VISION

The Department of ECE shall strive continuously to create highly motivated, technologically competent engineers, be a benchmark and a trend setter in Electronics and Communication Engineering by imparting quality education with interwoven input from academic institutions, research organizations and industries, keeping in phase with rapidly changing technologies imbibing ethical values.

MISSION

• Imparting quality technical education through flexible student centric curriculum evolved continuously for students of ECE with diverse backgrounds.
• Providing good academic ambience by adopting best teaching and learning practices.
• Providing congenial ambience in inculcating critical thinking with a quest for creativity, innovation, research and development activities.
• Enhancing collaborative activities with academia, research institutions and industries by nurturing ethical entrepreneurship and leadership qualities.
• Nurturing continuous learning in the stat-of-the-art technologies and global outreach programmes resulting in competent world class engineers.
The programme spells out Programme Educational Objectives (6 PEOs), Programme Outcomes (12 POs) with mapping and Program Specific Outcomes (4 PSOs)

1. PROGRAM EDUCATIONAL OBJECTIVES (PEOs)
THE OBJECTIVES OF THE B.E BIO MEDICAL ENGINEERING PROGRAMME IS BROADLY DEFINED ON THE FOLLOWING:

I. Prepare the students to comprehend the fundamental concepts in Bio Medical Engineering.

II. Enable the students to relate theory with practice for problem solving.

III. Enable the students to critically analyse the present trends and learn and understand future issues.

IV. Motivate the students to continue to pursue lifelong learning as professional engineers and scientists and effectively communicate.

V. The technical details and to work effectively in teams of multidisciplinary nature and to apply Bio Medical Engineering solutions to the society.

VI. Enhance the capability of the students to analyse existing healthcare systems in general and also in specific areas to find innovative and cost-effective solutions to the healthcare industry and hence may lead to entrepreneurial initiatives.

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

<table>
<thead>
<tr>
<th>PO#</th>
<th>GRADUATE ATTRIBUTE</th>
<th>PROGRAMME OUTCOME</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Engineering knowledge</td>
<td>Apply life science, engineering and mathematical concepts in modeling and design of biomedical systems of varying complexity.</td>
</tr>
<tr>
<td>2.</td>
<td>Problem analysis</td>
<td>Critically analyse a problem, identify and formulate solution in the field of Bio Medical Engineering taking into consideration the current trends and future issues.</td>
</tr>
<tr>
<td>3.</td>
<td>Design/development of solutions</td>
<td>Critically analyse the current healthcare systems and design components, systems or process based innovative solutions in the field of Bio Medical Engineering to meet the needs within realistic constraints such as economic, safety and sustainability.</td>
</tr>
<tr>
<td>4.</td>
<td>Conduct investigations of complex problems</td>
<td>Create Problem specific designs and arrive at point care solutions based on actual research outcomes.</td>
</tr>
<tr>
<td>5.</td>
<td>Modern tool usage</td>
<td>Gather hands-on knowledge on cutting edge hardware and software tools to acquire real time data, model and simulate physiological processes and analyze limitations on real time implementations.</td>
</tr>
<tr>
<td>6.</td>
<td>The engineer and society</td>
<td>Analyse the impact of healthcare delivery on individuals and society and develop professional responsibilities concerned with legal aspects.</td>
</tr>
<tr>
<td>7.</td>
<td>Environment and sustainability</td>
<td>Understand the necessity for environmental friendly biomedical engineering solutions and evaluate its sustainability across diverse scenarios.</td>
</tr>
<tr>
<td>8.</td>
<td>Ethics</td>
<td>Develop knowledge on ethical principles and work towards the implementation of ethically committed biomedical engineering practices.</td>
</tr>
<tr>
<td></td>
<td>Individual and team work</td>
<td>Work effectively in teams of multidisciplinary nature to accomplish a goal</td>
</tr>
<tr>
<td>---</td>
<td>--------------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>10.</td>
<td>Communication</td>
<td>Communicate efficiently to an audience of multidisciplinary nature and to prepare technical documents and to present effectively</td>
</tr>
<tr>
<td>11.</td>
<td>Project management and finance</td>
<td>Ability to understand and comprehend the engineering and managerial principles to manage projects individually or as a team.</td>
</tr>
<tr>
<td>12.</td>
<td>Life-long Learning</td>
<td>Understand the need and possess the ability for lifelong learning to have continuous professional development</td>
</tr>
</tbody>
</table>

### 3. PROGRAM SPECIFIC OUTCOMES (PSOs):

By the completion of Bio Medical Engineering program, the student will have following Program Specific Outcomes.

<table>
<thead>
<tr>
<th></th>
<th>Foundation</th>
<th>Graduates will have a strong foundation in Life Science, engineering, mathematics and current biomedical engineering practices with an ability to demonstrate advanced knowledge of a selected area within Bio Medical Engineering.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Communication</td>
<td>Graduates will be given a platform to develop their overall communication and interpersonal skills with exposure to team-building activities that are multi-disciplinary in nature.</td>
</tr>
<tr>
<td></td>
<td>Responsibility</td>
<td>Graduates will acknowledge their ethical, legal and professional responsibilities as a biomedical engineer to develop human, societal and environmental friendly sustainable solutions.</td>
</tr>
<tr>
<td></td>
<td>Design.</td>
<td>Graduates will be able to critically analyse the current healthcare systems and develop innovative solutions effectively through problem specific design and development using modern hardware and software tools.</td>
</tr>
</tbody>
</table>

### MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVE WITH PROGRAMME OUTCOMES

A broad relation between the programme objectives and the outcomes is given in the following table.

<table>
<thead>
<tr>
<th>PROGRAMME EDUCATIONAL OBJECTIVES</th>
<th>PROGRAMME OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>I.</td>
<td>✓</td>
</tr>
<tr>
<td>II.</td>
<td>✓</td>
</tr>
<tr>
<td>III.</td>
<td>✓</td>
</tr>
<tr>
<td>IV.</td>
<td>✓</td>
</tr>
<tr>
<td>V.</td>
<td>✓</td>
</tr>
<tr>
<td>VI.</td>
<td>✓</td>
</tr>
<tr>
<td>COURSE NAME</td>
<td>PROGRAMME OUTCOMES</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>PO1</td>
<td></td>
</tr>
<tr>
<td>PO2</td>
<td></td>
</tr>
<tr>
<td>PO3</td>
<td></td>
</tr>
<tr>
<td>PO4</td>
<td></td>
</tr>
<tr>
<td>PO5</td>
<td></td>
</tr>
<tr>
<td>PO6</td>
<td></td>
</tr>
<tr>
<td>PO7</td>
<td></td>
</tr>
<tr>
<td>PO8</td>
<td></td>
</tr>
<tr>
<td>PO9</td>
<td></td>
</tr>
<tr>
<td>PO10</td>
<td></td>
</tr>
<tr>
<td>PO11</td>
<td></td>
</tr>
<tr>
<td>PO12</td>
<td></td>
</tr>
</tbody>
</table>

**YEAR 1**

**SEMESTER 1**
- Technical English
- Engineering Mathematics I
- Engineering Physics
- Engineering Chemistry
- Problem Solving and Python Programming
- Basic Sciences Laboratory
- Problem Solving and Python Programming Lab

**SEMESTER 2**
- Professional Communication
- Engineering Mathematics II
- Engineering Mechanics
- Basics of Electrical and Electronics Engineering
- Circuit Theory
- Anatomy and Physiology
- Electrical and Electronics Engineering Lab
- Workshop Practices Laboratory

**YEAR 2**

**SEMESTER 3**
- Transform Techniques and Partial Differential Equations
- Electives – Humanities I
- Sensors and Measurements
- Java Programming
- Electron Devices and Circuits
<table>
<thead>
<tr>
<th>SEMESTER 4</th>
<th>Devices and Circuits Laboratory</th>
<th>√</th>
<th>√</th>
<th>√</th>
<th>√</th>
<th>√</th>
<th>√</th>
<th>√</th>
<th>√</th>
<th>√</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensors and Measurements Laboratory</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td></td>
<td>Fundamentals of Biochemistry</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td></td>
<td>Analog and Digital Integrated Circuits</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td></td>
<td>Environmental Sciences</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td></td>
<td>Control System for Biomedical Engineering</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td></td>
<td>Biomedical Instrumentation</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td></td>
<td>Electives – Humanities II</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td></td>
<td>Biochemistry and Human Physiology Laboratory</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td></td>
<td>Analog and Digital Integrated Circuits Laboratory</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Y E A R 3</td>
<td>Audit Course I</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SEMESTER 5</td>
<td>Diagnostic and Therapeutic Equipment I</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td></td>
<td>Discrete Time Signal Processing</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pathology and Microbiology</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hospital Management</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Audit Course II</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Professional Elective I</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Digital Signal Processing Laboratory</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Biomedical Instrumentation Laboratory</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Semester 6</td>
<td>Summer Internship / Summer Project (Minimum 4 weeks)</td>
<td>Diagnostic and Therapeutic Equipment II</td>
<td>Radiological Equipment</td>
<td>Microprocessors and Microcontrollers</td>
<td>Professional Elective II</td>
<td>Professional Elective III</td>
<td>Open Elective I</td>
<td>Diagnostic and Therapeutic Equipment Laboratory</td>
<td>Microcontroller and Interfacing Laboratory</td>
<td></td>
</tr>
<tr>
<td>-----------</td>
<td>----------------------------------------------------</td>
<td>-------------------------------------</td>
<td>----------------------</td>
<td>---------------------------------</td>
<td>------------------------</td>
<td>------------------------</td>
<td>----------------</td>
<td>-----------------------------------------------</td>
<td>---------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>YEAR 4</td>
<td>SEMESTER 7</td>
<td>Bio Mechanics</td>
<td>Principles of Digital Image Processing</td>
<td>Professional Elective IV</td>
<td>Professional Elective V</td>
<td>Open Elective II</td>
<td>Medical Image Processing Laboratory</td>
<td>Hospital Training</td>
<td>Project – I</td>
<td></td>
</tr>
<tr>
<td>SEMESTER 8</td>
<td>Professional Elective VI</td>
<td>Professional Elective VII</td>
<td>Project – II</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## SEMESTER I

<table>
<thead>
<tr>
<th>Sl. NO.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>CONTACT PERIODS</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>THEORY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>HS5151</td>
<td>Technical English</td>
<td>HSMC</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>MA5158</td>
<td>Engineering Mathematics I</td>
<td>BSC</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>3.</td>
<td>PH5151</td>
<td>Engineering Physics</td>
<td>BSC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>CY5151</td>
<td>Engineering Chemistry</td>
<td>BSC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>GE5153</td>
<td>Problem Solving and Python programming</td>
<td>ESC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td><strong>PRACTICALS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>GE5161</td>
<td>Problem Solving and Python programming Laboratory</td>
<td>ESC</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>7.</td>
<td>BS5161</td>
<td>Basic Sciences Laboratory</td>
<td>BSC</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td><strong>TOTAL PERIODS</strong></td>
<td></td>
<td></td>
<td></td>
<td>16</td>
<td>1</td>
<td>8</td>
<td>25</td>
<td>21</td>
</tr>
</tbody>
</table>

## SEMESTER II

<table>
<thead>
<tr>
<th>Sl. NO.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>CONTACT PERIODS</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>THEORY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>HS5251</td>
<td>Professional Communication</td>
<td>HSMC</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>MA5252</td>
<td>Engineering Mathematics II</td>
<td>BSC</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>3.</td>
<td>GE5152</td>
<td>Engineering Mechanics</td>
<td>ESC</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>4.</td>
<td>EE5251</td>
<td>Basics of Electrical and Electronics Engineering</td>
<td>ESC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>EC5251</td>
<td>Circuit Theory</td>
<td>ESC</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>6.</td>
<td>BM5201</td>
<td>Anatomy and Physiology</td>
<td>BSC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td><strong>PRACTICALS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>GE5162</td>
<td>Workshop Practices Laboratory</td>
<td>ESC</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>8.</td>
<td>EE5261</td>
<td>Electrical and Electronics Engineering Laboratory</td>
<td>ESC</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td><strong>TOTAL PERIODS</strong></td>
<td></td>
<td></td>
<td></td>
<td>19</td>
<td>3</td>
<td>8</td>
<td>30</td>
<td>26</td>
</tr>
</tbody>
</table>
### SEMESTER III

| Sl. NO. | COURSE CODE | COURSE TITLE                                           | CATEGORY | L | T | P | CONTACT PERIODS | C |
|--------|-------------|-------------------------------------------------------|----------|---|---|----------------|---|
| THEORY |             |                                                       |          |   |   |                |   |
| 1.     | MA5355      | Transform Techniques and Partial Differential Equations | BSC      | 3 | 1 | 0 | 4              | 4 |
| 2.     | BM5301      | Sensors and Measurements                               | PCC      | 3 | 0 | 0 | 3              | 3 |
| 3.     | BM5302      | Java Programming                                       | ESC      | 2 | 0 | 2 | 4              | 3 |
| 4.     | EC5305      | Electronic Devices and Circuits                         | PCC      | 3 | 0 | 0 | 3              | 3 |
| 5.     |             | Electives – Humanities I                               | HSMC     | 3 | 0 | 0 | 3              | 3 |
| PRACTICALS |       |                                                       |          |   |   |                |   |
| 6.     | EC5312      | Devices and Circuits Laboratory                         | PCC      | 0 | 0 | 4 | 4              | 2 |
| 7.     | BM5311      | Sensors and Measurements Laboratory                     | PCC      | 0 | 0 | 4 | 4              | 2 |
| TOTAL PERIODS |       |                                                       |          | 14| 1 | 10 | 25             | 20|

### SEMESTER IV

| Sl. NO. | COURSE CODE | COURSE TITLE                                           | CATEGORY | L | T | P | CONTACT PERIODS | C |
|--------|-------------|-------------------------------------------------------|----------|---|---|----------------|---|
| THEORY |             |                                                       |          |   |   |                |   |
| 1.     | BM5401      | Fundamentals of Biochemistry                           | PCC      | 3 | 0 | 0 | 3              | 3 |
| 2.     | EC5406      | Analog and Digital Integrated Circuits                 | PCC      | 3 | 0 | 0 | 3              | 3 |
| 3.     | GE5251      | Environmental Sciences                                 | BSC      | 3 | 0 | 0 | 3              | 3 |
| 4.     | BM5402      | Control System for Biomedical Engineering              | PCC      | 3 | 0 | 0 | 3              | 3 |
| 5.     | BM5403      | Biomedical Instrumentation                             | PCC      | 3 | 0 | 0 | 3              | 3 |
| 6.     |             | Electives – Humanities II                              | HSMC     | 3 | 0 | 0 | 3              | 3 |
| 7.     |             | Audit Course I *                                       | AC       | 3 | 0 | 0 | 3              | 0 |
| PRACTICALS |       |                                                       |          |   |   |                |   |
| 8.     | BM5411      | Biochemistry and Human Physiology Laboratory           | PCC      | 0 | 0 | 4 | 4              | 2 |
| 9.     | EC5413      | Analog and Digital Integrated Circuits laboratory      | PCC      | 0 | 0 | 4 | 4              | 2 |
| TOTAL PERIODS |       |                                                       |          | 21| 0 | 8 | 29             | 22|

*Audit Course is optional
### SEMESTER V

<table>
<thead>
<tr>
<th>Sl. NO.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>CONTACT PERIODS</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>THEORY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>BM5501</td>
<td>Diagnostic and Therapeutic Equipment I</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>BM5502</td>
<td>Discrete Time Signal Processing</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>BM5503</td>
<td>Pathology and Microbiology</td>
<td>PCC</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>HM5404</td>
<td>Hospital Management</td>
<td>HSMC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td></td>
<td>Audit Course II*</td>
<td>AC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>6.</td>
<td></td>
<td>Professional Elective I</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>PRACTICALS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>BM5511</td>
<td>Digital Signal Processing Laboratory</td>
<td>PCC</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>8.</td>
<td>BM5512</td>
<td>Biomedical Instrumentation Laboratory</td>
<td>PCC</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>9.</td>
<td>BM5513</td>
<td>Summer Internship / Summer Project</td>
<td>EEC</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
</tbody>
</table>

**TOTAL PERIODS** 17 0 10 27 21

*Audit Course is optional

### SEMESTER VI

<table>
<thead>
<tr>
<th>Sl. NO.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>CONTACT PERIODS</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>THEORY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>BM5601</td>
<td>Diagnostic and Therapeutic Equipment II</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>BM5602</td>
<td>Radiological Equipment</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>EC5551</td>
<td>Microprocessors and Microcontrollers</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td>Professional Elective II</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td></td>
<td>Professional Elective III</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td></td>
<td>Open Elective - I</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>PRACTICALS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>BM5611</td>
<td>Diagnostic and Therapeutic Equipment Laboratory</td>
<td>PCC</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>8.</td>
<td>EC5561</td>
<td>Microprocessor and Microcontroller Interfacing Laboratory</td>
<td>PCC</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

**TOTAL PERIODS** 18 0 8 26 22
### SEMESTER VII

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>CONTACT PERIODS</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>BM5701</td>
<td>Bio Mechanics</td>
<td>PCC</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>BM5702</td>
<td>Principles of Digital Image Processing</td>
<td>PCC</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td>Professional Elective IV</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td>Professional Elective V</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td></td>
<td>Professional Elective VI</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td></td>
<td>Open Elective II</td>
<td>OEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

#### THEORY

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>CONTACT PERIODS</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>BM5711</td>
<td>Hospital Training</td>
<td>EEC</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>8.</td>
<td>BM5712</td>
<td>Medical Image Processing Laboratory</td>
<td>PCC</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>9.</td>
<td>BM5713</td>
<td>Project I</td>
<td>EEC</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>4</td>
<td>3</td>
</tr>
</tbody>
</table>

**PRACTICALS**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>CONTACT PERIODS</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL PERIODS**

|                          |            | 18 | 0 | 10 | 26 | 25 |

**TOTAL CREDITS: 168**

### SEMESTER VIII

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>CONTACT PERIODS</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

#### THEORY

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>CONTACT PERIODS</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>0</td>
<td>16</td>
<td>16</td>
<td>8</td>
</tr>
</tbody>
</table>

**PRACTICALS**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>CONTACT PERIODS</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>0</td>
<td>16</td>
<td>16</td>
<td>8</td>
</tr>
</tbody>
</table>

**TOTAL PERIODS**

|                          |            | 3  | 0 | 16 | 19 | 11 |

**TOTAL CREDITS: 168**

**PROJECT PHASE I & II:**

Review Committee may include Experts from industry and clinical sides so that the students can be encouraged to take up industry and society relevant projects.
## HSMC COURSES

<table>
<thead>
<tr>
<th>S.NO</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>CONTACT PERIODS</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>HS5151</td>
<td>Technical English</td>
<td>HSMC</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>HS5251</td>
<td>Professional Communication</td>
<td>HSMC</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>3.</td>
<td>HM5404</td>
<td>Hospital Management</td>
<td>HSMC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

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

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

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

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

## BASIC SCIENCE COURSES

<table>
<thead>
<tr>
<th>S.NO</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>CONTACT PERIODS</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>MA5158</td>
<td>Engineering Mathematics I</td>
<td>BSC</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>PH5151</td>
<td>Engineering Physics</td>
<td>BSC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>CY5151</td>
<td>Engineering Chemistry</td>
<td>BSC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>BS5161</td>
<td>Basic Sciences Laboratory</td>
<td>BSC</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>S.NO</td>
<td>COURSE CODE</td>
<td>COURSE TITLE</td>
<td>CATEGORY</td>
<td>L</td>
<td>T</td>
<td>P</td>
<td>CONTACT PERIODS</td>
<td>C</td>
</tr>
<tr>
<td>------</td>
<td>-------------</td>
<td>------------------------------</td>
<td>----------</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>----------------</td>
<td>----</td>
</tr>
<tr>
<td>5.</td>
<td>MA5252</td>
<td>Engineering Mathematics II</td>
<td>BSC</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>6.</td>
<td>MA5355</td>
<td>Transform Techniques and Partial Differential Equations</td>
<td>BSC</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>7.</td>
<td>GE5251</td>
<td>Environmental Sciences</td>
<td>BSC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>8.</td>
<td>BM5201</td>
<td>Anatomy and Physiology</td>
<td>BSC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

**ENGINEERING SCIENCE COURSES**

<table>
<thead>
<tr>
<th>S.NO</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>CONTACT PERIODS</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>GE5152</td>
<td>Engineering Mechanics</td>
<td>ESC</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>GE5153</td>
<td>Problem Solving and Python Programming</td>
<td>ESC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>EE5251</td>
<td>Basics of Electrical and Electronics Engineering</td>
<td>ESC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>EC5251</td>
<td>Circuit Theory</td>
<td>ESC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>BM5302</td>
<td>Java Programming</td>
<td>ESC</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>EE5261</td>
<td>Electrical and Electronics Engineering Laboratory</td>
<td>ESC</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>7.</td>
<td>GE5161</td>
<td>Problem Solving and Python Programming Laboratory</td>
<td>ESC</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>8.</td>
<td>GE5162</td>
<td>Workshop Practices Laboratory</td>
<td>ESC</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

**PROFESSIONAL CORE COURSES**

<table>
<thead>
<tr>
<th>S.NO</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>CONTACT PERIODS</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>BM5301</td>
<td>Sensors and Measurements</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>EC5305</td>
<td>Electron Devices and Circuits</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>BM5401</td>
<td>Fundamentals of Biochemistry</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>EC5406</td>
<td>Analog and Digital Integrated Circuits</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>BM5402</td>
<td>Control System for Biomedical Engineering</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>BM5403</td>
<td>Biomedical Instrumentation</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>7.</td>
<td>BM5502</td>
<td>Discrete Time Signal Processing</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>S.NO</td>
<td>COURSE CODE</td>
<td>COURSE TITLE</td>
<td>CATEGORY</td>
<td>L</td>
<td>T</td>
<td>P</td>
<td>CONTACT PERIODS</td>
<td>C</td>
</tr>
<tr>
<td>------</td>
<td>-------------</td>
<td>------------------------------------------</td>
<td>----------</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>-----------------</td>
<td>---</td>
</tr>
<tr>
<td>8.</td>
<td>BM5503</td>
<td>Pathology and Microbiology</td>
<td>PCC</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>9.</td>
<td>BM5601</td>
<td>Diagnostic and Therapeutic Equipment II</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>10.</td>
<td>BM5602</td>
<td>Radiological Equipment</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>11.</td>
<td>EC5551</td>
<td>Microprocessors and Microcontrollers</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>12.</td>
<td>EC5312</td>
<td>Devices and Circuits Laboratory</td>
<td>PCC</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>13.</td>
<td>BM5311</td>
<td>Sensors and Measurements Laboratory</td>
<td>PCC</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>14.</td>
<td>BM5411</td>
<td>Biochemistry and Human Physiology Laboratory</td>
<td>PCC</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>15.</td>
<td>EC5413</td>
<td>Analog and Digital Integrated Circuits Laboratory</td>
<td>PCC</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>16.</td>
<td>BM5501</td>
<td>Diagnostic and Therapeutic Equipment I</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>17.</td>
<td>BM5502</td>
<td>Discrete Time Signal Processing</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>18.</td>
<td>BM5701</td>
<td>Bio Mechanics</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>19.</td>
<td>BM5702</td>
<td>Principles of Digital Image Processing</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>20.</td>
<td>BM5511</td>
<td>Digital Signal Processing Laboratory</td>
<td>PCC</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>21.</td>
<td>BM5512</td>
<td>Biomedical Instrumentation Laboratory</td>
<td>PCC</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>22.</td>
<td>BM5611</td>
<td>Diagnostic and Therapeutic Equipment II</td>
<td>PCC</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>23.</td>
<td>EC5561</td>
<td>Microcontroller and Interfacing Laboratory</td>
<td>PCC</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>24.</td>
<td>BM5712</td>
<td>Medical Image Processing Laboratory</td>
<td>PCC</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>2</td>
</tr>
</tbody>
</table>

**EEC COURSES**

<table>
<thead>
<tr>
<th>S.NO</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>CONTACT PERIODS</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>BM5513</td>
<td>Summer Internship / Summer Project</td>
<td>EEC</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Minimum 4 Weeks)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>BM5711</td>
<td>Hospital Training</td>
<td>EEC</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>BM5713</td>
<td>Project I</td>
<td>EEC</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>4.</td>
<td>BM5811</td>
<td>Project II</td>
<td>EEC</td>
<td>0</td>
<td>0</td>
<td>16</td>
<td>16</td>
<td>8</td>
</tr>
<tr>
<td>Sl. No.</td>
<td>COURSE CODE</td>
<td>COURSE TITLE</td>
<td>CATEGORY</td>
<td>L</td>
<td>T</td>
<td>P</td>
<td>CONTACT PERIODS</td>
<td>C</td>
</tr>
<tr>
<td>--------</td>
<td>-------------</td>
<td>--------------------------------------------------</td>
<td>----------</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>-----------------</td>
<td>---</td>
</tr>
<tr>
<td>1.</td>
<td>BM5001</td>
<td>Pattern Recognition and Neural Networks</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>BM5002</td>
<td>Medical Informatics</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>BM5003</td>
<td>Medical Ethics and Standards</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>BM5004</td>
<td>Communication Engineering</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>BM5005</td>
<td>Bio Signal Processing</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>BM5006</td>
<td>Biomaterials and Artificial Organs</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>7.</td>
<td>BM5007</td>
<td>Biomaterials and Characterisation</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>8.</td>
<td>BM5008</td>
<td>Biometric Systems</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>9.</td>
<td>BM5009</td>
<td>Body Area Networks</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>10.</td>
<td>BM5010</td>
<td>Brain Computer Interface and Applications</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>11.</td>
<td>BM5011</td>
<td>Physiological Modelling</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>12.</td>
<td>BM5012</td>
<td>Medical Optics</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>13.</td>
<td>BM5013</td>
<td>Medical Physics</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>14.</td>
<td>BM5014</td>
<td>MEMS and its Biomedical Applications</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>15.</td>
<td>BM5015</td>
<td>Rehabilitation Engineering</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>16.</td>
<td>BM5016</td>
<td>Virtual Reality in Medicine</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>17.</td>
<td>BM5017</td>
<td>Wearable Systems</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>18.</td>
<td>BM5018</td>
<td>Neural Engineering</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>19.</td>
<td>BM5019</td>
<td>Advanced Bio Analytical and Therapeutic Techniques</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>20.</td>
<td>BM5020</td>
<td>Principles of Tissue Engineering</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>21.</td>
<td>BM5021</td>
<td>Computer Hardware and Interfacing</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>22.</td>
<td>EC5071</td>
<td>Advanced Microcontrollers</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>23.</td>
<td>EC5072</td>
<td>Cryptography and Network Security</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>24.</td>
<td>EC5073</td>
<td>Electro Magnetic Interference and Compatibility</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>25.</td>
<td>EC5074</td>
<td>Foundations for Nano Electronics</td>
<td>PEC</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Sl. No</td>
<td>Course Code</td>
<td>Course Title</td>
<td>Periods Per week</td>
<td>Total Contact</td>
<td>Credits</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>-------------</td>
<td>-------------------------------------------------------</td>
<td>------------------</td>
<td>---------------</td>
<td>---------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26.</td>
<td>EC5076</td>
<td>Multimedia Compression and Networks</td>
<td>PEC 3 0 0 3 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27.</td>
<td>EC5077</td>
<td>Real Time Embedded Systems</td>
<td>PEC 3 0 0 3 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28.</td>
<td>EC5078</td>
<td>Robotics</td>
<td>PEC 3 0 0 3 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29.</td>
<td>EC5079</td>
<td>Soft Computing and Applications</td>
<td>PEC 3 0 0 3 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30.</td>
<td>EC5080</td>
<td>Speech Processing</td>
<td>PEC 3 0 0 3 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31.</td>
<td>EC5028</td>
<td>Computer Architecture and Organization</td>
<td>PEC 3 0 0 3 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32.</td>
<td>EC5029</td>
<td>VLSI Design</td>
<td>PEC 3 0 0 3 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33.</td>
<td>GE5073</td>
<td>Foundation Skills in Integrated Product Development</td>
<td>PEC 3 0 0 3 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34.</td>
<td>BM5022</td>
<td>Virtual Instrumentation</td>
<td>PEC 2 0 2 4 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35.</td>
<td>BM5023</td>
<td>Bio Statistics</td>
<td>PEC 3 0 0 3 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36.</td>
<td>BM5024</td>
<td>Internet of Things in Medicine</td>
<td>PEC 3 0 0 3 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**AUDIT COURSES (AC)**

Registration for any of these courses is optional to students

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Lecture</th>
<th>Tutorial</th>
<th>Practical</th>
<th>Total Contact</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>AD5091</td>
<td>Constitution of India</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>2.</td>
<td>AD5092</td>
<td>Value Education</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>3.</td>
<td>AD5093</td>
<td>Pedagogy Studies</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>4.</td>
<td>AD5094</td>
<td>Stress Management by Yoga</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>5.</td>
<td>AD5095</td>
<td>Personality Development Through Life Enlightenment Skills</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>6.</td>
<td>AD5096</td>
<td>Unnat Bharat Abhiyan</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>7.</td>
<td>AD5097</td>
<td>Essence of Indian Knowledge Tradition</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>8.</td>
<td>AD5098</td>
<td>Sanga Tamil Literature Appreciation</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

Total Credits: 24 0
### B.E. BIOMEDICAL ENGINEERING

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Subject Area</th>
<th>Credits per Semester</th>
<th>Credits Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>I</td>
<td>II</td>
</tr>
<tr>
<td>1</td>
<td>HSMC</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>BSC</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>ESC</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>4</td>
<td>PCC</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>PEC</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>OEC</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>EEC</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>21</td>
<td>25</td>
</tr>
<tr>
<td>8</td>
<td>Non-Credit / (Audit Course)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Credits Total</th>
<th>168</th>
</tr>
</thead>
</table>
OBJECTIVES:
The first semester English course entitled ‘Technical English’ aims to,
  • Familiarise first year students of engineering and technology with the fundamental aspects of technical English.
  • Develop all the four language skills by giving sufficient practice in the use of the skills in real life contexts.
  • Enhance the linguistic and communicative competence of first year engineering and technology students.

UNIT I   INTRODUCING ONESELF   12
Listening: Listening and filling a form, listening to speeches by specialists from various branches of engineering and completing activities such as answering questions, identifying the main ideas of the listening text, style of the speaker (tone and tenor) – Speaking: Introducing oneself – introducing friend/ family - Reading: Descriptive passages (from newspapers / magazines) - Grammar: Simple present, present continuous – Vocabulary Development: One word substitution

UNIT II   DIALOGUE WRITING   12
Listening: Listening to conversations (asking for and giving directions) – Speaking: making conversation using (asking for directions, making an enquiry), Role plays-dialogues - Reading: Reading a print interview and answering comprehension questions - Writing: Writing a checklist, Dialogue writing - Grammar: Simple past – question formation (Wh- questions, Yes or No questions, Tag questions) - Vocabulary Development: Stress shift, lexical items related to the theme of the given unit.

UNIT III   FORMAL LETTER WRITING   12
Listening: Listening to speeches by famous people and identifying the central message of the speech – answering multiple-choice questions) – Speaking: Giving short talks on a given topic - Reading: Reading motivational essays on famous engineers and technologists (answering open-ended and closed questions) - Writing: Writing formal letters/ emails (Complaint letters) - Grammar: Future Tense forms of verbs, subject and verb agreement - Vocabulary Development: Collocations – Fixed expressions

UNIT IV   WRITING COMPLAINT LETTERS   12

UNIT V   WRITING DEFINITIONS AND PRODUCT DESCRIPTION   12
Listening: Listening to a product description (labeling and gap filling) exercises - Speaking: Describing a product and comparing and contrasting it with other products - Reading: Reading graphical material for comparison (advertisements) - Writing: Writing Definitions (short and long) – compare and contrast paragraphs - Grammar: Adjectives – Degrees of comparison - compound nouns - Vocabulary Development: Use of discourse markers – suffixes (adjectival endings).

COURSE OUTCOMES
At the end of the course the students will have gained,
CO1: Exposure to basic aspects of technical English.
CO2: The confidence to communicate effectively in various academic situations.
CO3: Learnt the use of basic features of Technical English.
TEXTBOOK:

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

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

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

UNIT I  MATRICES  12

UNIT II  DIFFERENTIAL CALCULUS  12

UNIT III  FUNCTIONS OF SEVERAL VARIABLES  12

UNIT IV  INTEGRAL CALCULUS  12
Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

UNIT V  MULTIPLE INTEGRALS  12

TOTAL :60 PERIODS

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-40 025
COURSE OUTCOMES:
At the end of the course the students will be able to
CO1: Use the matrix algebra methods for solving practical problems.
CO2: Apply differential calculus tools in solving various application problems.
CO3: Able to use differential calculus ideas on several variable functions.
CO4: Apply different methods of integration in solving practical problems.
CO5: Apply multiple integral ideas in solving areas, volumes and other practical problems.

TEXTBOOKS:

REFERENCES:

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

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

UNIT I MECHANICS
UNIT II  ELECTROMAGNETIC WAVES

UNIT III  OSCILLATIONS, OPTICS AND LASERS

UNIT IV  BASIC QUANTUM MECHANICS
Photons and light waves - Electrons and matter waves - The Schrödinger equation (Time dependent and time independent forms) - meaning of wave function - Normalization - Particle in a infinite potential well - Normalization, probabilities and the correspondence principle.

UNIT V  APPLIED QUANTUM MECHANICS
The harmonic oscillator - Barrier penetration and quantum tunneling - Tunneling microscope - Resonant diode - Finite potential wells - particle in a three dimensional box - Bloch’s theorem for particles in a periodic potential, Kronig-Penney model and origin of energy bands.

TOTAL: 45 PERIODS

COURSE OUTCOME
After completion of this course, the students will be able to
CO1: Understand the importance of mechanics.
CO2: Express the knowledge of electromagnetic waves.
CO3: Know the basics of oscillations, optics and lasers.
CO4: Understand the importance of quantum physics.
CO5: Apply quantum mechanical principles towards the formation of energy bands in crystalline materials.

TEXT BOOKS:

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

UNIT I POLYMER CHEMISTRY

UNIT II NANOCHEMISTRY

UNIT III PHOTOCHEMISTRY AND SPECTROSCOPY

UNIT IV ENERGY CONVERSIONS AND STORAGE
Nuclear fission - controlled nuclear fission - nuclear fusion - differences between nuclear fission and fusion - nuclear chain reactions - nuclear energy - light water nuclear power plant – fast breeder reactor.Solar energy conversion - solar cells. Wind energy. Batteries - types of batteries – primary battery (dry cell), secondary battery (lead acid, nickel-cadmium and lithium-ion-battery). Fuel cells – H2-O2 and microbial fuel cell. Explosives – classification, examples: TNT, RDX, Dynamite; Rocket fuels and propellants – definition and uses.

UNIT V WATER TECHNOLOGY

TOTAL: 45 PERIODS
COURSE OUTCOMES:
CO1: To recognize and apply basic knowledge on different types of polymeric materials, their general preparation methods and applications to futuristic material fabrication needs.
CO2: To identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.
CO3: To identify and apply suitable spectroscopic technique for material analysis and study different forms of photochemical reactions.
CO4: To recognize different forms of energy resources and apply them for suitable applications in energy sectors.
CO5: To demonstrate the knowledge of water and their quality in using at different industries.

TEXT BOOKS:

REFERENCE BOOKS:

GE5153 PROBLEM SOLVING AND PYTHON PROGRAMMING

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

UNIT I INTRODUCTION TO COMPUTING AND PROBLEM SOLVING

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

SUGGESTED EVALUATION METHODS:
- Assignments on pseudocodes and flowcharts.
- Tutorials on Python programs.
UNIT II  CONDITIONALS AND FUNCTIONS


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

SUGGESTED EVALUATION METHODS:
- Tutorials on the above activities.
- Group discussion on external learning.

UNIT III  SIMPLE DATA STRUCTURES IN PYTHON


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

SUGGESTED EVALUATION METHODS:
- Tutorials on the above activities.
- Group Discussion on external learning component.

UNIT IV  STRINGS, DICTIONARIES, MODULES


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

SUGGESTED EVALUATION METHODS:
- Tutorials on the above activities.

UNIT V  FILE HANDLING AND EXCEPTION HANDLING

Introduction to Files – File Path – Opening and Closing Files – Reading and Writing Files – File Position – Exception: Errors and Exceptions, Exception Handling, Multiple Exceptions.
SUGGESTED ACTIVITIES:
- Developing modules using Python to handle files and apply various operations on files.
- Usage of exceptions, multiple except blocks - for applications that use delimiters like age, range of numerals etc.
- Implementing Python program to open a non-existent file using exceptions.

SUGGESTED EVALUATION METHODS:
- Tutorials on the above activities.
- Case Studies.

TOTAL: 45 PERIODS

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

TEXT BOOKS:
   (http://greenteapress.com/wp/thinkpython/).

REFERENCES:

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

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

OBJECTIVES:
- To understand the problem solving approaches.
- To learn the basic programming constructs in Python.
- To articulate where computing strategies support in providing Python-based solutions to real world problems.
- To use Python data structures - lists, tuples, dictionaries.
- To do input/output with files in Python.
EXPERIMENTS:
1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same.
2. Python programming using simple statements and expressions.
3. Scientific problems using Conditionals and Iterative loops.
4. Implementing real-time/technical applications using Lists, Tuples.
5. Implementing real-time/technical applications using Sets, Dictionaries.
6. Implementing programs using Functions.
7. Implementing programs using Strings.
9. Implementing real-time/technical applications using File handling.
10. Implementing real-time/technical applications using Exception handling.
12. Developing a game activity using Pygame like bouncing ball, car race etc.

TOTAL: 60 PERIODS

COURSE OUTCOMES:
On completion of the course, students will be able to:
CO1: Develop algorithmic solutions to simple computational problems.
CO2: Develop and execute simple Python programs.
CO3: Structure simple Python programs for solving problems.
CO4: Decompose a Python program into functions.
CO5: Represent compound data using Python data structures.
CO6: Apply Python features in developing software applications.

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

BS5161 BASIC SCIENCES LABORATORY
(Common to all branches of B.E. / B.Tech Programmes) 0 0 4 2

PHYSICS LABORATORY: (Any Seven Experiments)

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

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. Uniform bending – Determination of young’s modulus
4. Lee’s disc Determination of thermal conductivity of a bad conductor
5. Potentiometer-Determination of thermo e.m.f of a thermocouple
6. Laser- Determination of the wave length of the laser using grating
7. Air wedge - Determination of thickness of a thin sheet/wire
8. a) Optical fibre -Determination of Numerical Aperture and acceptance angle  
   b) Compact disc- Determination of width of the groove using laser.
10. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids.
11. Post office box - Determination of Band gap of a semiconductor.
13. Photoelectric effect
14. Michelson Interferometer.
16. Melede’s string experiment

TOTAL: 30 PERIODS

COURSE OUTCOME
Upon completion of the course, the students will be able
CO1: To determine various moduli of elasticity and also various thermal and optical properties of materials.
CO2: To determine the velocity of ultrasonic waves, band gap determination and viscosity of liquids.

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

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

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

TOTAL: 30 PERIODS

COURSE OUTCOMES:
CO3: To analyse the quality of water samples with respect to their acidity, alkalinity, hardness and DO.
CO4: To determine the amount of metal ions through volumetric and spectroscopic techniques
CO5: To determine the molecular weight of polymers by viscometric method.
CO6: To quantitatively analyse the impurities in solution by electroanalytical techniques
CO7: To design and analyse the kinetics of reactions and corrosion of metals

TEXT BOOKS:
1. Laboratory Manual- Department of Chemistry, CEGC, Anna University, 2014.
COURSE OBJECTIVES
The course entitles ‘Professional Communication’ aims to,
• Improve the relevant language skills necessary for professional communication.
• Develop linguistic and strategic competence in workplace context.
• Enhance language proficiency and thereby the employability of budding engineers and technologists.

UNIT I             TECHNICAL COMMUNICATION  12
Listening: Listening to telephone conversations (intent of the speaker and note taking exercises)-
Speaking: Role play exercises based on workplace contexts, introducing oneself-
Reading: Reading the interview of an achiever and completing exercises (skimming, scanning and predicting)-
Writing: Writing a short biography of an achiever based on given hints-
Grammar: Asking and answering questions, punctuation in writing, prepositional phrases-
Vocabulary Development: use of adjectives.

UNIT II            SUMMARY WRITING  12
Listening: Listening to talks/lectures both general and technical and summarizing the main points-
Speaking: Participating in debates-
Reading: Reading technical essays/articles and answering comprehension questions-
Writing: Summary writing-
Grammar: Participle forms, relative clauses-
Vocabulary Development: Use of compound words, abbreviations and acronyms.

UNIT III           PROCESS DESCRIPTION  12
Listening: Listening to a process description and drawing a flowchart-
Speaking: Participating in Group Discussions, giving instructions-
Reading: Reading instruction manuals-
Writing: Writing process descriptions-
Grammar: Use of imperatives, active and passive voice, sequence words-
Vocabulary Development: Technical jargon

UNIT IV            REPORT WRITING  12
Listening: Listening to a presentation and completing gap-filling exercises-
Speaking: Making formal presentations-
Reading: Reading and interpreting charts/tables and diagrams-
Writing: Interpreting charts/tables and diagrams, writing a report-
Grammar: Direct into indirect speech, use of phrases-
Vocabulary Development: reporting words

UNIT V             WRITING JOB APPLICATIONS  12
Listening: Listening to a job interview and completing gap-filling exercises-
Speaking: Mock interview, telephone interviews-
Reading: Reading a job interview, SOP, company profile and completing comprehension exercises-
Writing: job applications and resumes and SOPs-
Grammar: Present perfect and continuous tenses-
Vocabulary Development: Technical vocabulary.

COURSE OUTCOMES
At the end of the second semester the learners will be able to,
CO1: Read and comprehend technical texts effortlessly.
CO2: Write reports of a technical kind.
CO3: Speak with confidence in interviews and thereby gain employability.

TEXTBOOK

Assessment Pattern
• Assessments will assess all the four skills through both pen and paper and computer based tests.
• Assessments can be pen and paper based, quizzes.
MA5252  ENGINEERING MATHEMATICS – II  
(L T P C) 3 1 0 4
(Common to all branches of B.E. / B.Tech. Programmes in II Semester)

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

UNIT I  VECTOR CALCULUS
12

UNIT II  ANALYTIC FUNCTION
12
Analytic functions – Necessary and sufficient conditions for analyticity - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions - Bilinear transformation \( w = c + z, \ a z, \ 1/ z, \ z^2 \).

UNIT III  COMPLEX INTEGRATION
12

UNIT IV  DIFFERENTIAL EQUATIONS
12
Method of variation of parameters – Method of undetermined coefficients – Homogenous equations of Euler’s and Legendre’s type – System of simultaneous linear differential equations with constant coefficients.

UNIT V  LAPLACE TRANSFORMS
12

TOTAL : 60 PERIODS

COURSE OUTCOMES:
Upon successful completion of the course, students will be able to:
CO1: Calculate grad, div and curl and use Gauss, Stokes and Greens theorems to simplify calculations of integrals.
CO2: Construct analytic functions and use their conformal mapping property in application problems.
CO3: Evaluate real and complex integrals using the Cauchy’s integral formula and residue theorem.
CO4: Apply various methods of solving differential equation which arise in many application problems.
CO5: Apply Laplace transform methods for solving linear differential equations.

TEXT BOOKS:
COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:

- Applying the various methods to determine the resultant forces and its equilibrium acting on a particle in 2D and 3D.
- Applying the concept of reaction forces (non-concurrent coplanar and noncoplanar forces) and moment of various support systems with rigid bodies in 2D and 3D in equilibrium. Reducing the force, moment, and couple to an equivalent force - couple system acting on rigid bodies in 2D and 3D.
- Applying the concepts of locating centroids/center of gravity of various sections / volumes and to find out area moments of inertia for the sections and mass moment of inertia of solids.
- Applying the concepts of frictional forces at the contact surfaces of various engineering systems.
- Applying the various methods of evaluating kinetic and kinematic parameters of the rigid bodies subjected to concurrent coplanar forces.

UNIT I    STATICS OF PARTICLES

UNIT II    EQUILIBRIUM OF RIGID BODIES

UNIT III    DISTRIBUTED FORCES
Centroids of lines and areas – symmetrical and unsymmetrical shapes, Determination of Centroids by Integration, Theorems of Pappus - Guldinus, Distributed Loads on Beams, Centre of Gravity of a Three-Dimensional Body, Centroid of a Volume, Composite Bodies, Determination of Centroids of Volumes by Integration.
Moments of Inertia of Areas and Mass - Determination of the Moment of Inertia of an Area by Integration, Polar Moment of Inertia, Radius of Gyration of an Area, Parallel-Axis Theorem, Moments of Inertia of Composite Areas, Moments of Inertia of a Mass - Moments of Inertia of Thin Plates, Determination of the Moment of Inertia of a Three-Dimensional Body by Integration.
UNIT IV  FRICITION  
9+3

UNIT V  DYNAMICS OF PARTICLES  
9+3

TOTAL (L: 45 + T: 15)=60 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
CO1: Apply the various methods to determine the resultant forces and its equilibrium acting on a particle in 2D and 3D.
CO2: Apply the concept of reaction forces (non-concurrent coplanar and noncoplanar forces) and moment of various support systems with rigid bodies in 2D and 3D in equilibrium. Reducing the force, moment, and couple to an equivalent force - couple system acting on rigid bodies in 2D and 3D.
CO3: Apply the concepts of locating centroids / center of gravity of various sections / volumes and to find out area moments of inertia for the sections and mass moment of inertia of solids.
CO4: Apply the concepts of frictional forces at the contact surfaces of various engineering systems.
CO5: Apply the various methods of evaluating kinetic and kinematic parameters of the rigid bodies subjected to concurrent coplanar forces.

TEXT BOOKS:

REFERENCES:

<table>
<thead>
<tr>
<th>CO</th>
<th>PO</th>
<th>PSO</th>
</tr>
</thead>
<tbody>
<tr>
<td>[1]</td>
<td>0.9</td>
<td>0.6</td>
</tr>
<tr>
<td>[2]</td>
<td>0.9</td>
<td>0.6</td>
</tr>
<tr>
<td>[3]</td>
<td>0.9</td>
<td>0.6</td>
</tr>
<tr>
<td>[4]</td>
<td>0.9</td>
<td>0.6</td>
</tr>
<tr>
<td>[5]</td>
<td>0.9</td>
<td>0.6</td>
</tr>
</tbody>
</table>
OBJECTIVES:
- To understand the basic concepts of electric circuits, magnetic circuits and wiring.
- To understand the operation of AC and DC machines.
- To understand the working principle of electronic devices and circuits.

UNIT I BASIC CIRCUITS AND DOMESTIC WIRING

UNIT II THREE PHASE CIRCUITS AND MAGNETIC CIRCUITS

UNIT III ELECTRICAL MACHINES

UNIT IV BASICS OF ELECTRONICS
Intrinsic semiconductors, Extrinsic semiconductors – P-type and N-type, P-N junction, VI Characteristics of PN junction diode, Zener effect, Zener diode, Zener diode Characteristics-Rectifier circuits-Wave shaping.

UNIT V CURRENT CONTROLLED AND VOLTAGE CONTROLLED DEVICES
Working principle and characteristics - BJT, SCR, JFET, MOSFET.

TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:
EC5251 CIRCUIT THEORY L T P C 3 1 0 4

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.

UNIT I DC CIRCUIT ANALYSIS 9+3
Basic Components of electric Circuits, Charge, current, Voltage and Power, Voltage and Current Sources, Ohms Law, 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, Nodal analysis, Mesh analysis.

UNIT II NETWORK THEOREM AND DUALITY 9+3

UNIT III SINUSOIDAL STEADY STATE ANALYSIS 9+3

UNIT IV TRANSIENTS AND RESONANCE IN RLC CIRCUITS 9+3

UNIT V COUPLED CIRCUITS AND TOPOLOGY 9+3
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.

TOTAL: 60 PERIODS

COURSE OUTCOMES:
CO1: Ability to comprehend and design ac/dc circuits.
CO2: Develop and understand ac/dc circuits.
CO3: To be capable of evaluating ac/dc circuits.
CO4: Ability to analyze electrical circuits.
CO5: To inherit the ability to apply circuit theorems in real time.

TEXT BOOKS:
REFERENCES:
5. John O Mallay, Schaum’s Outlines "Basic Circuit Analysis", The Mc Graw Hill companies,

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

BM5201 ANATOMY AND PHYSIOLOGY L T P C 3 0 0 3

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
Cell: Structure and organelles - Functions of each component in the cell. Cell membrane –
transport across membrane – Origin of cell membrane potential – Action potential. Homeostasis -
Tissue: Types – Specialized tissues – functions.

UNIT II RESPIRATORY SYSTEM AND URINARY SYSTEM
Respiratory System: Components of respiratory system – Respiratory Mechanism. Types of
respiration - Oxygen and carbon dioxide transport and acid base regulation. Urinary system:
Structure of Kidney and Nephron. Mechanism of Urine formation – Urinary reflex – Homeostasis
and blood pressure regulation by urinary system.

UNIT III BLOOD AND CARDIOVASCULAR SYSTEM
Blood composition - functions of blood – functions of RBC.WBC types and their functions Blood
groups – importance of blood groups – identification of blood groups. Blood vessels - Structure of
heart – Properties of Cardiac muscle – Conducting system of heart – Cardiac cycle – Heart sound
- Volume and pressure changes and regulation of heart rate –Coronary Circulation. Factors
regulating Blood flow.

UNIT IV SKELETAL AND SPECIAL SENSORY SYSTEM
Skeletal system: Bone types and functions – Axial Skeleton and Appendicular Skeleton. Joint -
Types of Joint – Cartilage structure, types and functions. Special Sensory system- Eye, Ear and
Skin - diseases and related surgery.
UNIT V NERVOUS SYSTEM


TOTAL: 45 PERIODS

COURSE OUTCOMES:
The student will have knowledge to:
CO1: Describe basic structural and functional elements of human body.
CO2: Explain gaseous exchange and fluid maintenance in the human body.
CO3: Enlighten organs and structures involving in system formation and functions.
CO4: Identify all systems in the human body.
CO5: Elucidate special senses in the human body.

TEXT BOOKS:

REFERENCES:

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

GE5162 WORKSHOP PRACTICES LABORATORY
(Common to all Branches of B.E. / B.Tech. Programmes) L T P C 0 0 4 2

COURSE OBJECTIVES: The main learning objective of this course is to provide hands on training to the students in:
1. Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planing; making joints in wood materials used in common household wood work.
2. Wiring various electrical joints in common household electrical wire work.
3. Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipments; Making a tray out of metal sheet using sheet metal work.
4. Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.
GROUP – A (CIVIL & ELECTRICAL)

PART I CIVIL ENGINEERING PRACTICES

PLUMBING WORK:

a) Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.
b) Preparing plumbing line sketches.
c) Laying pipe connection to the suction side of a pump
d) Laying pipe connection to the delivery side of a pump.
e) Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

WOOD WORK:

a) Sawing,
b) Planing and
c) Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.

Wood Work Study:

a) Studying joints in door panels and wooden furniture
b) Studying common industrial trusses using models.

PART II ELECTRICAL ENGINEERING PRACTICES

WIRING WORK:

a) Wiring Switches, Fuse, Indicator and Lamp etc. such as in basic household,
b) Wiring Stair case light.
c) Wiring tube – light.
d) Preparing wiring diagrams for a given situation.

Wiring Study:

a) Studying an Iron-Box wiring.
b) Studying a Fan Regulator wiring.
c) Studying an Emergency Lamp wiring.

GROUP – B (MECHANICAL AND ELECTRONICS)

PART III MECHANICAL ENGINEERING PRACTICES

WELDING WORK:

a) Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.
b) Practicing gas welding.

BASIC MACHINING WORK:

a) (simple)Turning.
b) (simple)Drilling.
c) (simple)Tapping.

ASSEMBLY WORK:

a) Assembling a centrifugal pump.
b) Assembling a household mixer.
c) Assembling an air conditioner.

SHEET METAL WORK:

a) Making of a square tray

FOUNDRY WORK:

a) Demonstrating basic foundry operations.
SOLDERING WORK:
   a) Soldering simple electronic circuits and checking continuity.

ELECTRONIC ASSEMBLY AND TESTING WORK:
   a) Assembling and testing electronic components on a small PCB.

ELECTRONIC EQUIPMENT STUDY:
   a) Studying a FM radio.
   b) Studying an electronic telephone.

COURSE OUTCOMES:

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

CO1: Draw pipe line plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household wood work.

CO2: Wire various electrical joints in common household electrical wire work.

CO3: Weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipments; Make a tray out of metal sheet using sheet metal work.

CO4: Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.

<table>
<thead>
<tr>
<th>CO</th>
<th>PO</th>
<th>PSO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.6</td>
<td>0.3</td>
</tr>
<tr>
<td>2</td>
<td>0.6</td>
<td>0.6</td>
</tr>
<tr>
<td>3</td>
<td>0.6</td>
<td>0.3</td>
</tr>
<tr>
<td>4</td>
<td>0.6</td>
<td>0.3</td>
</tr>
</tbody>
</table>

EE5261 ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY

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

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

TOTAL: 60 PERIODS

COURSE OUTCOMES:
CO1: To become familiar with the basic circuit components and know how to connect them to make a real electrical circuit.
CO2: Ability to perform speed characteristic of different electrical machines.
CO3: Ability to use logic gates and Flip flops.

MA5355 TRANSFORM TECHNIQUES AND PARTIAL DIFFERENTIAL EQUATIONS

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;
- To develop the analytic solutions for partial differential equations used in engineering by Fourier series;
- 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 – Lagrange’s Linear equation – Solution of linear equations of higher order with constant coefficients – Linear non-homogeneous partial differential equations.

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

UNIT IV FOURIER TRANSFORM

UNIT V Z – TRANSFORM AND DIFFERENCE EQUATIONS

TOTAL : 60 PERIODS
COURSE OUTCOMES:
At the end of the course, students will be able to
CO1: Solve partial differential equations which arise in application problems.
CO2: Analyze the functions as an infinite series involving sine and cosine functions.
CO3: Obtain the solutions of the partial differential equations using Fourier series.
CO4: Obtain Fourier transforms for the functions which are needed for solving application problems.
CO5: Manipulate discrete data sequences using Z transform techniques.

TEXTBOOKS:

REFERENCES:

BM5301             SENSORS AND MEASUREMENTS             L T P C
                                      3 0 0 3

OBJECTIVES:
- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To understand the purpose of measurement, the methods of measurements, errors associated with measurements.
- To know the principle of transduction, classifications and the characteristics of different transducers and study its biomedical applications.
- To know the different display and recording devices.

UNIT I             SCIENCE OF MEASUREMENT

UNIT II             DISPLACEMENT, PRESSURE, TEMPERATURE SENSORS
Resistive Transducers: Strain Gauge: Gauge factor, sensing elements, configuration, biomedical applications; strain gauge as displacement & pressure transducers, RTD materials & range, Characteristics, thermistor characteristics, biomedical applications of Temperature sensors Capacitive transducer, Inductive transducer, LVDT, Active type: Thermocouple –characteristics.

UNIT III            PHOTOELECTRIC AND PIEZOELECTRIC SENSORS
Phototube, scintillation counter, Photo Multiplier Tube (PMT), photovoltaic, Photo conductive cells, photo diodes, phototransistor, comparison of photoelectric transducers, spectrophotometric 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. Demonstration of the display and recording devices.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of the course, the student will be able to:
CO1: Describe the purpose and methods of measurements.
CO2: Explain the principle of different sensors and its applications.
CO3: Analyze the characteristics of different transducers.
CO4: Describe the need and function of various signal conditioning circuits.
CO5: Explain different display and recording devices for various applications.

TEXT BOOKS:

REFERENCES:

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>
UNIT I FUNDAMENTALS OF OBJECT ORIENTED PROGRAMMING AND JAVA
Introduction to OOP. Introduction to Java – Java Specifications, Java Language basics – Variables, Operators, Expressions, Statements, Blocks, Control flow Statements, Arrays, Classes and Objects, Strings, Constructors and Destructors, Type Casting, Package Access - Java API Packages.

UNIT II INHERITANCE, POLYMORPHISM AND EXCEPTION HANDLING IN JAVA

UNIT III FILES AND STREAMS IN JAVA
Files and Streams – Formatted Output - Object Concurrency- Serialization - Generic Collections - Generic Classes and Methods - Java utility Packages and Bit Manipulation – Java Collections.

UNIT IV INTRODUCTION TO THE INTERNET

UNIT V JAVA PROGRAMMING IN THE INTERNET

TOTAL: 60 PERIODS

COURSE OUTCOMES:
Upon completion of the course, the student should be able to:
CO1: Design problem solutions using Object Oriented Techniques.
CO2: Apply the concepts of polymorphism, overloading, and inheritance for problem solutions.
CO3: Use the concepts of Java for problem solving.
CO4: Examine important technologies that are being used today by web developers to build a wide variety of web applications.
CO5: To design web applications using Java, Servlets, XML.

TEXT BOOKS:

REFERENCES:
5. http://www.w3schools.com
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
PN junction diode – structure, operation and V-I characteristics, diffusion and transient capacitance - Rectifiers – Half Wave and Full Wave Rectifier, Zener diode characteristics-Zener Reverse characteristics – Zener as regulator, Display devices- LED- characteristics, Laser diodes.

UNIT II TRANSISTORS
BJT, JFET, MOSFET- structure, operation, characteristics and Biasing. UJT, Thyristor (DIAC, SCR, TRIAC) and IGBT -Structure and characteristics.

UNIT III AMPLIFIERS
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

UNIT V FEEDBACK AMPLIFIERS, OSCILLATORS AND REGULATORS

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon Completion of the course, the students will be able to:
CO1: Explain the structure of basic electronic devices.
CO2: Design amplifier circuits and apply negative feedback principle to amplifier stages.
CO3: Realize power amplifier circuits for a given specification.
CO4: Apply positive feedback principle and design oscillators.
CO5: Understand the specifications of regulators and power supply circuits.
TEXT BOOKS:

REFERENCES:

<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>PROGRAMME OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
</tr>
</tbody>
</table>

EC5312

DEVICES AND CIRCUITS LABORATORY

L T P C
0 0 4 2

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

LIST OF EXPERIMENTS
1. Verification of ohm's law, Kirchhoff's law, and Thevenin’s theorem
2. Verification of superposition theorem and Maximum power transfer theorem
3. Frequency response of series resonance and parallel resonance circuits
5. PN Junction Diode Characteristics and application as half wave and full wave rectifiers
6. Zener Diode Characteristics and application as voltage regulator
7. FET Characteristics
8. Characteristics of Thyristor and UJT
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 and LC Oscillators using BJT.
13. General PCB design and practice for simple circuits

TOTAL: 60 PERIODS
OUTCOMES:
At the end of the course, the student should be able to:
- Design RL and RC circuits
- Verify Thevenin & Norton theorem KVL & KCL, and Super Position Theorems
- Draw the characteristics of series and parallel resonance circuits.
- Discuss the characteristics of basic electronic devices.
- Describe the characteristics of Amplifiers

<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>PROGRAMME OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
</tr>
</tbody>
</table>

BM5311 SENSORS AND MEASUREMENTS LABORATORY L T P C

OBJECTIVES:
- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues.
- To study the characteristics of sensors, signal conditioning circuits and display devices.

LIST OF EXPERIMENTS:
1. Characteristics of strain gauges.
2. Displacement measurement using LVDT.
3. Characteristics of temperature sensor-thermistor
4. Characteristics of temperature sensor-RTD.
5. Characteristics of thermocouple
6. Characteristics of Light sensors-LDR, Photo Diode, Photo Transistor.
8. Wheatstone Bridge and Kelvin’s Bridge for Measurement of Resistance.
12. Force measurement using force sensor and calibration.
13. Study of Multimeter and Medical Oscilloscope.

TOTAL: 60 PERIODS

OUTCOMES:
CO1: Design and understand characteristics and calibration of various transducers.
CO2: Design and develop bridge circuits to find unknown variables.
CO3: Design and analyze filter characteristics.
CO4: Understand various read out and display devices.
CO5: Students can design a measurement system for various applications.
OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues.
- 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.

UNIT I INTRODUCTION TO BIOCHEMISTRY
Introduction to Biochemistry, water as a biological solvent, weak acid and bases, pH, buffers, 
Handerson - Hassel Balch 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
CO1: Describe the surface properties involved in biological systems.
CO2: Explain about bio molecules such as Carbohydrates, Lipids, Nucleic Acid & Protein
CO3: Explain functions of bio molecules
CO4: Assess the significance of biomolecules in biological systems.
CO5: Analyze the etiology and biological parameters in metabolic diseases.

TEXT BOOKS:

REFERENCES:

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

EC5406 ANALOG AND DIGITAL INTEGRATED CIRCUITS L T P C 3 0 0 3

OBJECTIVES:
- To study the circuit configuration and introduce practical applications of linear integrated circuits.
- To introduce the concept of application of ADC and DAC in real time systems and Phase Locked Loop with applications.
- To introduce the design of various combinational digital circuits using logic gates
- To bring out the analysis and design procedures for synchronous and asynchronous sequential circuits

UNIT I INTRODUCTION TO OPERATIONAL AMPLIFIER AND ITS APPLICATIONS 9
Operational amplifier –ideal characteristics, Performance Parameters, Linear and Nonlinear Circuits and their analysis- voltage follower, Inverting amplifier, Noninverting Amplifiers, Differentiator, Integrator, Voltage to Current converter, Instrumentation amplifier, Low pass, High pass filter and band pass filters, Comparator, Multivibrator and Schmitt trigger, Triangular wave generator.

UNIT II DIGITAL TO ANALOG AND ANALOG TO DIGITAL CONVERTERS AND PLL 9
Analog switches, High speed sample and hold circuit and IC’s, Types of D/A converter –Weighted resistor, R-2R ladder DAC, D/A Accuracy and Resolution. A/D converter - Flash, Dual slope, Successive approximation, A/D Accuracy and Resolution. Voltage controlled oscillator, Voltage to Frequency converters. PLL-Closed loop analysis of PLL, Frequency multiplication/ division, FSK demodulator.
UNIT III THE BASIC GATES ANDCOMBINATIONAL LOGIC CIRCUITS

Number Systems – Decimal, Binary, Octal, Hexadecimal, 1’s and 2’s 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. Logic families- TTL, MOS, CMOS, BiCMOS - Comparison of Logic families.

UNIT IV COMBINATIONAL LOGIC CIRCUITS

Problem formulation and design of combinational circuits - Code-Converters, Half and Full Adders, 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, PLA and PAL.

UNIT V SEQUENTIAL LOGIC CIRCUITS

Flip flops – SR, JK, T, D, Master/Slave FF, Triggering of FF, Analysis and design of clocked sequential circuits – state minimization, state assignment, circuit implementation. Counters, Ripple Counters, Ring Counters. Types of Registers, Serial In - Serial Out, Serial In - Parallel out, Parallel In -Serial Out, Parallel In - Parallel Out, Universal Shift Register.

OUTCOMES:
CO1: Ability to design new analog linear circuits and develop linear IC based Systems.
CO2: Understand the concept of application of ADC and DAC in real time systems and Phase Locked Loop with applications.
CO3: Use Boolean algebra and apply it to digital systems.
CO4: Design various combinational digital circuits using logic gates.
CO5: Bring out the analysis and design procedures for synchronous and asynchronous sequential circuits.

TEXT BOOKS:

REFERENCES:

<table>
<thead>
<tr>
<th>COURSE OUTCOMES</th>
<th>PROGRAMME OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
</tr>
</tbody>
</table>
OBJECTIVES:

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

UNIT I

ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY

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 – bio geographical 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

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 47 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  6


TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: To recognize and understand the functions of environment, ecosystems and biodiversity and their conservation.
CO2: To identify the causes, effects and environmental pollution and natural disasters and contribute to the preventive measures in the immediate society.
CO3: To identify and apply the understanding of renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.
CO4: To recognize different forms of energy and apply them for suitable applications in for technological advancement and societal development.
CO5: To demonstrate the knowledge of societal activity on the long and short term environmental issues and abide by the legal provisions, National and International laws and conventions in professional and personal activities and to identify and analyse effect of population dynamics on human value education, consumerism and role of technology in environmental issues.

TEXT BOOKS:

REFERENCES:

BM5402 CONTROL SYSTEM FOR BIOMEDICAL ENGINEERING L T P C
3 0 0 3

OBJECTIVES:
- To study the mathematical techniques for analysis of given system.
- To study the given system in time domain and frequency domain analysis.
- To study the stability analysis of the given system.
- To study the concept of physiological control system.

[Signature]
DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025
UNIT I CONTROL SYSTEM MODELING
Terminology and basic structure of control system, example of a closed loop system, transfer function, modeling of electrical systems, translational and rotational mechanical systems, and electromechanical systems, block diagram and signal flow graph representation of systems, reduction of block diagram and signal flow graph, conversion of block diagram to signal flow graph. Need for modeling physiological system.

UNIT II TIMERESPONSE ANALYSIS
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. Introduction to PI, PD and PID controllers.

UNIT III STABILITY ANALYSIS
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
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 frequency and bandwidth.

UNIT V PHYSIOLOGICAL CONTROL SYSTEM
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. Illustration with real time applications.

COURSE OUTCOMES:
The students will be able to:
- CO1: Develop mathematical model for a given system.
- CO2: Determine and analyze the time domain specifications of different systems.
- CO3: Perform stability analysis of the given system using various techniques.
- CO4: Determine and Analyze the frequency domain specifications of the different systems.
- CO5: Explain the concept and model of physiological control systems.

REFERENCES:

TEXT BOOKS:

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

TOTAL: 45 PERIODS.
OBJECTIVES:
- To understand the basic theory of Bio potential Electrodes and Bio potential measurement.
- To design Bio potential amplifiers for acquisition of bio signals.
- To study the various non-electrical physiological parameter measurement and bio chemical measurements.

UNIT I  BIOPOTENTIAL ELECTRODES  9

UNIT II  BIOPOTENTIAL MEASUREMENT  9
Bio signal characteristics– frequency and amplitude ranges. ECG – Einthoven's triangle, standard 12 lead system, block diagram. Measurements of heart sounds - PCG. EEG – 10-20 electrode system, unipolar, bipolar and average mode, Functional block diagram. EMG – unipolar and bipolar mode, block diagram, EOG and ERG.

UNIT III  BIOPOTENTIAL AMPLIFIER  8

UNIT IV  NON ELECTRICAL PHYSIOLOGICAL PARAMETER MEASUREMENT  10

UNIT V  BIOCHEMICAL MEASUREMENT  9
Biochemical sensors - pH, pO$_2$ and pCO$_2$, 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.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of the course, the student will be able to:
CO1: Describe the electrode behavior and circuit models.
CO2: Describe the fundamentals of Bio potential recording.
CO3: Design various bio amplifiers.
CO4: Measure various nonelectrical physiological parameters.
CO5: Measure various biochemical parameters.

TEXT BOOKS:
REFERENCES:

<table>
<thead>
<tr>
<th>COURSE OUTCOMES</th>
<th>PROGRAMME OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
</tr>
</tbody>
</table>

HM5404 HOSPITAL MANAGEMENT L T P C 3 0 0 3

OBJECTIVES:
- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- The student should be made to understand the principles, practices and areas of application in Hospital management.

UNIT I OVERVIEW OF HOSPITAL ADMINISTRATION 7
Distinction between Hospital and Industry, Challenges in Hospital Administration –Hospital Planning – Equipment Planning- AMC – Functional Planning - Current Issues in Hospital Management - Telemedicine - Bio-Medical Waste Management

UNIT II HUMAN RESOURCE MANAGEMENT IN HOSPITAL 9

UNIT III MARKETING RESEARCH & CONSUMER BEHAVIOUR 10
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 10
UNIT V  QUALITY AND SAFETY ASPECTS IN HOSPITAL


TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of the course, the student should be able to:
CO1: Explain the principles, practices and areas of application in Hospital Management.
CO2: Understand the biomedical waste disposal concept.
CO3: Explain the importance of supportive services.
CO4: Comprehend the quality aspect specified by the international standards.
CO5: Knowledge on Hospital safety.

TEXT BOOKS:

REFERENCES:

<table>
<thead>
<tr>
<th>COURSE OUTCOMES</th>
<th>PROGRAMME OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
</tr>
</tbody>
</table>

BM5411  BIOCHEMISTRY AND HUMANPHYSIOLOGY LABORATORY  L T P C 0 0 4 2

OBJECTIVES:
To provide practice on
- Estimation and quantification of biomolecules.
- Separation of macromolecules.
- Interpreting the metabolic changes in pathological conditions

LIST OF EXPERIMENTS:
1. Study of Human anatomy with A.D.A.M interactive online software
2. General tests for carbohydrates, proteins and lipids.
3. Preparation of serum and plasma from blood.
4. Estimation of blood glucose.
5. Estimation of creatinine
6. Estimation of urea
7. Estimation of cholesterol
8. Assay of SGOT/SGPT
9. Separation of proteins by SDS electrophoresis
10. Separation of amino acids by thin layer chromatography
11. Separation of DNA by agarose gel electrophoresis
12. ESR, PCV, MCH, MCV, MCHC, total count of RBCs and hemoglobin estimation.
13. Differential count of different WBCs and blood group identification.
15. Ishihara chart for color blindness and Snellen’s chart for myopia and hyperopia - by letters reading and ophthalmoscope to view retina

TOTAL: 60 PERIODS

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

CO1: Use basic laboratory skills and apparatus to obtain reproducible data from biochemical experiments.

CO2: Separate and analyze the importance of macromolecules.

CO3: Discuss the various blood parameters in pathological conditions.

CO4: Analyze, interpret and report the results of the laboratory experiments.

CO5: Implement experimental protocols and adopt to plan and carry out simple investigations.

<table>
<thead>
<tr>
<th>COURSE OUTCOMES</th>
<th>PROGRAMME OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
</tr>
</tbody>
</table>

EC5413 ANALOG AND DIGITAL INTEGRATED CIRCUITS LABORATORY

OBJECTIVES:

- To design digital logic and circuits
- To learn the function of different ICs
- To understand the applications of operational amplifier.
- To learn the working of multivibrators
- To design circuits for generating waveforms using ICs.

LIST OF EXPERIMENTS:

1. Inverting, non-inverting amplifier and comparator
2. Integrator and Differentiator
3. Design and analysis of active filters using opamp
4. Schmitt trigger using operational amplifier
5. Instrumentation amplifier using operational amplifier
6. RC and LC oscillators
7. Multivibrators using IC555 Timer
8. Study of logic gates, Half adder and Full adder
9. Encoder and BCD to 7 segment decoder

[Attestation stamp]
10. Multiplexer and demultiplexer using digital ICs
11. Universal shift register using flip flops
12. Design of mod-N counter
13. Simulation and analysis of circuits using software

TOTAL: 60 PERIODS

COURSE OUTCOMES:
At the end of the course, the student will be able to:
CO1: Design Combinational Circuits using logic gates
CO2: Design and implement arithmetic circuits for different applications using opamp
CO3: Design Sequential Circuits using logic gates
CO4: Design waveform generators and analyse their characteristics
CO5: Simulate and analyse circuits using ICs

<table>
<thead>
<tr>
<th>COURSE OUTCOMES</th>
<th>PROGRAMME OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓</td>
</tr>
</tbody>
</table>

BM5501 DIAGNOSTIC AND THERAPEUTIC EQUIPMENT – I

OBJECTIVES:
• To understand the medical equipment used in the measurement of parameters related to cardiology and neurology
• To learn some of the cardiac assist devices.
• To understand the principle of biotelemetry
• To understand the function of various extracorporeal devices.

UNIT I CARDIAC EQUIPMENT
Electrocardiograph - Normal and Abnormal Waveforms, Heart rate monitor, Heart rate variability, Holter Monitor, Cardiac Pacemaker- Internal and External Pacemaker, types, Batteries. AC and DC Defibrillator- Internal and External, types, Precautions.

UNIT II NEUROLOGICAL EQUIPMENT
Multi channel EEG recording system, Clinical significance of EEG- Sleep patterns, Epilepsy, Evoked Potential –Visual, Auditory and Somatosensory, EEG Bio Feedback Instrumentation, Psychophysiological Measurements for testing sensory Responses, MEG (Magneto Encephalograph) -sensing principle and instrumentation

UNIT III MUSCULAR EQUIPMENT
EMG - recording and analysis of EMG waveforms, fatigue characteristics, Muscle stimulators, nerve stimulators, Nerve conduction velocity measurement, EMG Bio Feedback Instrumentation. EGG (Electro Gastro Graph), MMG (Magneto Myo Graph).
UNIT IV PATIENT MONITORING AND BIOTELEMETRY

UNIT V EXTRA CORPOREAL DEVICES AND SPECIAL DIAGNOSTIC TECHNIQUES

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of the course, the student will be able to
CO1: Apply different medical devices in the measurement of parameters related to cardiology, neurology.
CO2: Use various cardiac assist devices.
CO3: Measure and analyse signals generated by muscles.
CO4: Perform continuous monitoring and transmission of vital parameters.
CO5: Comprehend the need for special diagnostic and therapeutic devices and extra-corporeal devices.

TEXT BOOKS:

REFERENCES:

<table>
<thead>
<tr>
<th>COURSE OUTCOMES</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>
OBJECTIVES:
- To understand about the continuous time and discrete time signals and systems.
- To learn the analysis of LTI systems using Laplace and Z transform.
- To represent the signal in frequency domain using FFT.
- To gain knowledge about the design of IIR and FIR filters.

UNIT I  CLASSIFICATION OF SIGNALS AND SYSTEMS  9

UNIT II  ANALYSIS OF LTI SYSTEMS  9

UNIT III  DISCRETE FOURIER TRANSFORM  9
DFT and its properties, magnitude and phase representation-Circular Convolution, Overlap-add and overlap-save methods. FFT - Decimation in Time Algorithm, Decimation in Frequency Algorithm. Use of FFT in Linear Filtering.

UNIT IV  DESIGN OF INFINITE IMPULSE RESPONSE FILTERS  9
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 and parallel forms.

UNIT V  DESIGN OF FINITE IMPULSE RESPONSE FILTERS  9

COURSE OUTCOMES:
At the end of the course, the student will be able to:
CO1: Describe the continuous time and discrete time signals and systems.
CO2: Analyze the signals in both continuous time and discrete time
CO3: Compute the spectrum of any signal
CO4: Design IIR filter to process real world signals
CO5: Design FIR filter to process real world signals

TEXT BOOKS:

REFERENCES:

<table>
<thead>
<tr>
<th>COURSE OUTCOMES</th>
<th>PROGRAMME OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
</tr>
</tbody>
</table>

BM5503 PATHOLOGY AND MICROBIOLOGY L T P C 2 0 2 3

OBJECTIVES:
- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To understand the structural and functional aspects of living organisms.
- To know the etiology and remedy in treating the pathological diseases.
- To practice on chemical and structural examinations, histopathological examinations etc.

UNIT I  CELL DEGENERATION, REPAIR AND NEOPLASIA 9
Cell injury and necrosis, apoptosis, intracellular accumulations, cellular adaptations of growth and differentiation. Inflammation and repair including fracture healing, neoplasia, benign and malignant tumours, spread of tumours and biopsy. Visualization of histopathological slides of benign and malignant tumours.

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, sterilization techniques – physical and chemical methods, identification of bacteria, culture media and its types, culture techniques and observation of culture. Demonstration on sterilization techniques.

UNIT V  IMMUNOLOGY 9
Natural and artificial immunity, phagocytosis, inflammation, antibodies, antigen and antibody reactions, hypersensitivity, immunological techniques- immune diffusion, immuno electrophoresis, radioimmunoassay and enzyme linked immuno sorbent assay, monoclonal antibodies. Disease caused by bacteria and protozoa. Visualization of slides of malarial parasites, microfilaria and leishmania donovani.

TOTAL: 60 Periods
COURSE OUTCOMES:
At the end of the course, students will be able to:
CO1: Analyze structural and functional aspects of living organisms.
CO2: Explain the function of microscopes.
CO3: Discuss on the importance of public health.
CO4: Describe treatment methods involved in curing the pathological diseases.
CO5: Perform practical experiments on tissue processing, sterilization techniques and staining processes.

TEXT BOOKS:

REFERENCES:

<table>
<thead>
<tr>
<th>COURSE OUTCOMES</th>
<th>PROGRAMME OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
</tr>
</tbody>
</table>

BM5511 DIGITAL SIGNAL PROCESSING LABORATORY L T P C
0 0 4 2

OBJECTIVES:
1. To implement generation of sequences
2. To realize Linear and Circular Convolution
3. To design and realize FIR and IIR filters
4. To implement signal processing algorithms using digital signal processor

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
7. Generation of sequences
8. Linear and Circular Convolutions
9. DFT
10. FIR filter design
11. IIR filter design
12. Finite word length effects

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025
13. Decimation and Interpolation

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

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES:**
At the end of the course, students will be able to:

CO1: Ability to comprehend and appreciate the significance and role of this course in the present contemporary world.

CO2: Carry out simulation of DSP systems.

CO3: Demonstrate their abilities towards DSP processor based implementation of DSP systems.

CO4: Analyze Finite word length effect on DSP systems.

CO5: Demonstrate the applications of FFT to DSP.

CO6: Implement adaptive filters for various applications of DSP.

**BM5512 BIO MEDICAL INSTRUMENTATION LABORATORY**

**OBJECTIVES:**
- To study and design Bio amplifiers.
- To provide hands on training on Measurement of physiological parameters.

**LIST OF EXPERIMENTS:**
1. Design of low noise pre-amplifier.
2. Design of ECG amplifier and Measurement of heart rate.
3. Design of EMG amplifier.
4. Measurement of heart sounds using PCG.
10. Measurement of vital parameters using Patient Monitoring System
11. Study of Biotelemetry

**TOTAL: 60 PERIODS**

**OUTCOMES:**
At the end of the course, students will be able to:

CO1: Design the amplifier for Bio signal measurements

CO2: Measure heart rate and heart sounds.

CO3: Record and analyze pulse rate and respiration rate

CO4: Measure blood pressure and blood flow

CO5: Design isolation amplifier

---

**COURSE OUTCOMES**

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td></td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>√</td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>√</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
OBJECTIVES:
- Gain knowledge about measurements of parameters related to respiratory system.
- Understand Biomedical Laser principles and applications.
- Understand different types and uses of diathermy units.
- Know the principles of ultrasound and its use in diagnosis.
- Know the importance of patient safety against electrical and laser hazards.

UNIT I  RESPIRATORY MEASUREMENT AND ASSIST SYSTEMS  10

UNIT II  LASER BASED EQUIPMENTS  8

UNIT III  DIATHERMY  9
IR and UV lamp - application. Need for different diathermy units, Short wave diathermy, ultrasonic diathermy, Microwave diathermy. Electro surgery machine - Current waveforms, Tissue Responses, Electro surgical current level, Hazards and safety procedures.

UNIT IV  ULTRASOUND EQUIPMENT  9
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  9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of the course, students will be able to:
CO1: Explain about measurements of parameters related to respiratory system.
CO2: Appreciate the use of advanced laser technology in diagnosis and minimally invasive therapies.
CO3: Analyze different types of diathermy units.
CO4: Understand the concepts of ultrasound equipment.
CO5: Identify the electrical hazards and Implement methods of patient safety.

TEXT BOOKS:

REFERENCES:

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

BM5602 RADIOLICAL EQUIPMENT

OBJECTIVES:
- To understand generation of x-rays and its applications in imaging.
- To learn different types of radio diagnostic techniques.
- To know techniques used for visualizing different sections of the body
- To learn radiation therapy methodologies and the radiation safety.

UNIT I MEDICAL X-RAY EQUIPMENT

UNIT II COMPUTED TOMOGRAPHY

UNIT III MAGNETIC RESONANCE IMAGING
Fundamentals of magnetic resonance- Interaction of Nuclei with static magnetic field and Radiofrequency 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), Gradient magnetic fields, Radio Frequency coils (sending and receiving), shim coils, Electronic components. fMRI.

UNIT IV NUCLEAR IMAGING SYSTEM

UNIT V RADIATION THERAPY AND RADIATION SAFETY
Effects of radiation- direct and indirect. Radiation therapy – linear accelerator, Tele gamma Machine. Recent Techniques in radiation therapy - Stereotaxic Radiosurgery, Stereotaxic...

TOTAL: 45 PERIODS.

OUTCOMES:
At the end of the course, student will be able to
CO1: Discuss the principle and working of various radiography equipment.
CO2: Explain the tomography concept and image reconstruction techniques.
CO3: Describe the basic principle and working of Magnetic resonance imaging technique.
CO4: Explain the concept of nuclear imaging techniques and radiation detectors.
CO5: Demonstrate the effects of radiation, radiation safety and the principle of Radio therapy techniques.

TEXT BOOKS:

REFERENCES:

<table>
<thead>
<tr>
<th>COURSE OUTCOMES</th>
<th>PROGRAMME OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
</tr>
</tbody>
</table>

EC5551 MICROPROCESSORS AND MICROCONTROLLERS

OBJECTIVES:
- To study the architecture of 8085, 8086 , 8051and ARM.
- To study the addressing modes and instruction set of 8085, 8086 8051and ARM .
- To explore the need and use of Peripherals and Interfacing.
- To develop skill to explore system design technique .

UNIT I 8- BIT and 16 - BIT MICROPROCESSOR.
8085 Architecture, Instruction set, Addressing modes, Interrupts, Timing diagrams, Memory and I/O interfacing. 8086 Architecture, Instruction set and programming, Minimum and Maximum mode configurations.

UNIT II PERIPHERALS AND INTERFACING
Programmable Peripheral Interface (8255), Keyboard display controller (8279), ADC0808 and DAC0808 Interface, Programmable Timer Controller (8254), Programmable interrupt controller (8259), Serial Communication Interface (8251).
UNIT III MICROCONTROLLER 9
8051 – Architecture, Special Function Registers (SFRs), Instruction set, Addressing modes, Assembly language programming, I/O Ports, Timers / counters, Interrupts and serial communication.

UNIT IV MICROCONTROLLER BASED SYSTEM DESIGN 9
Interfacing to: matrix display, (16x2) LCD, high power devices, optical motorshaft encoder, Stepper Motor, DC Motor speed Control using PWM, RTC and EEPROM interface using I2C protocol.

UNIT V 32- BIT ARM PROCESSOR 9
RISC Vs CISC Architecture, ARM Processor Architecture, ARM Core data flow model, Barrel Shifter, ARM processor modes and families, pipelining, ARM instruction Set and its Programming.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: Ability to relate any architecture and assembly language for a processor.
CO2: Ability to comprehend the architectural and pipelining concepts for Microprocessors.
CO3: Ability to design and deploy the Interfacing peripherals in real time scenario.
CO4: Ability to discriminate different microprocessor and microcontroller and its special function registers.
CO5: Ability to design, develop and trouble shoot microcontroller based system.

TEXT BOOKS:

REFERENCES:

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

BM5611 DIAGNOSTIC AND THERAPEUTIC EQUIPMENT LABORATORY L T P C 0 0 4 2

OBJECTIVES:
- To provide practice on recording and analysis of different Biopotentials.
- 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 and analysis of EMG signal and plotting of fatigue characteristics.
4. Simulation of ECG – detection of QRS complex and heart rate.
5. Study of shortwave and ultrasonic diathermy.
7. Analysis of characteristics of surgical diathermy.
9. Measurement of GSR.
10. Recording of Audiogram.
11. Study of muscle stimulator.

**TOTAL: 60 PERIODS**

**OUTCOMES:**
At the end of the course, the student will be able to
- Record and Analyse physiological signal.
- Describe the functional characteristics of therapeutic equipment.
- Test the safety of medical equipment.
- Study the effect of stimulators.
- Process Biosignals in VI Platforms.

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

**EC5561** MICROPROCESSOR AND MICROCONTROLLER INTERFACING LABORATORY

**OBJECTIVES:**
- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues.
- To study and introduce the programming language of 8085, 8086 and 805.
- To develop skill in program writing for microprocessors and controllers.
- To introduce microprocessor and microcontroller based system design.
- To impart knowledge on embedded S/W development.

**LIST OF EXPERIMENTS:**
**Assembly Language Programming of 8085 and 8086.**
1. Programs for 8 / 16 bit Arithmetic, Sorting, Searching and String operations,
2. Programs for Digital clock, Interfacing ADC and DAC.
3. Interfacing and programming 8279, 8259, and 8253.
4. Serial Communication between two microprocessors kits using 8251.
5. Interfacing Stepper Motor, Speed control of DC Motor.
6. Parallel communication between two microprocessors kits using Mode 1 and Mode 2 of 8255.
7. Macro assembler Programming for 8086.
8051 based experiments using assembly language and C programming:
8. Programming using Arithmetic, Logical and Bit Manipulation instructions of the 8051 microcontroller.
10. Interfacing – DAC and ADC and 8051 based temperature measurement
11. Interfacing – LED and LCD
12. Interfacing – Stepper motor and traffic light control system
13. Communication between 8051 Microcontroller kit and PC.
14. Programming ARM processor using Embedded C.

TOTAL: 60 PERIODS

COURSE OUTCOMES:
CO1: Ability to develop assembly language program for microprocessors and microcontrollers.
CO2: Ability to comprehend the architectural and pipelining concepts for Microprocessors.
CO3: Ability to interface peripherals, sensors and actuators and in embedded systems.
CO4: Ability to design microprocessor / microcontroller based system.
CO5: Ability to design, develop and troubleshoot microcontroller based system.

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

BM5701 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
COURSE OUTCOMES:
At the end of the course, the student will be able to
CO1: Understand the use of mechanics in medicine.
CO2: Understand the mechanics of physiological systems.
CO3: Distinguish the reason for abnormal patterns.
CO4: Analyze the biomechanical systems using mathematical models.
CO5: Design and develop the models specific to orthopedic applications.

TEXT BOOKS:

REFERENCES:

BM5702 PRINCIPLES OF DIGITAL IMAGE PROCESSING

OBJECTIVES:
- To study the formation of an image and its acquisition
- To introduce the use and application of transforms in image processing
- To study techniques for improving quality of information in corrupted images
- To introduce schemes for compressing images to save storage space

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

UNIT II IMAGE ENHANCEMENT AND RESTORATION
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, Image

TOTAL: 45 PERIODS

**UNIT III IMAGE SEGMENTATION** 9
Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and merging – Segmentation by morphological watersheds – Hybrid methods

**UNIT IV IMAGE FEATURE EXTRACTION AND SELECTION** 9
Features- Feature space, Statistical features, Texture features-co-occurrence features and Run length features, shape features. Feature selection – Need-PCA, statistical analysis and selection of features.

**UNIT V IMAGE COMPRESSION** 9
Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, Vector Quantization, Transform coding, JPEG standard, MPEG.

TOTAL : 45 PERIODS

**COURSE OUTCOMES**
At the end of the course, the student will be able to
CO1: Process color images and compute image transforms.
CO2: Preprocess the image using image enhancement and filtering techniques.
CO3: Restore the degraded images.
CO4: Segment the region of interest in images.
CO5: Apply various compression techniques on images.

**TEXT BOOKS:**

**REFERENCES:**
BM5712  MEDICAL IMAGE PROCESSING LABORATORY  L T P C  0 0 4 2

OBJECTIVES:
- To study the various aspects of image processing techniques for medical images

LIST OF EXPERIMENTS:
1. Display of color and grayscale Images.
2. Conversion between color spaces
3. Histogram Equalization.
4. Spatial filtering
5. Non-linear Filtering.
6. Edge detection using Operators.
7. 2-D DFT and DCT.
8. Filtering in frequency domain.
9. DWT of images.
10. Segmentation using watershed transform.
11. Steganography
12. Feature extraction in medical images.
13. Medical Image Compression techniques.
14. Medical image fusion
15. Study of DICOM standards.

OUTCOMES:
At the end of the course the student will be able to
CO1: Apply filtering techniques to medical images.
CO2: Apply segmentation techniques.
CO3: Perform Encryption in image.
CO4: Identify and perform fusion techniques.
CO5: Understand standards in Image storage and communication.

REFERENCES:

| COURSE OUTCOMES | PROGRAMME OUTCOMES
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>PO1     PO2    PO3    PO4    PO5    PO6    PO7    PO8    PO9    PO10   PO11   PO12</td>
</tr>
<tr>
<td>KO2</td>
<td>PO1     PO2    PO3    PO4    PO5    PO6    PO7    PO8    PO9    PO10   PO11   PO12</td>
</tr>
<tr>
<td>KO3</td>
<td>PO1     PO2    PO3    PO4    PO5    PO6    PO7    PO8    PO9    PO10   PO11   PO12</td>
</tr>
<tr>
<td>KO4</td>
<td>PO1     PO2    PO3    PO4    PO5    PO6    PO7    PO8    PO9    PO10   PO11   PO12</td>
</tr>
<tr>
<td>KO5</td>
<td>PO1     PO2    PO3    PO4    PO5    PO6    PO7    PO8    PO9    PO10   PO11   PO12</td>
</tr>
</tbody>
</table>

BM5001  PATTERN RECOGNITION AND NEURAL NETWORKS  L T P C  3 0 0 3

OBJECTIVES:
- To study the fundamentals of pattern recognition and its application.
- To learn algorithms suitable for pattern classification.
- To understand applications of pattern recognition and classification in image processing and computer vision.

UNIT I  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  9

UNIT III  INTRODUCTION TO NEURAL NETWORK  9
Elementary neurophysiology and biological neural network – Artificial neural network – Architecture, biases and thresholds, Hebb net, Perceptron, Adaline and Madaline.

UNIT IV  BACK PROPAGATION NETWORK AND ASSOCIATIVE MEMORY  9
Back propagation network, generalized delta rule, Bidirectional Associative memory, Hopfield Network

UNIT V  NEURAL NETWORKS BASED ON COMPETITION  9
Kohonen Self organizing map, Learning Vector Quantisation, Counter Propagation network, Case studies.

COURSE OUTCOMES:

At the end of the course, the student will be able to
CO1: Classify patterns using statistical pattern classifier
CO2: Perform unsupervised classification using clustering techniques.
CO3: Explain the fundamentals of neural networks.
CO4: Design Back Propagation and Hopfield network.

TEXT BOOKS:

REFERENCES:

<table>
<thead>
<tr>
<th>COURSE OUTCOMES</th>
<th>PROGRAMME OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
</tr>
</tbody>
</table>
OBJECTIVES:
- To teach ICT applications in medicine with an introduction to health informatics.
- To 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 taken by computer, Dialogue with the computer.

UNIT II  MEDICAL STANDARDS

UNIT III  MEDICAL DATA ACQUISITION AND STORAGE
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 , Data mining.

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:
CO1: To discuss about health informatics and different ICT applications in medicine.
CO2: To explain the function of Hospital Information Systems.
CO3: To appreciate and adopt medical standards.
CO4: Understand the virtual reality tools.
CO5: Understand the concept and need of different information systems.

TEXT BOOKS:
OBJECTIVES:

- Students will be able to know about the legal and ethical principles in health care settings & gain knowledge about the medical standards that to be followed in hospitals.
- Professional ethics to be followed by Biomedical Engineers.
- Patient safety and regulatory aspects followed in hospitals.

UNIT I INTRODUCTION TO MEDICAL ETHICS


UNIT II CODE OF ETHICS FOR BIOMEDICAL ENGINEERS


UNIT III MEDICAL DEVICE SAFETY

Shared Responsibility for Medical device safety, WHO – International Health Regulations (IHR), Stages of regulatory control of medical devices, Ethics committee- its members and functions, Global Harmonization Task Force (GHTF). Quality systems requirement –ISO, Voluntary and mandatory standards, Collateral Standards- EMC radiation protection & programmable medical device system, Particular Standards-type of medical device.

UNIT IV REGULATORY STANDARDS FOR MEDICAL DEVICE MAINTENANCE


UNIT V HOSPITAL ACCREDITATION AND SAFETY STANDARDS


TOTAL: 45 PERIODS
COURSE OUTCOMES:
Upon completion of this course the student should be able to: demonstrate a measurable increase in their knowledge, skills and abilities related to
CO1: Legal and professional guidelines for the health professions
CO2: Social responsibility in healthcare systems
CO3: Bioethics and engineers role
CO4: Medical device maintenance
CO5: Understand safety aspects.

TEXTBOOKS:

REFERENCES:

<table>
<thead>
<tr>
<th>COURSE OUTCOMES</th>
<th>PROGRAMME OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
</tr>
</tbody>
</table>

BM5004 COMMUNICATION ENGINEERING

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

UNIT I ANALOG MODULATION

UNIT II RECEIVER CHARACTERISTICS

UNIT III INFORMATION THEORY
UNIT IV  
BANDPASS SIGNALING  
9  
Geometric representation of signals – Correlator and matched filter – ML detection – generation and detection, PSD, BER of coherent BPSK, BFSK, QPSK – Principles of QAM – Structure of non-coherent receivers – BFSK, DPSK

UNIT V  
ERROR CONTROL CODING TECHNIQUES  
9  
Channel coding theorem – Linear block codes – Hamming codes – Cyclic codes (CRC) – Convolutional codes – Viterbi decoding (Soft/Hard decision decoding).

COURSE OUTCOMES:
At the end of the course, the student will be able to
CO1: Ability to comprehend and appreciate the significance and role of this course in the present contemporary world.
CO2: Apply analog modulation techniques.
CO3: Apply digital modulation techniques.
CO4: Knowledge on various types of noises during transmission.
CO5: Analyze various error control coding techniques.

TEXT BOOKS:

REFERENCES:

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

BM5005  
BIO SIGNAL PROCESSING  
L T P C  
3 0 0 3

OBJECTIVES:
• To study the characteristics of different biosignals
• To learn linear and non-linear filtering techniques to extract desired information
• To understand various techniques for automated classification and decision making to aid diagnosis

UNIT I  
BIOSIGNAL AND SPECTRAL CHARACTERISTICS  
9  
UNIT II TIME SERIES ANALYSIS AND SPECTRAL ESTIMATION


UNIT III ADAPTIVE FILTERING AND WAVELET DETECTION

Filtering – LMS adaptive filter, adaptive noise canceling in ECG, improved adaptive filtering in ECG, Wavelet detection in ECG – structural features, matched filtering, adaptive wavelet detection, detection of overlapping wavelets.

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.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon the completion of this course, the students will be able to
CO1: Preprocess the Biosignals.
CO2: Analyze biosignals in time domain & to estimate the spectrum.
CO3: Apply wavelet detection techniques for biosignal processing.
CO4: Classify Biosignals using neural networks and statistical classifiers.
CO5: Extract the features using multivariate component analysis.

TEXT BOOKS:

REFERENCES:
### OBJECTIVES:
- To study the characteristics and classification of biomaterials.
- To understand the response of biomaterials in living system.
- To learn about the polymeric materials and composites in tissue replacements.
- To know the compatibility and functioning of artificial organs inside the living system.

### UNIT I  STRUCTURE OF BIO-MATERIALS AND BIO-COMPATIBILITY 9
Definition and classification of bio-materials, mechanical properties, visco elasticity, wound-healing process, body response to implants, blood compatibility, HLA compatibility.

### UNIT II  IMPLANT MATERIALS 9
Metallic implant materials, stainless steels, Ti-based alloys, ceramic implant materials, aluminum oxides, hydroxyapatite, glass ceramics, carbons, medical applications.

### UNIT III  POLYMERIC IMPLANT MATERIALS 9

### UNIT IV  TISSUE REPLACEMENT IMPLANTS 9

### UNIT V  ARTIFICIAL ORGANS 9
Artificial Blood, Artificial Skin, Artificial Heart, Prosthetic Cardiac valves, Artificial Lung( Oxygenator), Artificial Kidney ( Dialyzer Membrane), Dental Implants, Retinal Implants.

**TOTAL: 45 PERIODS**

### COURSE OUTCOMES:
**At the end of the course, the student will able to**
- CO1: Analyze different types of materials and its application in biomedical field.
- CO2: Choose materials for design of implants in tissue replacement.
- CO3: Evaluate response of biomaterials in living system.
- CO4: Assess compatibility and functioning of artificial organs inside the living system.
- CO5: Design and develop biomaterial based scaffold for biomedical application.
TEXT BOOKS:

REFERENCES:

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

BM5007 BIOMATERIALS AND CHARACTERISATION L T P C
3 0 0 3

OBJECTIVES:
- To study the characteristic features of bio materials in medicine.
- To know biocompatibility and functionality of biomaterials and implement in living system.

UNIT I BIOMATERIALS AND PROPERTIES 9

UNIT II PHYSIO-CHEMICAL CHARACTERIZATION 9
Material Characterization: X-ray Diffraction Analysis (XRD), FT- Raman and micro Raman analysis, electron spectroscopy for chemical Analysis (ESCA) and X-ray photo electron spectroscopy (XPS), mechanical testing: tensile, compression, wears, fatigue, corrosion studies and fracture toughness. Thermal and viscoelastic properties.

UNIT III SURFACE CHARACTERIZATION 9
Surface properties and adhesion, contact angle measurement, scanning electron microscopy (SEM), transmission electron microscopy (TEM), scanning tunneling microscopy and atomic force microscopy (AFM).Secondary ion mass spectrometry and confocal laser scanning microscopy.

UNIT IV BIOMATERIAL TESTING 9
Biofunctionality and biocompatibility, preservation techniques for biomaterials, in vitro & in vivo assessment of tissue compatibility, testing of blood (HLA typing and blood grouping) – materials, interactions and animal models.
UNIT V BIOMATERIALS IN MEDICINE


TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Apply the knowledge of science and engineering and to function on multidisciplinary team.

CO2: Analyze different types of materials and their properties.

CO3: Explain the basic principles and features of polymeric materials and understand key relationship between the structure, property and processing of polymers.

CO4: Analyze the roles of the natural and synthetic polymer in designing the medical device.

CO5: Explain methods to repair and regenerate injured or lost functional tissue with materials, autologous or stem cells.

TEXT BOOKS:


REFERENCES:


<table>
<thead>
<tr>
<th>COURSE OUTCOMES</th>
<th>PROGRAMME OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
</tr>
</tbody>
</table>
OBJECTIVES:
- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues.
- To understand the general principles of design of biometric systems and the underlying trade-offs.
- To study the technologies of fingerprint, iris, face and speech recognition.
- To study of evaluation of biometrics systems.

UNIT I  INTRODUCTION TO BIOMETRICS
Introduction and back ground – biometric technologies – passive biometrics – active biometrics – Biometric characteristics, Biometric applications – Biometric Authentication systems- Taxonomy of Application Environment, Accuracy in Biometric Systems- False match rate- False non match rate- Failure to enroll rate- Derived metrics-Biometrics and Privacy.

UNIT II  FINGERPRINT TECHNOLOGY
History of fingerprint pattern recognition - General description of fingerprints- fingerprint sensors, fingerprint enhancement, Feature Extraction- Ridge orientation, ridge frequency, fingerprint matching techniques- correlation based, Minutiae based, Ridge feature based, fingerprint classification, Applications of fingerprints, Finger scan- strengths and weaknesses, Evaluation of fingerprint verification algorithms.

UNIT III  FACE RECOGNITION AND HAND GEOMETRY

UNIT IV  IRIS RECOGNITION
Introduction, Anatomical and Physiological underpinnings, Iris sensor, Iris representation and localization- Daugman and Wilde’s approach, Iris matching, Iris scan strengths and Weaknesses, System performance, future directions.

UNIT V  VOICE SCAN AND MULTIMODAL BIOMETRICS
Voice scan, speaker features, short term spectral feature extraction, Mel frequency cepstral coefficients, speaker matching, Gaussian mixture model, NIST speaker Recognition Evaluation Program, Introduction to multimodal biometric system – Integration strategies – Architecture – level of fusion – combination strategy, examples of multimodal biometric systems, Securing and trusting a biometric transaction – matching location – local host - authentication server – match on card (MOC).

COURSE OUTCOMES:
At the end of the course, the student will be able to
CO1: Demonstrate the principles of biometric systems.
CO2: Develop fingerprint recognition technique.
CO3: Design face recognition and hand geometry system.
CO4: Design iris recognition system.
CO5: Develop speech recognition and multimodal biometric systems.

TEXT BOOKS:
REFERENCES:

### COURSE OUTCOMES

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

### PROGRAMME OUTCOMES

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

**BM5009 BODY AREA NETWORKS**

**OBJECTIVES:**
- To know the hardware requirement of BAN
- To understand the communication and security aspects in the BAN
- To know the applications of BAN in the field of medicine

**UNIT I INTRODUCTION**

**UNIT II HARDWARE FOR BAN**

**UNIT III WIRELESS COMMUNICATION AND NETWORK**
RF communication in Body, Antenna design and testing, Propagation, Base Station-Network topology-Stand –Alone BAN, Wireless personal Area Network Technologies-IEEE 802.15.1, IEEE P802.15.13, IEEE 802.15.14, Zigbee.

**UNIT IV COEXISTENCE ISSUES WITH BAN**
Interferences – Intrinsic - Extrinsic, Effect on transmission, Counter measures- on physical layer and data link layer, Regulatory issues-Medical Device regulation in USA and Asia, Security and Self-protection-Bacterial attacks, Virus infection, Secured protocols, Self-protection.

**UNIT V APPLICATIONS OF BAN**
Monitoring patients with chronic disease, Hospital patients, Elderly patients, Cardiac arrhythmias monitoring, Multi patient monitoring systems, Multichannel Neural recording, Gait analysis, Sports Medicine, Electronic pill.

**TOTAL: 45 PERIODS**
COURSE OUTCOMES:

At the end of the course the student will be able to
CO1: Comprehend and appreciate the significance and role of this course in the present contemporary world.
CO2: Design a BAN for appropriate application in medicine.
CO3: Assess the efficiency of communication and the security parameters.
CO4: Understand the need for medical device regulation and regulations followed in various regions.
CO5: Extend the concepts of BAN for medical applications.

TEXT BOOKS:

REFERENCES:

<table>
<thead>
<tr>
<th>COURSE OUTCOMES</th>
<th>PROGRAMME OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>PO1</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
</tr>
</tbody>
</table>

BM5010 BRAIN COMPUTER INTERFACE AND APPLICATIONS L T P C 3 0 0 3

OBJECTIVES:

- To understand 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

UNIT II ELECTROPHYSIOLOGICAL SOURCES

UNIT III FEATURE EXTRACTION METHODS

UNIT IV FEATURE TRANSLATION METHODS
UNIT V APPLICATIONS OF BCI


TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Describe BCI system and its potential applications.
CO2: Analyze event related potentials and sensory motor rhythms.
CO3: Compute features suitable for BCI.
CO4: Design classifier for a BCI system.
CO5: Implement BCI for various applications.

TEXT BOOKS:

REFERENCES:

<table>
<thead>
<tr>
<th>COURSE OUTCOMES</th>
<th>PROGRAMME OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>√</td>
</tr>
<tr>
<td>CO2</td>
<td>√</td>
</tr>
<tr>
<td>CO3</td>
<td>√</td>
</tr>
<tr>
<td>CO4</td>
<td>√</td>
</tr>
<tr>
<td>CO5</td>
<td>√</td>
</tr>
</tbody>
</table>

BM5011 PHYSIOLOGICAL MODELLING

OBJECTIVES:
- To understand the application of Physiological models and Vital organs.
- To understand methods and techniques for analysis and synthesis of dynamic models.
- To model dynamically varying physiological system.
- To develop differential equations to describe the dynamic models.
- To simulate and visualize, dynamic responses of physiological models using software.

UNIT I SYSTEM CONCEPT


UNIT II SYSTEM ANALYSIS

Review of transfer function, transfer function of coupled system. Impedance based transfer function - flexible tube feeding a single port compliant model, development of a lung model. Periodic signals: sinusoidal analysis of second order system, analysis of respiratory system based on sinusoidal excitation, pendelluft.
UNIT III  TRANSIENT AND FEEDBACK  9

UNIT IV  MODELING OF CARDIOPULMONARY SYSTEM  9
Model of cardiac output regulation - Starling's law, Physical Significance of under damped responses of post systolic operations in aortic arch, model of circadian rhythms, chemical regulation of ventilation, Cheyne-Stoke breathing, biot breathing.

UNIT V  OTHER PHYSIOLOGICAL MODELS AND SIMULATION  9
Steady state analysis of regulation of glucose, Hodgkin-Huxley model, Thermal system – model and simulation, modeling of eye movement- types of eye movement, saccade model, model of oculumotor control. Introduction to digital control system. TOTAL: 45PERIODS

COURSE OUTCOMES:
At the end of the course, students will be able to:
CO1: Explain application of Physiological models.
CO2: Model dynamically varying physiological system.
CO3: Analyze and synthesize dynamic models of physiological system.
CO4: Develop differential equations to describe the dynamic models, simulate and visualize.
CO5: Implement physiological models using software to get dynamic responses.

TEXT BOOKS:

REFERENCES:

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

- Provide a possibility for the student to acquire knowledge about the impact and interaction of light with biological tissue.
- Understand practical applications of optics related to medicine.

UNIT I  INSTRUMENTATION IN PHOTONICS  

UNIT II  OPTICAL PROPERTIES OF THE TISSUES  
Light transport inside the tissue, optical properties of tissue. Laser Characteristics as applied to medicine and biology-Laser tissue Interaction-Chemical, Thermal, Electromechanical. Photo ablative processes.

UNIT III  SURGICAL APPLICATIONS OF LASERS  

UNIT IV  NON THERMAL DIAGNOSTIC APPLICATIONS  
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  
Phototheropy, Photodynamic therapy (PDT) - Principle and mechanism - Oncological and non-oncological applications of PDT - Biostimulation effect – applications-Laser Safety Procedures.

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

CO1: Comprehend and appreciate the significance and role of this course in the present contemporary world.
CO2: Demonstrate knowledge of the fundamentals of optical properties of tissues.
CO3: Describe surgical applications of laser.
CO4: Describe photonics and its therapeutic applications.
CO5: Apply the concepts of laser and light to understand the laser safety procedures.

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
OBJECTIVES:  
- To study effects of sound and light in human body  
- To understand the effects of radiation in matter and how isotopes are produced

UNIT I
NON IONIZING RADIATION AND ITS MEDICAL APPLICATION

UNIT II
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 (Technetiumgenerator).

UNIT III
INTERACTION OF RADIATION WITH MATTER

UNIT IV
PRINCIPLES OF RADIATION DETECTION AND DOSIMETERS
Principles of radiation detection, Properties of dosimeters, Theory of gas filled detectors, Ionization Chamber, Proportional chamber, G.M. Counter, Film dosimetry, luminescence dosimetry, scintillation detectors, Radiation detection instruments, Area survey meters, Personal Radiation monitoring device, Film badge, TLD, OSLD.

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.
COURSE OUTCOMES:
At the end of the course, the student will be able to
CO1: Comprehend and appreciate the significance and role of this course in the present contemporary world.
CO2: Discuss the effect of non ionising radiation in human body and applications in the field of medicine.
CO3: Understand radioactive decay and production of radio nuclides.
CO4: Discuss the measurement of ionizing radiation.
CO5: Enumerate the effect of ionising radiation in human body.

TEXT BOOKS:

REFERENCES:

<table>
<thead>
<tr>
<th>COURSE OUTCOMES</th>
<th>PROGRAMME OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>√</td>
</tr>
<tr>
<td>CO2</td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td></td>
</tr>
</tbody>
</table>

BM5014 MEMS AND ITS BIOMEDICAL APPLICATIONS L T P C 3 0 0 3

OBJECTIVES:
- To learn various MEMS fabrication techniques.
- To understand different types of sensors and actuators and their principles of operation at the micro scale level.
- To know the applications of MEMS in different fields of medicine

UNIT I MEMS MATERIALS AND FABRICATION 9
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 9
Mechanics for MEMs design- static bending of thin plates, mechanical vibration thermo mechanics, 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, 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

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, electronic nose. Introduction to 3D printing.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of the course, the student will be able to
CO1: Discuss various MEMS fabrication techniques.
CO2: Explain different types of sensors and actuators and their principles of operation at the micro scale level.
CO3: Comprehend the characteristics of fluid flow and actuation through micro channels.
CO4: Explain the need and use of CAD for MEMS design.
CO5: Design MEMS devices for different medical applications.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:

- To explain the need for medical aids.
- To understand the sensory rehabilitation systems.
- To learn the use of the orthopedic prosthetics and orthotics in rehabilitation.
- To have an understanding of rehabilitation medicine and advocacy.

UNIT I INTRODUCTION 9

UNIT II ENGINEERING CONCEPTS IN SENSORY REHABILITATION ENGINEERING 9

UNIT III ORTHOPEDIC PROSTHETICS AND ORTHOTICS IN REHABILITATION 9
Engineering concepts in motor rehabilitation, Artificial limbs- body powered, externally powered and controlled orthotics and prosthetics, Myoelectric hand and arm prosthetics. Functional Electrical Stimulation systems-Restoration of hand function, restoration of standing and walking, Hybrid Assistive Systems (HAS).

UNIT IV VIRTUAL REALITY IN REHABILITATION 9
Introduction to virtual reality, 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 9
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.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of the course, the student will be able to
CO1: Understand the key terminologies used by the rehabilitation team.
CO2: Devise new concepts for future development and applications.
CO3: Design and develop different sensory assist devices, orthotics and prosthetics for rehabilitation applications.
CO4: Understand the need of virtual reality tools for different aids.
CO5: Appreciate the legal aspects for building rehabilitation aids for the needed people.

TEXT BOOKS:
REFERENCES:
7. Rory A Cooper (Editor), Hisaichi Ohnabe (Editor), Douglas A. Hobson (Editor), “An Introduction to Rehabilitation Engineering (Series in Medical Physics and Biomedical Engineering” CRC Press, 2006.

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

BM5016 VIRTUAL REALITY IN MEDICINE L T P C 3 0 0 3

OBJECTIVES:
- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues.
- To impart the fundamental aspects, principles of virtual reality technology.
- To gain knowledge about applications of virtual reality.

UNIT I INTRODUCTION 10

UNIT II MODELING 9
Geometric modeling - kinematics modeling- physical modeling - behavior modeling - model management.

UNIT III HUMAN FACTORS 8
Methodology and terminology-user performance studies-VR health and safety issues-Usability of virtual reality system- cyber sickness -side effects of exposures to virtual reality environment

UNIT IV VR PROGRAMMING 10
Introducing Java 3D-loading and manipulating external models-using a lathe to make shapes. 3D Sprites- animated 3D sprites-particle systems.

UNIT V APPLICATIONS 8
Medical applications--robotics applications- Advanced Real time Tracking-other applications-games, movies, simulations, therapy

TOTAL: 45 PERIODS
COURSE OUTCOMES:
At the end of the course the student will be able to
CO1: Comprehend and appreciate the significance and role of this course in the present contemporary world.
CO2: Understand the basic concepts of Virtual reality.
CO3: Expose the concept of Virtual Reality Programming with toolkits.
CO4: Design of various modeling concepts.
CO5: Develop the Virtual Reality applications in different areas.

TEXT BOOKS:

REFERENCES:

BM5017 WEARABLE SYSTEMS

OBJECTIVES:
- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To know the sensor and signal processing requirement of wearable systems
- To understand the communication and security aspects
- To know the level of energy involvement in wearable systems

UNIT I SENSORS
Need for wearable systems, Sensors for wearable systems-Inertia movement sensors, Respiration activity sensor, Inductive plethysmography, Impedance plethysmography, pneumography, Wearable ground reaction force sensor, GSR, Radiant thermal sensor, Wearable motion sensors, CMOS –Based Biosensors, E-Textiles, Bio compatibility

UNIT II SIGNAL PROCESSING
Wearability issues -physical shape and placement of sensor, Technical challenges - sensor design, signal acquisition, Constraint on sampling frequency for reduced energy consumption, light weight signal processing, Rejection of irrelevant information, Datamining.

UNIT III ENERGY HARVESTING FOR WEARABLE DEVICES
Solar cell, Vibration based, Thermal based, Human body as a heat source for power generation, Hybrid thermoelectric photovoltaic energy harvests, Thermopiles.

UNIT IV WIRELESS HEALTH SYSTEMS
Need for wireless monitoring, Definition of Body area network, BAN and Healthcare, Technical Challenges- System security and reliability, BAN Architecture – Introduction, Wireless communication techniques.

UNIT V APPLICATIONS OF WEARABLE SYSTEMS
Medical Diagnostics, Medical Monitoring-Patients with chronic disease, Hospital patients, Elderly patients, Multi parameter monitoring, Neural recording, Gait analysis, Sports Medicine, Smart Fabrics

TOTAL: 45 PERIODS
COURSE OUTCOMES:
At the end of the course student will be able to
CO1: Comprehend and appreciate the significance and role of this course in the present contemporary world
CO2: Choose appropriate sensors and signal processing techniques for wearable systems
CO3: Assess the energy requirement for a wearable system and analyse and experiment energy harvesting techniques for wearable systems
CO4: Appreciate the need for BAN and the challenges involved in the design of BAN
CO5: Design basic wearable systems for medical applications

TEXT BOOKS:

REFERENCES:

<table>
<thead>
<tr>
<th>COURSE OUTCOMES</th>
<th>PROGRAMME OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
</tr>
</tbody>
</table>

BM5018  NEURAL ENGINEERING  L T P C  3 0 0 3

OBJECTIVES:
- To be familiar with the nervous system development
- To be exposed to neuronal diseases and disorders
- To be familiar with nerve reconstruction and repairing

UNIT I  BASICS OF NEURON STRUCTURE AND FUNCTIONS  9

UNIT II  BRAIN, BRAIN STEM AND SPINAL CORD  9

UNIT III  NEURONAL DISEASES AND DISORDERS  9
UNIT IV NEUROPHYSIOLOGY & NEURORADIOLOGY 9

UNIT V NERVE RECONSTRUCTION AND REHABILITATION 9
Neural plasticity; Neurological dysfunctions - Regeneration of the peripheral nervous system. Neural tissue engineering; Nerve graft; Drug delivery system in CNS. Rehabilitation: Mechanisms for Neuromotor rehabilitation; Robotics and virtual reality in physical therapy; Transcranial magnetic stimulation.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon Completion of the course, the students will be able to
CO1: Explain the basic structure and functions of human nervous system.
CO2: Understand diseases and degeneration related to nervous system.
CO3: Analyze visualization and radiological assessment of nervous system.
CO4: Apply neural tissue engineering for rehabilitation.
CO5: Discuss about Regeneration of nervous system.

TEXT BOOKS:

REFERENCES:

<table>
<thead>
<tr>
<th>COURSE OUTCOMES</th>
<th>PROGRAMME OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>PO1</td>
</tr>
<tr>
<td>CO2</td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
</tr>
</tbody>
</table>

BM5019 ADVANCED BIO ANALYTICAL AND THERAPEUTIC TECHNIQUES L T P C

OBJECTIVES:
- To understand the basic preparation of standards.
- To study common analytical techniques.
- To enumerate the effects of radioactive radiation on human body.
- To learn the appropriate technique for a given size & type of sample.
- To understand the scientific foundation concerning characterization, testing and approval of nanoscale drugs in diagnostics, imaging agents, and therapeutics

UNIT I ANALYTICAL TECHNIQUES 9
Principle, instrumentation and application of electrophoresis- SDS, native gel. UV and IR spectroscopy and its application. Spectrophotometry, fluorimetry. 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 dosimetry.

UNIT IV GENE THERAPY

UNIT V NANOTHERAPEUTICS
Introduction to nanoparticles – their types, nanocarriers in drug delivery, synthesis and physiochemical properties of particles at nanoscale. Transport across biological barriers, Nanotechnology in Cancer therapy, bone treatment, oral vaccination and skin disease. Fate of nanoparticle and its toxicity.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of course, the student will be able to
CO1: Report and discuss on chemical analytical aspects relevant for the selection of proper analytical techniques.
CO2: Implement bio analytical aspects in medical sciences.
CO3: Discuss on preventive measures of radioactive pollution and regulations regarding safety measures for radiation exposure.
CO4: Analyze the underlying etiology of the disease that might be treated by gene therapy.
CO5: Describe the basic science behind the properties of materials at nanoscale and the principles behind advanced experimental and computational techniques for studying nanomaterials.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:

- To study Cell cycle and differentiation
- To learn basics about stem cells and its applications
- To describe different synthetic and natural biomaterials in tissue replacements

UNIT I  FUNDAMENTALS OF TISSUE ENGINEERING  9
Tissue Engineering: Introduction - Objectives of tissue engineering - Laboratory set up for tissue engineering. Tissue development and Tissue exchange - Cell cycle and differentiation - cell adhesion - cell adhesion molecules - cell migration - cell aggregation and tissue equivalent.

UNIT II  COMPONENTS OF TISSUE ENGINEERING  9
Cell: Cell harvesting In Vitro – Medium: Synthetic and Biological media – Scaffold: Natural and Synthetic scaffold: Cell and Drug delivery systems - Transplantation – Implantation - Nanotechnology in tissue engineering – Biocompatibility studies In Vitro and In Vivo.

UNIT III  STEM CELLS  8
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 IV  MATERIALS IN TISSUE ENGINEERING  9

UNIT V  APPLICATION OF TISSUE ENGINEERING  10

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After the completion of these course students will be able to

- CO1: Understand the basic concepts of tissue engineering
- CO2: Acquire ability to function on multi-disciplinary teams
- CO3: Apply the knowledge of professional and ethical responsibility in use of stem cells and gene therapy in creating tissue engineered therapies.
- CO4: Design and develop different biomaterial in tissue engineering application.
- CO5: Gain knowledge in research or clinical application on tissue repair/ engineering.

TEXT BOOKS:


REFERENCES:

# OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientists, national/international policies with a futuristic vision along with socio-economic impact and issues.
- The student should be made to learn advanced 8086 family of processors, motherboard, PC based data acquisition and troubleshooting of PCs.

## UNIT I
### PC HARDWARE AND OVERVIEW
- System Unit - Overview of Mother Boards - Processors, Memory, Adapter cards, Ports, Power supply - BIOS – DOS interaction, POST, Functional and Architecture Block diagram of a PC, Mother Board logics - Memory and I/O map.

## UNIT II
### PROCESSORS AND PERIPHERAL INTERFACING
- Introduction to intel processors Intel CoreTM@ i7 Processor Keyboard and Mouse Interfaces - Memory types - RAM - SDRAM and RDRAM, Cache memory, ROM and its types, Flash memory, CMOS semiconductor memory - Adapter Cards - Sound Card, Modem card, Video card, Network Card.

## UNIT III
### PERIPHERAL CONTROLLERS
- I/O slots - ISA, PCI and AGP bus slots - Ports - Serial and Parallel ports, USB, FireWire port, MIDI, SCSI, IrDA, Bluetooth – Connectors - System Bus, ISA, EISA, PCI, AGP and PCI bus - Disk controllers.

## UNIT IV
### TROUBLESHOOTING, MAINTAINING & REPAIRING
- Memory troubleshooting, Monitor troubleshooting, Motherboard troubleshooting, Port troubleshooting, Sound Boards and Video adapters troubleshooting, USB troubleshooting.

## UNIT V
### COMPUTERISED DATA ACQUISITION AND PROGRAMMING
- Plug-in-Data acquisition and control Boards, - Data acquisition using GPIB and serial Interfaces and Programming in C – DSP in Medical applications.

**TOTAL : 45 PERIODS**

## COURSE OUTCOMES:

At the end of the course, the student will be able to:
- CO1: Explain the concept of 8086 family of processors.
- CO2: Understand motherboards concepts.
- CO3: Able to troubleshoot the PCs.
- CO4: Understand the concepts of peripheral controllers.
- CO5: Known PC based data acquisition.
TEXT BOOKS:

REFERENCES:

<table>
<thead>
<tr>
<th>COURSE OUTCOMES</th>
<th>PROGRAMME OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>PO1</td>
</tr>
<tr>
<td></td>
<td>√</td>
</tr>
<tr>
<td>CO2</td>
<td>√</td>
</tr>
<tr>
<td>CO3</td>
<td>√</td>
</tr>
<tr>
<td>CO4</td>
<td>√</td>
</tr>
<tr>
<td>CO5</td>
<td>√</td>
</tr>
</tbody>
</table>

EC5071 ADVANCED MICROCONTROLLERS L T P C 3 0 0 3

OBJECTIVES:
- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To introduce the concept of microcontroller based system development.
- To introduce the concept of RISC and CISC microcontrollers.
- To study the architecture of PIC, R8C and MSP430 family microcontrollers

UNIT I RISC PROCESSORS
RISC Vs CISC, RISC properties and evolution, Advanced RISC microcontrollers, PIC18xx microcontroller family, Architecture, Instruction set, ROM, RAM, Timer programming, Serial port programming, Interrupt programming, ADC and DAC interfacing, CCP module and programming.

UNIT II CISC PROCESSORS
RL78 16 BIT Microcontroller architecture, addressing modes, on-Chip memory, ADC, interrupts, MAC unit, Barrel shifter, internal and external clock generation, memory CRC, on chip debug function and self programming.

UNIT III MSP430 16 - BIT MICROCONTROLLER
The MSP430 Architecture, CPU Registers, Instruction Set, addressing modes, the MSP430 family viz. MSP430x2x, MSP430x4x, MSP430x5x. Low power aspects of MSP430 : low power modes, active Vs standby current consumption, FRAM Vs Flash for low power and reliability.

UNIT IV PROGRAMMING AND PERIPHERAL INTERFACE USING MSP430 FAMILIES
Memory mapped peripherals, I/O pin multiplexing, Timers, RTC, watchdog timer, PWM control, Analog interfacing and data acquisition, DMA, programming with above internal peripherals using optimal power consumption. Case study: Remote control of air conditioner and home appliances.
UNIT V COMMUNICATION INTERFACE USING MSP 430 MICROCONTROLLER


TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: Ability to discriminate RISC and CISC processors, and work with PIC microcontrollers.
CO2: Ability to work with the 16 bit microcontroller RL78 and design microcontroller based systems for a Real world application.
CO3: Gaining design knowledge and concepts on MSP430 family of Microcontroller.
CO4: Ability to design real time systems by deploy the Interfacing peripherals.
CO5: Ability to design and develop microcontroller based smart electronic system and home appliances.

TEXT BOOK:

REFERENCES:

<table>
<thead>
<tr>
<th>COURSE OUTCOMES</th>
<th>PROGRAMME OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>2</td>
</tr>
<tr>
<td>CO2</td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
</tr>
</tbody>
</table>

EC5072 CRYPTOGRAPHY AND NETWORK SECURITY LTPC 3003

OBJECTIVES:
- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- 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
Significance of network and data security in today's communication scenario – Overall Classification - Integer Arithmetic Modular Arithmetic – matrices – Linear congruence Substitution ciphers – Transposition ciphers – Stream cipher - Block ciphers – Algebraic structures – GF(2^n) fields.
UNIT II MODERN SYMMETRIC KEY CIPHERS
Modern block ciphers – Modern stream ciphers – DES – AES – uses of modern block ciphers and stream cipher, Application Examples

UNIT III ASYMMETRIC KEY ENCIPHERMENT

UNIT IV INTEGRITY AUTHENTICATION AND KEY MANAGEMENT

UNIT V NETWORK SECURITY

TOTAL : 45 PERIODS

COURSE OUTCOMES:
CO1: Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
CO2: The student would have gained the knowledge about the importance of security for networks, use of number theory and Galois field concepts.
CO3: The student would have ability to design new symmetric and Asymmetric key crypto system
CO4: The student would have ability to develop new authentication and key management techniques
CO5: The student would have ability to develop a new network security protocols

TEXT BOOKS:

REFERENCES:

<table>
<thead>
<tr>
<th>COURSE OUTCOMES</th>
<th>PROGRAMME OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
<td>2</td>
</tr>
<tr>
<td>CO3</td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
</tr>
<tr>
<td>CO5</td>
<td>1</td>
</tr>
</tbody>
</table>
OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- 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 7
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 9
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, Government policies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Ability to comprehend and appreciate the significance and role of this course in the present contemporary world Upon Completion of the course, the students will be able to:

CO1: To design a EMI free system.
CO2: To reduce system level crosstalk.
CO3: To design high speed Printed Circuit board with minimum interference.
CO4: To make our world free from unwanted electromagnetic environment

TEXT BOOKS:

REFERENCES:
OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- The objectives of the course is to introduce quantum mechanics concepts, approximations and statistical mechanics for understanding nano systems

UNIT I INTRODUCTION TO QUANTUM MECHANICS
Particles, waves, probability amplitudes, schrodinger equation, wave packets solutions, operators, expectation values, eigenfunctions, piecewise constant potentials.

UNIT II SIMPLE HARMONIC OSCILLATORS AND APPROXIMATIONS
SHM Operators, SHM wavepacket solutions, Quantum LC circuit, WKB approximations, variational methods.

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

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

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

TOTAL : 45 PERIODS

COURSE OUTCOMES:
CO1: Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
CO2: The student would have gained the knowledge on quantum mechanics concepts, approximations and statistical mechanics for understanding nano systems

TEXT BOOKS:

REFERENCES:
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 networking

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  

UNIT V  MULTIMEDIA NETWORKING  
Multimedia Networking- Applications-Streamed stored and audio-making – Best Effort service protocols for real time interactive Applications-distributing multimedia-beyond best effort service secluding and Policing Mechanisms-Integrated services-Differentiated Services-RSVP.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

CO1: Ability to characterize the features of multimedia components.
CO2: Ability to develop audio and video processing systems.
CO3: Ability to develop compression algorithms for processing text and images.
CO4: Ability to tackle network issues in the transmission of text, audio and video signals.

TEXT BOOKS:


REFERENCES:

2. Marcus Goncalves —Voice over IP Networks, McGraw Hill,

EC5077 REAL TIME EMBEDDED SYSTEMS L T P C
3 0 0 3

OBJECTIVES:
- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- To study the architecture and programming of ARM processors.
- To introduce the basic concepts of hard real time multiprocessing.
- To introduce the analytical concepts for effective programming.

UNIT I INTRODUCTION TO EMBEDDED COMPUTING AND ARM PROCESSORS 9
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 9
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 9
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 9

UNIT V HARDWARE ACCELERATORS & NETWORKS 9

TOTAL : 45 PERIODS
COURSE OUTCOMES:
- Ability to design and develop ARM processor based systems.
- Ability to comprehend and appreciate the significance and role of microcontrollers in embedded systems.
- Ability to analyze and demonstrate program design and optimization and proper scheduling of the process.
- Ability to apply the concept of process, multiprocesses and operating systems in embedded system design.
- Ability to implement various communication protocols in distributed embedded computing platform.

TEXT BOOKS:

REFERENCES:

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

EC5078 ROBOTICS

OBJECTIVES:
- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues.
- To introduce the electronics and software aspects in the design of 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 14

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
CO2: Ability to design and develop robotic based systems.
CO3: Ability to develop system for industrial automation and medical applications.
CO4: Ability to provide automatic solution for replacing humans in life threatening area.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientists, national/international policies with a futuristic vision along with socio-economic impact and issues
- 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  10

UNIT II  OPTIMIZATION  8

UNIT III  NEURAL NETWORKS  10

UNIT IV  NEURO FUZZY MODELING  9

UNIT V  APPLICATIONS OF COMPUTATIONAL INTELLIGENCE  8

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Ability to comprehend and appreciate the significance and role of this course in the present contemporary world.
Upon completion of the course, the student should be able to:
CO1: Apply various soft computing frameworks.
CO2: Design of various neural networks.
CO3: Use fuzzy logic.
CO4: Discuss hybrid soft computing

TEXT BOOKS:

REFERENCES:

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

EC5080 SPEECH PROCESSING L T P C 3 0 0 3

OBJECTIVES:
- To introduce speech production and related parameters of speech
- To show the computation and use of techniques such as short time Fourier transform, linear predictive coefficients and other coefficients in the analysis of speech
- To understand different speech modeling procedures such as Markov and their implementation issues
- To introduce speech recognition and synthesis techniques

UNIT I BASIC CONCEPTS 10

UNIT II SPEECH ANALYSIS 10
Features, Feature Extraction and Pattern Comparison Techniques: Speech distortion measures – mathematical and perceptual – Log–Spectral Distance, Cepstral Distances, Weighted Cepstral Distances and Filtering, Likelihood Distortions, Spectral Distortion using a Warped
Frequency Scale, LPC, PLP and MFCC Coefficients, Time Alignment and Normalization – Dynamic Time Warping, Multiple Time – Alignment Paths.

UNIT III  SPEECH MODELING  8

UNIT IV  SPEECH RECOGNITION  8
Large Vocabulary Continuous Speech Recognition: Architecture of a large vocabulary continuous speech recognition system – acoustics and language models – n-grams, context dependent subword units; Applications and present status.

UNIT V  SPEECH SYNTHESIS  9
Text-to-Speech Synthesis: Concatenative and waveform synthesis methods, sub-word units for TTS, intelligibility and naturalness – role of prosody, Applications and present status.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: Ability to use speech related parameters.
CO2: Ability to extract significant features from speech to reduce redundancy in speech by using several distortion measures.
CO3: Ability to develop models for speech signals.
CO4: Ability to develop speech recognition algorithms.
CO5: Ability to develop artificial speech generation of human speech.

TEXT BOOKS:

REFERENCES:
national/international policies with a futuristic vision along with socio-economic impact and issues
- 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 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.

UNIT III CONTROL DESIGN

Hardwired Control, Micro programmed 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

COURSE OUTCOMES:

CO1: Ability to comprehend and appreciate the significance and role of this course in the present contemporary world

CO2: Describe data representation, instruction formats and the operation of a digital computer. (Level – II (Comprehension))

CO3: Illustrate the data path unit and control unit for ALU operation. (Level – I(Comprehension))

CO4: Discuss about implementation schemes of control unit and pipeline performance. (Level – II (Comprehension))

CO5: Explain the concept of various memories, interfacing and organization of multiple processors. (Level – II (Comprehension))

CO6: Discuss about the interrupts, I/Os and other components of the system. (Level – II (Comprehension))

TEXTBOOKS:


REFERENCES:

EC5029 VLSI DESIGN L T P C
3 0 0 3

OBJECTIVES:
- To learn the fundamentals of VLSI design
- To understand the IC Manufacturing Process
- To familiarize with VLSI combinational logic circuits design
- To familiarize with VLSI sequential logic circuits design
- To learn the various arithmetic circuits and testing methodologies
- To familiarize with the different FPGA architectures.

UNIT I MOS TRANSISTOR PRINCIPLES 9
MOSFET and Current Equations, Clock Distance Modeling. Characteristics of CMOS inverter, Scaling principles and fundamental limits. Propagation Delays, CMOS inverter scaling, Stick diagram, Layout diagrams, Elmore’s constant. Case study: Study of technology development in MOS.

UNIT II COMBINATIONAL LOGIC CIRCUITS 9
Static CMOS logic Design, Design techniques to improve the speed, power dissipation of CMOS logic, low power circuit techniques, Ratioed logic, Pass transistor Logic, