
Angle modulation – PM and FM – PSD, modulators and demodulators – Superheterodyne receivers

UNIT - II  PULSE MODULATION
Low pass sampling theorem – Quantisation – PAM – Line coding – PCM, DPCM, DM, ADPCM, and ADM, Channel Vocoder - Time Division Multiplexing, Frequency Division Multiplexing
UNIT - III  DIGITAL MODULATION AND TRANSMISSION
Phase shift keying – BPSK, DPSK, QPSK – Principles of M-ary signaling M-ary PSK & QAM – Comparison, ISI – Pulse shaping – Duo binary encoding – Cosine filters – Eye pattern, equalizers

UNIT - IV  INFORMATION THEORY AND CODING
Measure of information – Entropy – Source coding theorem – Shannon–Fano coding, Huffman Coding, LZ Coding – Channel capacity – Shannon-Hartley law – Shannon’s limit – Error control codes – Cyclic codes, Syndrome calculation – Convolutional Coding, Sequential and Viterbi decoding

UNIT – V  SPREAD SPECTRUM AND MULTIPLE ACCESS
PN sequences – properties – m-sequence – DSSS – Processing gain, Jamming – FHSS – Synchronisation and tracking – Multiple Access – FDMA, TDMA, CDMA,

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
- Apply analog and digital communication techniques.
- Use data and pulse communication techniques.
- Analyze Source and Error control coding.

TEXT BOOKS:
2. S. Haykin “Digital Communications” John Wiley 2005

REFERENCES:
2. H P Hsu, Schaum Outline Series – “Analog and Digital Communications” TMH 2006
3. B.Sklar, Digital Communications Fundamentals and Applications” 2/e Pearson Education 2007

BM8502  CONTROL SYSTEMS FOR BIO MEDICAL ENGINEERING  L T P C
3 1 0 4

OBJECTIVES:
- To study the concept and different mathematical techniques applied in analyzing any given system
- To learn the analysis of given system in time domain and frequency domain
- To study the stability analysis of the given system
- To study the concept of physiological control system
UNIT I  CONTROL SYSTEM MODELING  9+3
Terminology and basic structure of control system, example of a closed loop system, transfer
functions, modeling of electrical systems, translational and rotational mechanical systems, and
electromechanical systems, block diagram and signal flow graph representation of systems,
conversion of block diagram to signal flow graph, reduction of block diagram and signal flow
graph.

UNIT II  TIME RESPONSE ANALYSIS  9+3
Step and impulse responses of first order and second order systems, determination of time
domain specifications of first and second order systems from its output responses, definition
of steady state error constants and its computations.

UNIT III  STABILITY ANALYSIS  9+3
Definition of stability, Routh- Hurwitz criteria of stability, root locus technique, construction of
root locus and study of stability, definition of dominant poles and relative stability.

UNIT IV  FREQUENCY RESPONSE ANALYSIS  9+3
Frequency response, Nyquist stability criterion, Nyquist plot and determination of closed loop
stability, definition of gain margin and phase margin, Bode plot, determination of gain margin
and phase margin using Bode plot, use of Nichol’s chart to compute response frequency and
bandwidth.

UNIT V  PHYSIOLOGICAL CONTROL SYSTEM  9+3
Example of physiological control system, difference between engineering and physiological
control systems, generalized system properties, models with combination of system elements,
linear models of physiological systems-Examples, introduction to simulation.

L : 45, T: 15, TOTAL : 60 PERIODS.

OUTCOMES:
The students will be able to:
• Analyze the time and frequency domains of the given system using different mathematical
  techniques

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
The student should be made to:

- Understand the medical devices applied in measurement of parameters related to cardiology, neurology and the methods of continuous monitoring and transmitting them
- Learn some of the cardiac assist devices
- Learn to measure the signals generated by muscles
- Understand the need and use of some of the extracorporeal devices

UNIT I  CARDIAC EQUIPMENT

UNIT II  NEUROLOGICAL EQUIPMENT
Clinical significance of EEG, Multi channel EEG recording system, Epilepsy, Evoked Potential –Visual, Auditory and Somatosensory, MEG (Magneto Encephalo Graph). EEG Bio Feedback Instrumentation.

UNIT III  SKELETAL MUSCULAR EQUIPMENT
Generation of EMG, recording and analysis of EMG waveforms, fatigue characteristics , Muscle stimulators, nerve stimulators, Nerve conduction velocity measurement, EMG Bio Feedback Instrumentation.

UNIT IV  PATIENT MONITORING AND BIOTELEMETRY
Patient monitoring systems, ICU/CCU Equipments, Infusion pumps, bed side monitors, Central consoling controls. Radio Telemetry (single, multi), Portable and Landline Telemetry unit, Applications in ECG and EEG Transmission.

UNIT V  EXTRA CORPOREAL DEVICES AND SPECIAL DIAGNOSTIC TECHNIQUES

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:

- Use different medical devices applied in measurement of parameters related to cardiology, neurology
- Explain about cardiac assist devices, its continuous monitoring and transmission
- Measure signals generated by muscles
TEXT BOOKS:

REFERENCES:

EC8503 MICROPROCESSOR AND MICROCONTROLLERS  L T P C
3 0 0 3

OBJECTIVES:
• To study the architecture of 8085 and 8086, 8051
• To study the addressing modes and instruction set of 8085 and 8086, 8051
• To introduce the need and use of interrupt structure in 8085 and 8051.
• To develop skill in simple program writing for 8085 and 8051 applications.
• To introduce commonly used peripheral / interfacing ICs.

UNIT I ARCHITECTURE OF 8085 /8086
8085- Functional Block Diagram- Description - Addressing Modes, Timing diagrams. Introduction to 8086 – Architecture, Instruction set, Addressing Modes.

UNIT II ASSEMBLY LANGUAGE PROGRAMMING
8085: Assembly Language Programming, programming techniques, Subroutines, serial I/O and data communication, Interrupts, Interrupt programming, 8086: Simple Assembly Language Programming, Assembler Directives- Interrupts and Interrupt Applications.

UNIT III PERIPHERAL INTERFACING & APPLICATION
Programmable Peripheral Interface (8255), keyboard display controller (8279), ADC, DAC Interface, Programmable Timer Controller (8254), Programmable interrupt controller (8259), Serial Communication Interface (8251).

UNIT IV MICROCONTROLLER
8051 – Architecture, Special Function Registers(SFRs), I/o Pins Ports and Circuits, Instruction set, Addressing modes, Assembly language programming,
UNIT V INTERFACING 8051: MEMORY, I/O, INTERRUPTS

TOTAL : 45 PERIODS

OUTCOMES:
At the end of the course the students will be able to
- Describe the architecture of 8085 and 8086, 8051.
- Identify the addressing modes and instruction set of 8085, 8086 and 8051.
- Analyze the need and use of interrupt function.
- Write simple program writing for 8085 and 8051 based applications and Interfaces

TEXTBOOKS:

REFERENCES:

EC8551 DISCRETE TIME SIGNAL PROCESSING

OBJECTIVES:
- To introduce discrete fourier transform and its applications
- To teach the design of infinite and finite impulse response filters for filtering undesired signals
- To introduce signal processing concepts in systems having more than one sampling frequency

UNIT I DISCRETE FOURIER TRANSFORM
Review of discrete-time signals & systems - DFT and its properties, FFT algorithms & its application to convolution, Overlap-add & overlap-save methods.
UNIT II  DESIGN OF INFINITE IMPULSE RESPONSE FILTERS  9+3
Analog filters – Butterworth filters, Chebyshev Type I filters (upto 3rd order), Analog Transformation of prototype LPF to BPF /BSF/ HPF. Transformation of analog filters into equivalent digital filters using Impulse invariant method and Bilinear Z transform method- Realization structures for IIR filters – direct, cascade, parallel forms.

UNIT III  DESIGN OF FINITE IMPULSE RESPONSE FILTERS  9+3
Design of Linear Phase FIR filters - windowing and Frequency sampling method - Realization structures for FIR filters – Transversal and Linear phase structures- Comparison of FIR & IIR.

UNIT IV  FINITE WORDLENGTH EFFECTS  9+3
Representation of numbers-ADC Quantization noise-Coefficient Quantization error-Product Quantization error-truncation & rounding errors -Limit cycle due to product round-off error-Round-off noise power-limit cycle oscillation due to overflow in digital filters- Principle of scaling.

UNIT V  MULTIRATE SIGNAL PROCESSING  9+3
Introduction to Multirate signal processing-Decimation-Interpolation-Polyphase Decomposition of FIR filter-Multistage implementation of sampling rate conversion- Design of narrow band filters - Applications of Multirate signal processing.

TOTAL: L:45, T:15, 60 : PERIODS

OUTCOMES:
At the end of the course the students will be able to
- Understand discrete Fourier transform and its applications.
- Design of infinite and finite impulse response filters for various applications.
- Apply signal processing concepts in systems having more than one sampling frequency

TEXT BOOKS:

REFERENCES:
HS8561

EMPLOYABILITY SKILLS

(Commmon to all branches of Fifth or Sixth Semester B.E / B.Tech programmes)

OBJECTIVES:

• To enhance the employability skills of students with a special focus on Presentation skills, Group discussion skills and Interview skills

• To help them improve their soft skills, including report writing, necessary for the workplace situations


2. Creating effective PPTs – presenting the visuals effectively

3. Using appropriate body language in professional contexts – gestures, facial expressions, etc.

4. Preparing job applications - writing covering letter and résumé

5. Applying for jobs online - email etiquette

6. Participating in group discussions – understanding group dynamics - brainstorming the topic

7. Training in soft skills - persuasive skills – People skills - questioning and clarifying skills – mock GD

8. Writing Project proposals – collecting, analyzing and interpreting data / drafting the final report

9. Attending job interviews – answering questions confidently

10. Interview etiquette – dress code – body language – mock interview

TOTAL: 30 PERIODS

REQUIREMENTS FOR A CLASS OF 30 STUDENTS:

1. A PC or a lap top with one or two speakers

2. A Collar mike and a speaker

3. An LCD projector and a screen

4. CD’s and DVD’s on relevant topics

OUTCOMES:

At the end of the course, learners should be able to

• Take international examination such as IELTS and TOEFL

• Make presentations and Participate in Group Discussions.

• Successfully answer questions in interviews.

REFERENCES:


EXTENSIVE READERS

WEB RESOURCES
1. www.humanresources.about.com
2. www.careerride.com

EC8511 MICROCONTROLLER AND INTERFACING LABORATORY L T P C
0 0 3 2

OBJECTIVES:
The student should be made to:
- Understand and write assembly language programs
- Learn about various interfacing methods

8085 BASED EXPERIMENTS
1. Assembly Language Programming of 8085

8086 BASED EXPERIMENTS
2. Programs for 16 bit Arithmetic, Sorting, Searching and String operations,
3. Programs for Digital clock, Interfacing ADC and DAC
4. Interfacing and Programming 8279, 8259, and 8253.
5. Serial Communication between two Microprocessor Kits using 8251.
6. Interfacing and Programming of Stepper Motor and DC Motor Speed control and Parallel Communication between two Microprocessor Kits using Mode 1 and Mode 2 of 8255.
7. Macroassembler Programming for 8086

8051 BASED EXPERIMENTS
8. Programming using Arithmetic, Logical and Bit Manipulation instructions of 8051 microcontroller.
10. Interfacing – DAC and ADC and 8051 based temperature measurement
11. Interfacing – LED and LCD
12. Interfacing – stepper motor traffic light control
13. Communication between 8051 Microcontroller kit and PC.
14. R8C based applications

TOTAL: 45 PERIODS
OUTCOMES
At the end of the course the students will be able to

- Write assembly language programs for 8085, 8086 and 8051.
- Identify various interfacing methods using the 8085, 8086 and 8051.

LAB REQUIREMENTS:
1. 8085 trainer kit 15 Nos.
2. 8051 trainer kit 15 Nos.
3. 8086 trainer kit 10 Nos.
4. Macro assembler MASM (Simulator) - 10 Users.
5. 8279 Interfacing card compatible with 8085, 8051 and 8086 trainers – 2 Nos.
6. 8251 Interfacing card compatible with 8085, 8051 and 8086 trainers – 2 Nos.
7. ADC and DAC Interfacing card compatible with 8085, 8051 and 8086 trainers – 2 Nos.
8. Traffic Light - Interfacing card compatible with 8085, 8051 and 8086 trainers – 2 Nos.
10. (16X2) LCD Display - Interfacing card compatible with 8085, 8051 and 8086 trainers. – 2 Nos
11. Temperature measurement card - Interfacing card compatible with 8085, 8051 and 8086 trainers – 2 Nos
12. DC motor speed control card- Interfacing card compatible with 8085, 8051 and 8086 trainers – 2 Nos

EC8561 DIGITAL SIGNAL PROCESSING LABORATORY

OBJECTIVES:
The student should be made to:

- To implement Linear and Circular Convolution
- To implement FIR and IIR filters
- To study the architecture of DSP processor
- To demonstrate Finite word length effect

DSP PROCESSOR IMPLEMENTATION
1. Study of architecture of Digital Signal Processor
2. MAC operation using various addressing modes
3. Implementation of difference equations
4. Linear Convolution
5. Circular Convolution
6. Waveform generation

MATLAB / EQUIVALENT SOFTWARE PACKAGE
1. Generation of sequences
2. Linear and Circular Convolutions

65
3. DFT
4. FIR filter design
5. IIR filter design
6. Finite wordlength effects
7. Decimation and Interpolation

TOTAL: 45 PERIODS

LAB REQUIREMENTS:
TMS 320C5x / TMS 320C6x kits – 15 Nos.
MATLAB or Equivalent S/w – 15 User License

OUTCOMES:
Students will be able to
- Carry out simulation of DSP systems
- Demonstrate their abilities towards DSP processor based implementation of DSP systems
- Analyze Finite word length effect on DSP systems
- Demonstrate the applications of FFT to DSP
- Implement adaptive filters for various applications of DSP

BM8601 BIOMECHANICS

OBJECTIVES:
- To study about the mechanics involved with various physiological systems.
- To gain knowledge in deriving the mathematical models related to blood vessels.

UNIT I INTRODUCTION

UNIT II MECHANICS OF PHYSIOLOGICAL SYSTEMS
Heart valves, power developed by the heart, prosthetic valves. Constitutive equations for soft tissues, dynamics of fluid flow in cardiovascular system and effect of vibration - shear stresses in extra-corporeal circuits.

UNIT III ORTHOPAEDIC MECHANICS
Mechanical properties of cartilage, diffusion properties of articular cartilage, mechanical properties of bone, kinetics and kinematics of joints, Lubrication of joints.

UNIT IV MATHEMATICAL MODELS
Introduction to Finite Element Analysis, Mathematical models - pulse wave velocities in arteries, determination of in-vivo elasticity of blood vessel, dynamics of fluid filled catheters.

UNIT V ORTHOPAEDIC APPLICATIONS
OUTCOMES:
At the end of the course, the student should be able to:
- Explain the mechanics of physiological systems.
- Analyze the biomechanical systems.
- Design orthopaedic applications.

TEXT BOOKS:

REFERENCES:

BM8602 DIAGNOSTIC AND THERAPEUTIC EQUIPMENT - II

OBJECTIVES:
The student should be made to:
- Gather basic knowledge about measurements of parameters related to respiratory system
- Learn measurement techniques of sensory responses
- Understand different types and uses of diathermy units.
- Know ultrasound imaging technique and its use in diagnosis
- Know the importance of patient safety against electrical hazard

UNIT I RESPIRATORY MEASUREMENT SYSTEM

UNIT II SENSORY MEASUREMENT
Psycho Physiological Measurements-for testing and sensory Responses, Electro occulograph, Electro retinograph, Audiometer-Pure tone, Speech. EGG (Electrogastrograph), galvanic skin resistance(GSR).

UNIT III DIATHERMY
IR and UV lamp and its application. Short wave diathermy, ultrasonic diathermy, Microwave diathermy, Electro surgery machine - Current waveforms, Tissue Responses, Electro surgical current level, Hazards and safety procedures.
UNIT IV  ULTRASONIC TECHNIQUE
Diagnosis: Tissue Reaction, Basic principles of Echo technique, display techniques A, B and M mode, B Scan, Application of ultrasound as diagnostic tool – Echocardiogram, Echoencephalogram, abdomen, obstetrics and gynecology, ophthalmology.

UNIT V  PATIENT SAFETY

OUTCOMES:
At the end of the course, the student should be able to:
• Explain about measurements of parameters related to respiratory system
• Describe the measurement techniques of sensory responses
• Analyze different types and uses of diathermy units
• Discuss ultrasound imaging techniques and its usefulness in diagnosis
• Outline the importance of patient safety against electrical hazard

TEXT BOOKS:

REFERENCES:

BM8603  HOSPITAL MANAGEMENT
OBJECTIVES:
The student should be made to:
Understand the principles, practices and areas of application in Hospital management.
UNIT I  OVERVIEW OF HOSPITAL ADMINISTRATION
Distinction between Hospital and Industry, Challenges in Hospital Administration –Hospital Planning – Equipment Planning – Functional Planning - Current Issues in Hospital Management - Telemedicine - Bio-Medical Waste Management

UNIT II  HUMAN RESOURCE MANAGEMENT ON HOSPITAL

UNIT III  MARKETING RESEARCH & CONSUMER BEHAVIOUR
Marketing information systems - assessing information needs, developing & disseminating information - Market Research process - Other market research considerations - Consumer Markets & Consumer Buyer Behaviour - Model of consumer behaviour - Types of buying decision behaviour - The buyer decision process - Model of business buyer behaviour - Major types of buying situations - global marketing in the medical sector - WTO and its implications

UNIT IV  HOSPITAL INFORMATION SYSTEMS & SUPPORTIVE SERVICES

UNIT V  QUALITY AND SAFETY ASPECTS IN HOSPITAL

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
• Explain the principles, practices and areas of application in Hospital Management

TEXT BOOKS:

REFERENCES:
BM8604  RADIOLOGICAL EQUIPMENT  L T P C  3 0 0 3

OBJECTIVES:
- Understand generation of x-rays and its uses in imaging.
- Learn different types of radio diagnostic techniques.
- Know techniques used for visualizing different sections of the body.
- Learn radiation therapy methodologies and the radiation safety.

UNIT I  MEDICAL X-RAY EQUIPMENT  9

UNIT II  COMPUTED TOMOGRAPHY  9

UNIT III  MAGNETIC RESONANCE IMAGING  9
Fundamentals of magnetic resonance- Interaction of Nuclei with static magnetic field and Radio frequency wave- rotation and precession – Induction of magnetic resonance signals – bulk Magnetization – Relaxation processes T1 and T2. Block Diagram approach of MRI system- system Magnet (Permanent, Electromagnet and Super conductors), generations of gradient magnetic fields, Radio Frequency coils (sending and receiving), shim coils, Electronic components, fMRI.

UNIT IV  NUCLEAR MEDICINE SYSTEM  9

UNIT V  RADIATION THERAPY AND RADIATION SAFETY  9
Dosimeter, film Badges, Thermo Luminescent dosimeters- electronic dosimeter- Radiation protection in medicine- radiation protection principles. TOTAL: 45 PERIODS.

OUTCOMES:
At the end of the course, the student should be able to:
• Explain the different radio diagnostic and therapeutic techniques.

TEXT BOOKS:

REFERENCES:

BM8611 DIAGNOSTIC AND THERAPEUTIC EQUIPMENT LABORATORY

OBJECTIVES:
• To provide practice on recording and analysis of different Bio potentials
• Study the function of different Therapeutic equipments.

LIST OF EXPERIMENTS:
1. Recording and analysis of ECG signals
2. Recording and analysis of EEG signals.
3. Recording - Fatigue test of EMG signals.
4. Simulation of ECG – detection of QRS complex and heart rate
5. Study of shortwave and ultrasonic diathermy
6. Study of Patient Monitoring System
7. Study of biotelemetry
8. Electrical safety measurements.
11. Measurement of GSR.
Outcomes:
- The learner is able to analyze the biomedical signals, to check the safety of any medical equipments and to have the knowledge about therapeutic equipments.

**BM 8612  MEDICAL ELECTRONICS SYSTEM DESIGN LAB**

This laboratory would focus on training and honing technical skills of the students with regard to design and development of basic prototypes leading to low cost systems applied in the field of Biomedical Engineering. These prototypes will be used either to develop basic level rehabilitation tools and aids or to have decision making or control by the introduction of intelligence in the system. This laboratory is thus to provide a platform for the students to gain knowledge in the development of socially relevant projects in the field of Medical Electronics

**BM 8701  MEDICAL INFORMATICS**

Objectives:
The student should be made to:
- Learn ICT applications in medicine with an introduction to health informatics.
- Understand the theories and practices adopted in Hospital Information Systems in the light of medical standards, medical data formats and recent trends in Hospital Information Systems

**UNIT I  MEDICAL INFORMATICS**

Introduction – Medical Informatics – Bioinformatics – Health Informatics - Structure of Medical Informatics – Functional capabilities of Hospital Information System - On-line services and Off-line services - History taking by computer, Dialogue with the computer
UNIT II MEDICAL STANDARDS

UNIT III MEDICAL DATA STORAGE AND AUTOMATION
Plug-in Data Acquisition and Control Boards – Data Acquisition using Serial Interface - Medical Data formats – Signal, Image and Video Formats – Medical Databases - Automation in clinical laboratories - Intelligent Laboratory Information System - PACS

UNIT IV HEALTH INFORMATICS
Bioinformatics Databases, Bio-information technologies, Semantic web and Bioinformatics, Genome projects, Clinical informatics, Nursing informatics, Public health informatics, Education and Training

UNIT V RECENT TRENDS IN MEDICAL INFORMATICS
Medical Expert Systems, Virtual reality applications in medicine, Virtual Environment - Surgical simulation - Radiation therapy and planning – Telemedicine – virtual Hospitals - Smart Medical Homes – Personalized e-health services – Biometrics - GRID and Cloud Computing in Medicine

OUTCOMES:
At the end of the course, the student should be able to:
• Discuss about health informatics and different ICT applications in medicine.
• Explain the function of Hospital Information Systems
• Analyze medical standards

TEXT BOOKS:

TOTAL: 45 PERIODS

BM8702 PATTERN RECOGNITION AND NEURAL NETWORKS

OBJECTIVES:
• The course will introduce the student to the fundamentals of pattern recognition and its
The course will discuss several supervised and unsupervised algorithms suitable for pattern classification. Particular emphasis will be given to computational methods such as linear discriminant functions and nearest neighbor rule.

The course also covers basic neural network architectures and learning algorithms, for applications in pattern recognition, image processing, and computer vision.

The major focus of this course will be on the use of Pattern and Neural Classifiers for classification applications.

UNIT I INTRODUCTION AND SUPERVISED LEARNING
Overview of Pattern recognition, Types of Pattern recognition, Parametric and Nonparametric approach, Bayesian classifier, Discriminant function, non parametric density estimation, histograms, kernels, window estimators, k- nearest neighbor classifier, estimation of error rates.

UNIT II UNSUPERVISED LEARNING AND CLUSTERING ANALYSIS
Unsupervised learning- Hierarchial clustering- Single-linkage Algorithm, Complete –linkage Algorithm, Average-linkage algorithm and Ward’s method. Partitional clustering- Forgy’s Algorithm, k-means algorithm and Isodata Algorithm

UNIT III INTRODUCTION AND SIMPLE NEURAL NET

UNIT IV BACK PROPAGATION AND ASSOCIATIVE MEMORY
Back propagation network, generalized delta rule, Bidirectional Associative memory Hopfield Network

UNIT V NEURAL NETWORKS BASED ON COMPETITION
Kohonen Self organizing map, Learning Vector Quantisation, Counter Propagation network. TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
• Explain the fundamentals of pattern recognition and neural networks.
• Design and apply different pattern recognition techniques to the applications of interest.

TEXT BOOKS:
2. Earl Gose, Richard Johnsonbaugh Steve Jost, “Pattern Recognition and Image Analysis”, Prentice Hall of India Pvt Ltd., New Delhi, 1999

REFERENCES:
OBJECTIVES:
The student should be made to:

- Learn digital image fundamentals.
- Be exposed to simple image processing techniques.
- Be familiar with image compression and segmentation techniques.
- Learn to represent image in terms of features

UNIT I  DIGITAL IMAGE FUNDAMENTALS
Elements of digital image processing systems, Vidicon and Digital Camera working principles,
- Elements of visual perception, brightness, contrast, hue, saturation, mach band effect,
Color image fundamentals - RGB, HSI models, Image sampling, Quantization, dither, Two-
dimensional mathematical preliminaries, 2D transforms - DFT, DCT, KLT, SVD.

UNIT II  IMAGE ENHANCEMENT
Point processing, Histograms, Histogram equalization and specification techniques, Noise
distributions, Spatial averaging, Directional Smoothing, Median, Geometric mean, Harmonic
mean, Contra harmonic mean filters, Homomorphic filtering, Color image enhancement.

UNIT III  IMAGE RESTORATION
Image Restoration - degradation model, Unconstrained and Constrained restoration, Inverse
filtering, Wiener filtering, Geometric transformations-spatial transformations.

UNIT IV  IMAGE SEGMENTATION
Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation
– Region growing – Region splitting and Merging – Segmentation by morphological watersheds
– Hybrid methods

UNIT V  IMAGE COMPRESSION
Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding,
Vector Quantization, Transform coding, JPEG standard, MPEG.

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

- Discuss digital image fundamentals.
- Apply image enhancement and restoration techniques.
- Use image compression and segmentation Techniques.
- Represent features of images.

TEXT BOOKS:
REFERENCES:
BM8712 MEDICAL IMAGE PROCESSING LABORATORY

OBJECTIVES:
- To study the various aspects of acquisition and analysis of bio medical images

LIST OF EXPERIMENTS:
1. Display of Grayscale Images.
2. Histogram Equalization.
4. Edge detection using Operators.
5. 2-D DFT and DCT.
6. Filtering in frequency domain.
7. Display of color images.
8. Conversion between color spaces.
9. DWT of images.
10. Segmentation using watershed transform.
11. Study of DICOM standards.
12. Stegnoigraphy
13. Medical Image Compression techniques.

OUTCOMES:
Apply the techniques of medical image analysis and providing security

REFERENCE:

BM8001 ADVANCED BIO ANALYTICAL AND THERAPEUTIC TECHNIQUES

OBJECTIVES:
- To know the basic principle of techniques
- To implement the engineering aspects in medical sciences

UNIT I ANALYTICAL TECHNIQUES
Principle, instrumentation and application of electrophoresis- SDS, native gel. UV and IR spectroscopy and its application. Spectrophotometry, flame photometry and flourimetry. NMR – principle, instrumentation and application in medical sciences.

UNIT II ENZYMES AS A DIAGNOSTIC TOOL
UNIT III  RADIOISOTOPIC TECHNIQUES
Types of radioisotopes, units of measurements, methods in measuring radioactivity – G.M liquid scintillation counter application in diagnosis (RIA & ELISA), autoradiography, biological hazards, safety measures in handling isotopes, disposal of labeled compounds and radiodosimetry

UNIT IV  GENE THERAPY

UNIT V  NANTHERAPEUTICS
Nanoparticles as carriers in drug delivery-design, manufacture and Physiochemical properties, transport across biological barriers, nanotechnology in Cancer therapy, bone treatment, nanoparticles for oral vaccination and skin disease.

TOTAL : 45 PERIODS.

OUTCOMES
- Students can function effectively in a laboratory environment using complex machinery and protocols.
- Can work independently and find out innovations in the rapidly changing field of nanotechnology.
- Able to report and discuss on chemical analytical aspects relevant for the selection of proper analytical techniques for real-life problem situations.
- Gain knowledge in experimental design, data analysis and interpretation, scientific reports and presentations, and exposure to the research literature

TEXT BOOKS:
- Principles of Instrumental Analysis. By D.A. Skoog
- Trevor Palmer, “Understanding Enzymes”, Ellis Horwood.
- Molecular Cell Biology by Lodish et al
OBJECTIVES:
• To study the microprocessor architecture.
• To study the addressing modes and instruction set of 8086.
• To impart knowledge on 80186, 80286, 80386 and 80486 microprocessors.
• To introduce the high performance CISC architecture - PENTIUM
• To introduce the high performance CISC architecture - ARM

UNIT I  MICROPROCESSOR ARCHITECTURE

UNIT II  8086 MICROPROCESSOR
 8086- Architecture, Instruction set, Addressing Modes, Assembly Language Programming, minimum and maximum mode configuration, Strings, Procedures, Macros, Assembler Directives, Interrupts and Interrupt Applications.

UNIT III  HIGH PERFORMANCE CISC ARCHITECTURE – PENTIUM

UNIT IV  HIGH PERFORMANCE RISC ARCHITECTURE – ARM
 Organization of CPU – Bus architecture – Memory management unit - ARM instruction set- Thumb Instruction set- addressing modes – Programming the ARM processor.

UNIT V  ARM INSTRUCTION AND ASSEMBLY LANGUAGE PROGRAMMING

TOTAL : 45 PERIODS

OUTCOMES:
• The student will be able to work with suitable microprocessor for a specific real world application.

TEXTBOOKS:
REFERENCES:

BM8003 BIO MATERIALS AND ARTIFICIAL ORGANS L T P C
3 0 0 3

OBJECTIVES:
The student should be made to:
• Learn characteristics and classification of Biomaterials
• Understand different metals and ceramics used as biomaterials
• Learn polymeric materials and combinations that could be used as a tissue replacement implants
• Know artificial organ developed using these materials

UNIT I STRUCTURE OF BIO-MATERIALS AND BIO-COMPATIBILITY
Definition and classification of bio-materials, mechanical properties, visco elasticity, wound-healing process, body response to implants, blood compatibility.

UNIT II IMPLANT MATERIALS
Metallic implant materials, stainless steels, co-based alloys, Ti-based alloys, ceramic implant materials, aluminum oxides, hydroxyapatite, glass ceramics, carbons, medical applications.

UNIT III POLYMERIC IMPLANT MATERIALS

UNIT IV TISSUE REPLACEMENT IMPLANTS
Small intestinal submucosa and other decullarized matrix biomaterials for tissue repair. Soft-tissue replacements, sutures, surgical tapes, adhesive, Percutaneous and skin implants, maxillofacial augmentation, Vascular grafts, hard tissue replacement Implants, joint replacements, Pancreas replacement.

UNIT V ARTIFICIAL ORGANS
Artificial blood, Artificial skin, Artificial Heart, Prosthetic Cardiac Valves, Artificial lung (oxygenator), Artificial Kidney (Dialyser membrane), Dental Implants.

TOTAL: 45 PERIODS
OUTCOMES:
At the end of the course, the student should be able to:
• Analyze different types of Biomaterials and its classification.
• Perform combinations of materials that could be used as a tissue replacement implant.

TEXT BOOKS:

REFERENCES:
5. Materials Science and Technology: Volume 14, Medical and Dental Materials: A comprehensive Treatment Volume Editor D F Williams, VCH Publishers 1992

BM8004 BIOMEMS L T P C 3 0 0 3

OBJECTIVES:
The student should be made to:
• Learn various MEMS fabrication techniques.
• Understand different types of sensors and actuators and their principles of operation at the micro scale level.
• Know the application of MEMS in different field of medicine

UNIT I MEMS MATERIALS AND FABRICATION
Typical MEMs and Microsystems, materials for MEMS - active substrate materials- Silicon and its compounds, Silicon piezoresistors, Gallium Arsenide, quartz, polymers. Micromachining- photolithography, thin film deposition, doping, etching, bulk machining, wafer bonding, LIGA

UNIT II MECHANICAL AND THERMAL SENSORS AND ACTUATORS
Mechanics for MEMs design- static bending of thin plates, mechanical vibration, thermomechanics, fracture and thin film mechanics. Mechanical sensors and actuators – beam and cantilever – microplates, strain, pressure and flow measurements, Thermal sensors and actuators- actuator based on thermal expansion, thermal couples, thermal resistor, Shape memory alloys- Inertia sensor, flow sensor
UNIT III  ELECTROSTATIC AND PIEZOELECTRIC SENSORS AND ACTUATORS
Parallel plate capacitor, pull in effect, Electrostatic sensors and actuators- Inertia sensor, Pressure sensor, flow sensor, tactile sensor, comb drive. Properties of piezoelectric materials, Piezoelectric sensor and actuator – inchworm motor, inertia sensor, flow sensor.

UNIT IV  MICROFLUIDIC SYSTEMS
Fluid dynamics, continuity equation, momentum equation, equation of motion, laminar flow in circular conduits, fluid flow in microconduits, in submicrometer and nanoscale. Microscale fluid, expression for liquid flow in a channel, fluid actuation methods, dielectrophoresis, microfluid dispenser, microneedle, micropumps-continuous flow system, micromixers

UNIT V  APPLICATIONS OF BIOMEMS
CAD for MEMs, Drug delivery, micro total analysis systems (MicroTAS) detection and measurement methods, microsystem approaches to polymerase chain reaction (PCR),DNA sensor, MEMS based drug delivery

OUTCOMES:
At the end of the course, the student should be able to:
• Discuss various MEMS fabrication techniques.
• Explain different types of sensors and actuators and their principles of operation at the micro Scale level.
• Apply MEMS in different field of medicine.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To introduce the characteristics of different biosignals
- To discuss linear and non-linear filtering techniques to extract desired information
- To introduce techniques for automated classification and decision making to aid diagnosis

UNIT I   BIOSIGNAL AND SPECTRAL CHARACTERISTICS

UNIT II   TIME SERIES ANALYSIS AND SPECTRAL ESTIMATION
Time series analysis – linear prediction models, process order estimation, lattice representation, non stationary process, fixed segmentation, adaptive segmentation, application in EEG, PCG signals, Time varying analysis of Heart-rate variability, model based ECG simulator. Spectral estimation – Blackman Tukey method, periodogram, and model based estimation. Application in Heart rate variability, PCG signals.

UNIT III  ADAPTIVE FILTERING AND WAVELET DETECTION

UNIT IV   BIOSIGNAL CLASSIFICATION AND RECOGNITION

UNIT V   TIME FREQUENCY AND MULTIVARIATE ANALYSIS
Time frequency representation, spectrogram, Wigner distribution, Time-scale representation, scalogram, wavelet analysis – Data reduction techniques, ECG data compression, ECG characterization, Feature extraction- Wavelet packets, Multivariate component analysis-PCA,ICA

OUTCOMES:
Upon the completion of this course, the students are able
- To come across the different types of signals & systems
- To analyse signals in time series domain & estimate the spectrum
- To understand the significance of wavelet detection applied in biosignal processing.
- To extract the features using multivariate component analysis.

REFERENCES:
2. Rangaraj M. Rangayyan, ‘Biomedical Signal Analysis-A case study approach’, Wiley-
Objectives:

- To focus on the importance of biomaterials in medicine
- To study the application of materials in solving the problems in medicine
- To highlight the characteristic features of biomaterials

UNIT I  BIOMATERIALS AND PROPERTIES

Biomaterials: Introduction to biomaterials and requirements of biomaterials, Classification of biomaterials: Metallic, Ceramic, Polymeric and biological biomaterials. Properties of biomaterials: Bulk properties and Surface properties.

UNIT II  BIOMATERIALS IN MEDICINE


UNIT III  PHYSIO-CHEMICAL CHARACTERIZATION

UNIT IV  SURFACE CHARACTERIZATION


UNIT V  BIOMATERIAL TESTING


OUTCOMES:
- Gain a scientific knowledge in analysing physical and physico-chemical characterisation techniques in materials science and polymer chemistry.
- Achieve an extensive outline standards and methods for assessing the safety, sterility and biocompatibility of biomaterials.
- Able to apply instrumental methods of chemical analysis to natural material.

TEXT BOOKS:

REFERENCES:
5. Materials Science and Technology: Volume 14, Medical and Dental Materials: A comprehensive Treatment: Volume Editor D F Williams, VCH Publishers 1992

BM8007  BIOMETRIC SYSTEMS  L T P C
3 0 0 3

OBJECTIVES:
- To understand the technologies of fingerprint, iris, face and speech recognition
- To understand the general principles of design of biometric systems and the underlying trade-offs.
- To recognize personal privacy and security implications of biometrics based identification technology.
- To identify issues in the realistic evaluation of biometrics based systems.
UNIT I  INTRODUCTION TO BIOMETRICS  9

UNIT II  FINGERPRINT TECHNOLOGY  9
History of fingerprint pattern recognition - General description of fingerprints - Finger print feature processing techniques - fingerprint sensors using RF imaging techniques - fingerprint quality assessment – computer enhancement and modeling of fingerprint images – fingerprint enhancement – Feature extraction – fingerprint classification – fingerprint matching -

UNIT III  FACE RECOGNITION AND HAND GEOMETRY  9
Introduction to face recognition, Neural networks for face recognition – face recognition from correspondence maps – Hand geometry – scanning – Feature Extraction - Adaptive Classifiers - Visual-Based Feature Extraction and Pattern Classification - feature extraction – types of algorithm – Biometric fusion

UNIT IV  MULTIMODAL BIOMETRICS AND PERFORMANCE EVALUATION  9

UNIT V  BIOMETRIC AUTHENTICATION  9

OUTCOMES:
At the end of the course, the student should be able to:
- Demonstrate knowledge engineering principles underlying biometric systems.
- Analyze design basic biometric system applications.

REFERENCES :
3. L C Jain, I Hayashi, S B Lee, U Halici, “Intelligent Biometric Techniques in Fingerprint and Face Recognition”
OBJECTIVES:
- To introduce the basic concepts of brain computer interface
- To study the various signal acquisition methods
- To study the signal processing methods used in BCI

UNIT I INTRODUCTION TO BCI
Fundamentals of BCI – Structure of BCI system – Classification of BCI – Invasive, Non-invasive and Partially invasive BCI – EEG signal acquisition - Signal Preprocessing – Artifacts removal

UNIT II ELECTROPHYSIOLOGICAL SOURCES
Sensorimotor activity – Mu rhythm, Movement Related Potentials – Slow Cortical Potentials - P300 - Visual Evoked Potential - Activity of Neural Cells - Multiple Neuromechanisms

UNIT III FEATURE EXTRACTION METHODS

UNIT IV FEATURE TRANSLATION METHODS
Linear Discriminant Analysis – Support Vector Machines - Regression – Vector Quantization – Gaussian Mixture Modeling – Hidden Markov Modeling – Neural Networks

UNIT V APPLICATIONS OF BCI

TOTAL: 45 PERIODS

OUTCOMES:
- Students will be able to evaluate user interfaces and detect usability problems by doing usability studies (observations) with human subjects
- Be able to assign functions appropriately to the human and to the machine
- Be able to develop high-fidelity prototypes using at least one development tool

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
The student should be made to:
- Learn advanced 8086 family of processors, motherboards, PC based data acquisition and troubleshooting of PCs.

UNIT I  INTEL ADVANCED PROCESSORS  9
8086, 80186, 80286, 80386, 80486 - Architecture, Memory management.

UNIT II  PENTIUM PROCESSORS  9
Pentium Architecture- Memory Management- Pentium Pro microprocessors – Pentium II, Pentium III, Pentium 4 – Special features and software changes.

UNIT III  PC HARDWARE OVERVIEW  9
Functional units & Interconnection, New generation motherboards 286 to Pentium 4 Bus interface – ISA – EISA- VESA- PCI- PCIX, Memory and I/O port addresses, Peripheral interfaces and controller.

UNIT IV  PC BASED DATA ACQUISITION  9
Plug in data acquisition and control boards and programming- ADC, DAC, Digital I/O board and Timing Board, Serial port and parallel port programming. Data acquisition and programming using serial interfaces- PC and microcontroller serial ports, USB and IEEE 1394.

UNIT V  TROUBLESHOOTING, MAINTAINING & REPAIRING  9
Memory troubleshooting, Monitor troubleshooting, Motherboard troubleshooting, Port troubleshooting, Sound Boards and Video adapters troubleshooting, USB troubleshooting.

OUTCOMES:
At the end of the course, the student should be able to:
- Explain 8086 family of processors, motherboards, PC based data acquisition and troubleshooting of PCs

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES:
OBJECTIVES:

- To study the architecture and programming of ARM processor.
- To introduce the basic concepts of hard real time multiprocessing.
- To introduce the analysis concepts for effective programming.
- To study about the basics of the buses used for embedded system networking.

UNIT I INTRODUCTION TO EMBEDDED COMPUTING AND ARM PROCESSORS

Complex systems and microprocessors– Embedded system design process – Formalism for system design– Design example: Model train controller- ARM Processor Fundamentals-Instruction Set and Programming using ARM Processor.

UNIT II COMPUTING PLATFORM

CPU: Programming input and output – Supervisor mode, exception and traps – Coprocessor – Memory system mechanism – CPU performance – CPU power consumption- CPU buses – Memory devices – I/O devices – Component interfacing- System Level Performance Analysis-Parallelism. Design Example : Data Compressor.

UNIT III PROGRAM DESIGN AND ANALYSIS

Program design – Model of programs – Assembly and Linking – Basic compilation techniques – Program Optimization- Analysis and optimization of execution time, power, energy, program size – Program validation and testing- Example : Software Modem.

UNIT IV PROCESS AND OPERATING SYSTEMS


UNIT V HARDWARE ACCELERATORS & NETWORKS


OUTCOMES:

- The students able to understand the concepts of embedded system design for real time applications
- To enable the students to have a programming knowledge on ARM processor

TOTAL: 45 PERIODS
TEXT BOOKS:

REFERENCES:

BM8011 MEDICAL OPTICS L T P C 3 0 0 3

OBJECTIVES:
To Study about:
- The optical properties of the tissues and the applications of laser in diagnosis and therapy.

UNIT I OPTICAL PROPERTIES OF THE TISSUES 9
- Refraction, Scattering, Absorption, Light transport inside the tissue, Tissue properties, Laser Characteristics as applied to medicine and biology-Laser tissue Interaction-Chemical-Thermal-Electromechanical – Photoablation processes.

UNIT II INSTRUMENTATION IN PHOTONICS 9
- Instrumentation for absorption, Scattering and emission measurements, excitation light sources – high pressure arc lamp, LEDs, Lasers, Optical filters, - optical detectors - Time resolved and phase resolved detectors.

UNIT III SURGICAL APPLICATIONS OF LASERS 9

UNIT IV NON THERMAL DIAGNOSTIC APPLICATIONS 9
- Optical coherence tomography, Elastography, Laser Induced Fluorescence (LIF)-Imaging, FLIM Raman Spectroscopy and Imaging, FLIM – Holographic and speckle application of lasers in biology and medicine.

UNIT V THERAPEUTIC APPLICATIONS 9
- Phototherapy, Photodynamic therapy (PDT) - Principle and mechanism - Oncological and non-oncological applications of PDT - Biostimulation effect – applications-Laser Safety Procedures.
TOTAL: 45 PERIODS
OUTCOMES:
At the end of the course, the student should be able to:
- Demonstrate knowledge of the fundamentals of optical properties of tissues
- Describe surgical applications of laser.
- Describe photonics and its therapeutic applications.

TEXT BOOKS:

REFERENCES:

BM8012 NEURAL ENGINEERING

OBJECTIVES:
The student should be made to:
- Be familiar with the nervous system development
- Be exposed to neuronal diseases and disorders
- Be familiar with nerve reconstruction and repairing

UNIT I BASICS OF NEURON STRUCTURE AND FUNCTIONS

UNIT II BRAIN, BRAIN STEM AND SPINAL CORD

UNIT III NEUROPHYSIOLOGY & NEURORADIOLOGY
UNIT IV  NEURONAL DISEASES AND DISORDERS

UNIT V  NERVE RECONSTRUCTION AND REPAIRING
Regeneration of the nervous system. Nerve graft; Neural tissue engineering; Drug delivery system in CNS. Cognitive & neurobehavioral rehabilitation.

OUTCOMES:
Upon Completion of the course, the students will be able to
• Explain the structure of human nervous system
• Apply neural tissue engineering for rehabilitation
• Regenerate nervous system

TEXT BOOKS:

REFERENCES:

BM8013  PHYSIOLOGICAL MODELING

OBJECTIVES:
The student should be made to:
• Understand and appreciate the value and application of Physiological models and Vital organs.
• Model dynamically varying physiological system
• Understand methods and techniques for analysis and synthesis of dynamic models
• Develop differential equations to describe the dynamic models, simulate and visualize, dynamic responses of physiological models using software.

UNIT I  SYSTEM CONCEPT
UNIT II TRANSFER FUNCTION
System as an operator and use of Transfer function, Bio Engineering of a coupled system, Example of transformed signals and circuits for the transfer function with impedance concept, Development of lung model, Impedance of a two stage ladder network, Measurement of airway resistance.

UNIT III PERIODIC SIGNALS
Sinusoidal Functions, Analysis of Instrumentation to measure air flow system, second order system – representation of a respiratory system Evaluation of Transfer function from frequency response for muscle response mode Relationship between Phase lag and Time Delay-closed loop aspects of pupillary control system,Transient Response of an Undamped Second order system, General Description of Natural Frequency Damping, Physical Significance of under damped responses of post systolic operations in aortic arch.

UNIT IV FEEDBACK

UNIT V SIMULATION OF BIOLOGICAL SYSTEMS
Simulation of thermal regulation, pressure and flow control in circulation, oculo motor system, Endocrinal system, functioning of receptors, introduction to digital control system.

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
- Explain application of Physiological models.
- Model dynamically varying physiological system
- Discuss methods and techniques to analyze and synthesis dynamic models
- Develop differential equations to describe the dynamic models, simulate and visualize
- Implement physiological models using software to get dynamic responses

REFERENCES:
OBJECTIVES:
- Introduction of Tissue Engineering
- Cell cycle and differentiation
- Basics about stem cells and its applications
- Different synthetic and biomaterials in tissue replacements
- Application of Tissue Engineering

UNIT I FUNDAMENTALS OF TISSUE ENGINEERING
Tissue exchange and tissue development - Objectives of tissue engineering - Laboratory set up for tissue engineering. Cell cycle and differentiation - cell adhesion - cell adhesion molecules - cell migration - cell aggregation and tissue equivalent.

UNIT II STEM CELLS
Definition of stem cells – types of stem cells – differentiation, dedifferentiation maturation, proliferation, pleuripotency and immortalization. Sources of stem cells: haematopoetic – fetal - cord blood – placenta - bone marrow - primordial germ cells - cancer stem cells - induced pleuripotent stem cells.

UNIT III COMPONENTS OF TISSUE ENGINEERING

UNIT IV MATERIALS IN TISSUE ENGINEERING

UNIT V APPLICATION OF TISSUE ENGINEERING

OUTCOMES:
After the completion of these course students able to:
- Acquire ability to function on multi-disciplinary teams
- Understands professional and ethical responsibility in use of stem cells and gene therapy in creating tissue engineered therapies.
- Gain knowledge in research or clinical application on tissue repair/ engineering.

TEXT BOOKS:
REFERENCES:

BM8015 REHABILITATION ENGINEERING L T P C
3 0 0 3

OBJECTIVES:
On completion of the course the student will be able to
1. Explain the need for medical aids.
2. Devise new concepts for future development and applications.
3. Have a understanding of the sensory rehabilitation systems.
4. Have a understanding of the orthopedic prosthetics and orthotics in rehabilitation.
5. Have a understanding of rehabilitation medicine and advocacy.

UNIT I INTRODUCTION

UNIT II ENGINEERING CONCEPTS IN SENSORY REHABILITATION ENGINEERING

UNIT III ORTHOPEDIC PROSTHETICS AND ORTHOTICS IN REHABILITATION
Engineering concepts in motor rehabilitation, applications. Artificial limb & hands, Externally powered & controlled orthotics & prosthetics, Myoelectric hand & arm prostheses. Functional Electrical Stimulation systems-Restoration of hand function, restoration of standing and walking, Hybrid Assistive Systems (HAS)

UNIT IV VIRTUAL REALITY IN REHABILITATION
Virtual reality based rehabilitation, Hand motor recovery systems with Phantom haptics, Robotics and Virtual Reality Applications in Mobility Rehabilitation

UNIT V REHABILITATION MEDICINE AND ADVOCACY
Physiological aspects of Function recovery, Psychological aspects of Rehabilitation therapy, Legal aspect available in choosing the device and provision available in education, job and in
day-to-day life.

OUTCOMES:
- Explain the need for medical aids.
- Devise new concepts for future development and applications.
- Design and develop different sensory rehabilitation systems.
- Design and develop orthopedic prosthetics and orthotics in rehabilitation.
- Have an understanding of rehabilitation medicine and advocacy

TEXT BOOKS:
2. Robinson C.J; Rehabilitation engineering. CRC press 1995

REFERENCES:
2. Etienne Grandjean, Harold Oldroyd, Fitting the task to the man, Taylor & Francis, 1988.

GE8751 ENGINEERING ETHICS AND HUMAN VALUE L T P C 3 0 0 3

OBJECTIVES:
- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

UNIT I HUMAN VALUES 10

UNIT II ENGINEERING ETHICS 9

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9
Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law – The Challenger Case Study

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9

UNIT V  GLOBAL ISSUES

OUTCOMES :
Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society

TEXT BOOK:

REFERENCES:

WEB SOURCES:
1. www.onlineethics.org
2. www.nspe.org
3. www.globalethics.org
4. www.ethics.org

MG8654  TOTAL QUALITY MANAGEMENT  L T P C
3 0 0 3

AIM
• To provide comprehensive knowledge about the principles, practices, tools and techniques of Total quality management.

OBJECTIVES:
• To understand the various principles, practices of TQM to achieve quality.
• To learn the various statistical approaches for Quality control.
• To understand the TQM tools for continuous process improvement.
• To learn the importance of ISO and Quality systems
UNIT I INTRODUCTION

UNIT II TQM PRINCIPLES
Quality statements - Customer focus –Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Continuous process improvement – PDCA cycle, 5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS & TECHNIQUES I

UNIT IV TQM TOOLS & TECHNIQUES II

UNIT V QUALITY SYSTEMS

OUTCOMES :
- The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

TEXT BOOK:

REFERENCES:
OBJECTIVES:
• To comprehend the fundamentals of object oriented programming, particularly in C++.
• To use object oriented programming to implement data structures.
• To introduce linear, non-linear data structures and their applications.

UNIT – I DATA ABSTRACTION & OVERLOADING

UNIT – II INHERITANCE & POLYMORPHISM
Base Classes and Derived Classes – Protected Members – Casting Class pointers and Member Functions – Overriding – Public, Protected and Private Inheritance – Constructors and Destructors in derived Classes – Implicit Derived – Class Object To Base – Class Object Conversion – Composition Vs. Inheritance – Virtual functions – This Pointer – Abstract Base Classes and Concrete Classes – Virtual Destructors – Dynamic Binding.

UNIT – III LINEAR DATA STRUCTURES
Asymptotic Notations: Big-Oh, Omega and Theta – Best, Worst and Average case Analysis: Definition and an example – Arrays and its representations – Stacks and Queues – Linked lists – Linked list based implementation of Stacks and Queues – Evaluation of Expressions – Linked list based polynomial addition.

UNIT – IV NON-LINEAR DATA STRUCTURES

UNIT – V SORTING & SEARCHING
Insertion sort – Merge sort – Quick sort – Heap sort – Linear Search – Binary Search.

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course, students will be able to:
• Explain the concepts of Object oriented programming.
• Write simple applications using C++.
• Discuss the different methods of organizing large amount of data.
TEXTBOOKS:

REFERENCES:

EC8071 CRYPTOGRAPHY AND NETWORK SECURITY L T P C
3 0 0 3

OBJECTIVES:
• To teach the importance of security for networks
• To teach the basics of number theory and galois field concepts
• To teach symmetric and asymmetric key in crypto systems
• To teach authentication and key management techniques
• To teach security specific to network layer

UNIT I NUMBER THEORETIC AND ALGEBRAIC ALGORITHMS

UNIT II MODERN SYMMETRIC KEY CIPHERS
Modern block ciphers – Modern stream ciphers – DES – AES – Multiple uses of modern block ciphers and stream cipher.

UNIT III ASYMMETRIC KEY ENCIHERMENT

UNIT IV INTEGRITY AUTHENTICATION AND KEY MANAGEMENT

UNIT V NETWORK SECURITY

TOTAL : 45 PERIODS
OUTCOMES:
- The student would be able to demonstrate an understanding of the ways in which communication network security may get compromised and the basic principles of security algorithm design.
- The students should be able to solve various real time security issues by understanding the various security issues and algorithms.
- The student would be able to implement and analyse the different algorithms and compare their performances.
- The student would be in a position to apply his knowledge for designing or modifying existing algorithms and implementing them atleast by simulation.

TEXT BOOKS:

REFERENCES:

EC8072 ELECTRO MAGNETIC INTERFERENCE AND COMPATIBILITY

OBJECTIVES
- To tutor the basics of EMI, EMC
- To instill knowledge on the EMI coupling mechanism and its mitigation techniques
- To impart comprehensive insight about the current EMC standards and about various measurement techniques

UNIT I BASIC CONCEPTS
Definition of EMI and EMC; Intra and Inter system EMI; Sources and victims of EMI, Conducted and Radiated EMI emission and susceptibility; Transient & ESD; Case Histories; Radiation Hazards to humans.

UNIT II COUPLING MECHANISM
Common made coupling; Differential mode coupling; Common impedance coupling; Ground loop coupling; Field to cable coupling; Cable to cable coupling; Power mains and Power supply coupling.
UNIT III  EMI MITIGATION TECHNIQUES  10
Shielding – principle, choice of materials for H, E and free space fields, and thickness; EMI gaskets; Bonding; Grounding – circuits, system and cable grounding; Filtering; Transient EMI control devices and applications; PCB Zoning, Component selection, mounting, trace routing.

UNIT IV  STANDARDS AND REGULATION  7
Units of EMI; National and International EMI Standardizing Organizations – IEC, ANSI, FCC, CISPR, BIS, CENELEC; FCC standards; EN Emission and Susceptibility standards and specifications; MIL461E Standards.

UNIT V  TEST METHODS AND INSTRUMENTATION  12
EMI test sites - Open area site; TEM cell; Shielded chamber; Shielded Anechoic chamber; EMI test receivers; Spectrum Analyzer; Transient EMI Test wave Simulators; EMI coupling Networks - Line impedance Stabilization Networks; Feed through capacitors; Antennas and factors; Current probes and calibration factor; MIL-STD test methods; Civilian STD Test methods.

TOTAL : 45 PERIODS

OUTCOMES:
• The student would be able to demonstrate an understanding of the different aspects of EMI coupling and EMC in PCB design.
• Given the user requirements the student would be in a position to apply his knowledge for identifying a suitable EMI testing and controlling technique

TEXT BOOKS:

REFERENCES:

OBJECTIVES:
The objective of the course is to introduce quantum mechanics concepts, approximations and statistical mechanics for understanding nano systems

UNIT I  INTRODUCTION TO QUANTUM MECHANICS  9
Particles, waves, probability amplitudes, schrodinger equation, wavepackets solutions, operators, expectation values, eigenfuntions, piecewise constant potentials.
UNIT II  SIMPLE HARMONIC OSCILLATORS AND APPROXIMATIONS  9
SHM Operators, SHM wavepacket solutions, Quantum LC circuit, WKB approximations, variational methods.

UNIT III  SYSTEMS WITH TWO AND MANY DEGREES OF FREEDOM  9
Two level systems with static and dynamic coupling, problems in more than one dimensions, electromagnetic field quantization, density of states.

UNIT IV  STATISTICAL MECHANICS  9
Basic concepts, microscopic, quantum systems in equilibrium, statistical models applied to metals and semiconductors

UNIT V  APPLICATIONS  9
Hydrogen and Helium atoms, electronic states, Atomic force microscope, Nuclear Magnetic Resonance, carbon nanotube properties and applications

TOTAL : 45 PERIODS

OUTCOMES:
The learner is able to:
• Explain quantum mechanics concepts, approximations and statistical mechanics for understanding nano systems

TEXT BOOKS:
2. Rainer Waser, “Nanoelectronics and Information Technology”, Wiley 2005

REFERENCES:

EC8074  MULTIMEDIA COMPRESSION AND COMMUNICATION  L T P C
3 0 0 3

OBJECTIVES:
• To introduce probability related study of the characteristics of text, voice, image and video data
• To introduce various compression schemes for text, voice, image and video
• To analyse the compression schemes
• To introduce communication protocols for voice over internet and multimedia
UNIT I  MULTIMEDIA COMPONENTS
Introduction - Multimedia skills - Multimedia components and their characteristics - Text, sound, images, graphics, animation, video, hardware.

UNIT II  AUDIO AND VIDEO COMPRESSION

UNIT III  TEXT AND IMAGE COMPRESSION
Compression principles-source encoders and destination encoders-lossless and lossy compression- entropy encoding –source encoding -text compression –static Huffman coding dynamic Huffman coding –arithmetic coding –Lempel Ziv-Welsh Compression-image compression

UNIT IV  VOIP TECHNOLOGY
Basics of IP transport, VoIP challenges, H.323/ SIP –Network Architecture, Protocols, Call establishment and release, VoIP and SS7, Quality of Service- CODEC Methods-VOIP applicability

UNIT V  MULTIMEDIA NETWORKING
Multimedia networking -Applications-streamed stored and audio-making. The best Effort service-protocols for real time interactive Applications-distributing multimedia-beyond best effort service-secluding and policing Mechanisms-integrated services-differentiated Services- RSVP.

TEXT BOOKS:

OUTCOMES:
1. The student would be able to demonstrate an understanding of the challenges involved in multimedia signal processing and their transmission.
2. The student would be in a position to apply his knowledge for identifying a suitable strategy for compression and communication based on the signal characterization and its needs.
REFERENCES:
1. Marcus goncalves “Voice over IP Networks”, McGraw Hill,

EC8075  ROBOTICS 

OBJECTIVES: 

• To introduce the electronics and software aspects in robots
• To bring out the different languages for programming robot
• To specify robot requirements in the industry
• To introduce latest state of the art robots

UNIT I  SCOPE OF ROBOTS  
The scope of industrial Robots - Definition of an industrial robot - Need for industrial robots –Economic and Social Issues- applications.

UNIT II  ROBOT COMPONENTS  

UNIT III  ROBOT PROGRAMMING  
Robot Programming - Methods - interlocks textual languages. Characteristics of Robot level languages, characteristic of task level languages.

UNIT IV  ROBOT WORK CELL  
Robot Cell Design and Control - Remote Center compliance - Safety in Robotics.

UNIT V  FUTURE TRENDS  
Advanced robotics, Advanced robotics in Space - Specific features of space robotics systems - long-term technical developments, Advanced robotics in under - water operations. Robotics Technology of the Future - Future Applications.

TOTAL : 45 PERIODS

OUTCOMES: 

• The Student must be able to design automatic manufacturing cells with robotic control using the principle behind robotic drive system, end effectors, sensor, machine vision robot kinematics and programming

TEXT BOOK: 
REFERENCES:

EC8076 SOFT COMPUTING AND APPLICATIONS

OBJECTIVES:
• This course gives an idea and principles of various soft computing techniques, which are applicable to core areas such as networks, pattern recognition, image processing
• To introduce fuzzy set theory
• To teach different optimization techniques
• To introduce neural networks and neuro-fuzzy modeling
• To teach various applications of computational intelligence

UNIT I FUZZY SET THEORY

UNIT II OPTIMIZATION

UNIT III NEURAL NETWORKS

UNIT IV NEURO FUZZY MODELING

UNIT V APPLICATIONS OF COMPUTATIONAL INTELLIGENCE

TOTAL : 45 PERIODS
OUTCOMES:
- An understanding of the fundamental Computational Intelligence models
- Understanding the concepts of neural networks, genetic algorithms, fuzzy neural networks, and ant colony optimization algorithms
- Application of computational Intelligence techniques to classification, pattern recognition, prediction, rule extraction, and optimization problems.

TEXT BOOKS:

REFERENCES:

EC8451 COMPUTER ARCHITECTURE AND ORGANIZATION  L  T  P  C
3  0  0  3

OBJECTIVES:
- To study the general purpose architecture for computer system.
- To study the design of data path unit and control unit for ALU operation.
- Understanding the concept of various memories.
- To introduce the concept of interfacing and organization of multiple processors.

UNIT I  INTRODUCTION

UNIT II  DATA PATH DESIGN
Fixed Point Arithmetic, Addition, Subtraction, Multiplication and Division, Combinational and Sequential ALUs, Carry look ahead adder, Robertson algorithm, booth’s algorithm, non-restoring division algorithm, Floating Point Arithmetic, Coprocessor, Pipeline Processing, Pipeline Design, Modified booth’s Algorithm

139
UNIT III  CONTROL DESIGN
Hardwired Control, Microprogrammed Control, Multiplier Control Unit, CPU Control Unit, Pipeline Control, Instruction Pipelines, Pipeline Performance, Superscalar Processing, Nano Programming.

UNIT IV  MEMORY ORGANIZATION
Random Access Memories, Serial - Access Memories, RAM Interfaces, Magnetic Surface Recording, Optical Memories, multilevel memories, Cache & Virtual Memory, Memory Allocation, Associative Memory.

UNIT V  SYSTEM ORGANIZATION
Communication methods, Buses, Bus Control, Bus Interfacing, Bus arbitration, IO and system control, IO interface circuits, Handshaking, DMA and interrupts, vectored interrupts, PCI interrupts, pipeline interrupts, IOP organization, operation systems, multiprocessors, fault tolerance, RISC and CISC processors, Superscalar and vector processor.

TOTAL : 45 PERIODS

OUTCOMES:
• Able to understand the advanced concepts of parallel architecture
• Understand the memory hierarchy for multiprocessor system
• Able to analyze the design structures of pipelined and multiprocessor systems

TEXT BOOKS:

REFERENCES:
OBJECTIVES:

• In this course, the MOS circuit realization of the various building blocks that is common to any microprocessor or digital VLSI circuit are studied.
• Architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology are discussed.
• The main focus in this course is on the transistor circuit level design and realization for digital operation and the issues involved as well as the topics covered are quite distinct from those encountered in courses on CMOS Analog IC design.

UNIT I MOS TRANSISTOR PRINCIPLE
NMOS and PMOS transistors, Process parameters for MOS and CMOS, Electrical properties of CMOS circuits and device modeling, Scaling principles and fundamental limits, CMOS inverter scaling, propagation delays, Stick diagram, Layout diagrams

UNIT II COMBINATIONAL LOGIC CIRCUITS
Examples of Combinational Logic Design, Elmore’s constant, Pass transistor Logic, Transmission gates, static and dynamic CMOS design, Power dissipation – Low power design principles

UNIT III SEQUENTIAL LOGIC CIRCUITS
Static and Dynamic Latches and Registers, Timing issues, pipelines, clock strategies, Memory architecture and memory control circuits, Low power memory circuits, Synchronous and Asynchronous design

UNIT IV DESIGNING ARITHMETIC BUILDING BLOCKS
Data path circuits, Architectures for ripple carry adders, carry look ahead adders, High speed adders, accumulators, Multipliers, dividers, Barrel shifters, speed and area tradeoff

UNIT V IMPLEMENTATION STRATEGIES
Full custom and Semi custom design, Standard cell design and cell libraries, FPGA building block architectures, FPGA interconnect routing procedures.

TOTAL: 45 PERIODS

OUTCOMES:

• The student would have gained knowledge in the circuit design aspects at the next transistor and block level abstractions of FPGA and ASIC design. In combination with the course on CAD for VLSI, the student would have gained sufficient theoretical knowledge for carrying out FPGA and ASIC designs.
• Enables the students to design digital circuits satisfying various performance metrics
• Enables the student to design system level arithmetic circuits, memory circuits and design digital circuits in FPGA.
TEXT BOOKS:

REFERENCES:

CS8075 FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT 3 0 0 3

OBJECTIVE:
This program can be offered with all Undergraduate programs/courses for all engineering streams. The FSIPD program aims to improve student's awareness and understanding of the basic concepts involved in Integrated product Development (IPD) by providing exposure to the key product development concepts. Students, who complete this program, will stand a better chance to be considered for jobs in the Engineering industry.

OBJECTIVES:
After completing this program, the student will be able to obtain the technical skills needed to effectively play the entry level design engineer role in an engineering organization.

The student will be able to:
- Understand the global trends and development methodologies of various types of products and services
- Conceptualize, prototype and develop product management plan for a new product based on the type of the new product and development methodology integrating the hardware, software, controls, electronics and mechanical systems
- Understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them in to design specification
- Understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics
- Gain knowledge of the Innovation & Product Development process in the Business Context
UNIT I  
FUNDAMENTALS OF PRODUCT DEVELOPMENT  
9
Global Trends Analysis and Product decision - Social Trends - Technical Trends - 
Economical Trends - Environmental Trends - Political/Policy Trends - Introduction to 
Product Development Methodologies and Management - Overview of Products  
and Services - Types of Product Development - Overview of Product Development 
methodologies - Product Life Cycle - Product Development Planning and 
Management

UNIT II  
REQUIREMENTS AND SYSTEM DESIGN  
9
Requirement Engineering - Types of Requirements - Requirement Engineering - 
Traceability Matrix and Analysis - Requirement Management - System Design & 
Modeling - Introduction to System Modeling - System Optimization - System 
Specification - Sub-System Design - Interface Design

UNIT III  
DESIGN AND TESTING  
9
Conceptualization - Industrial Design and User Interface Design - Introduction to 
Concept generation Techniques – Challenges in Integration of Engineering Disciplines - 
Concept Screening & Evaluation - Detailed Design - Component Design and 
Verification – Mechanical, Electronics and Software Subsystems - High Level 
Design/Low Level Design of S/W Program - Types of Prototypes, S/W Testing- 
Hardware Schematic, Component design, Layout and Hardware Testing – Prototyping - 
Introduction to Rapid Prototyping and Rapid Manufacturing - System Integration, 
Testing, Certification and Documentation

UNIT IV  
SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT  
9
Introduction to Product verification processes and stages - Introduction to Product 
validation processes and stages - Product Testing standards and Certification - Product 
Documentation - Sustenance - Maintenance and Repair – Enhancements - Product EoL 
- Obsolescence Management - Configuration Management - EoL Disposal

UNIT V  
BUSINESS DYNAMICS ENGINEERING SERVICES INDUSTRY  
9
The Industry - Engineering Services Industry - Product development in Industry versus 
Academia - The IPD Essentials - Introduction to vertical specific product 
development processes - Manufacturing/Purchase and Assembly of Systems - 
Integration of Mechanical, Embedded and S/W systems – Product development Trade-
offs - Intellectual Property Rights and Confidentiality - Security and configuration 
management.

TOTAL: 45 PERIODS

OUTCOMES:
The students will be able to
- Define, formulate and analyze a problem
- Solve specific problems independently or as part of a team
- Develop documentation, test specifications and coordinate with various teams 
to validate and sustain up to the EoL (End of Life) support activities for 
engineering customer
- Work independently as well as in teams
- Manage a project from start to finish
OBJECTIVES:
- NASSCOM has agreed to prepare / revise the course materials [selected teachers Anna University from major disciplines will be included in the process] as PPT slides for all the UNITS. The PPTs can be printed and given to each student if necessary at a Nominal Fee. This is the best possible material for this special course.
- NASSCOM will train the teachers of Anna University to enable them to teach this course. A training programme for nearly 3500 teachers needs to be organized. The team is exploring use of technology including the EDUSAT facility at Anna University.
- The course is to be offered as an elective to all UG Students both in the Constituent Colleges and Affiliated colleges of Anna University.

TEXT BOOKS [INDIAN ECONOMY EDITIONS]:

REFERENCES:

GE8072 DISASTER MANAGEMENT

OBJECTIVES:
- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity
UNIT I  INTRODUCTION TO DISASTERS
Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT II  APPROACHES TO DISASTER RISK REDUCTION (DRR)
Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Institutional Processes and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT III  INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT
Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV  DISASTER RISK MANAGEMENT IN INDIA
Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V  DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS
Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL: 45 PERIODS
OUTCOMES:

The students will be able to

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarios in the Indian context, Disaster damage assessment and management

TEXT BOOKS:

REFERENCES
1. Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005

GE8073 HUMAN RIGHTS L T P C 3 0 0 3

OBJECTIVES:

- To sensitize the Engineering students to various aspects of Human Rights.

UNIT I

UNIT II

UNIT III
Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV
Human Rights in India – Constitutional Provisions / Guarantees.
UNIT V

TOTAL : 45 PERIODS

OUTCOMES:
- Engineering students will acquire the basic knowledge of human rights.

REFERENCES: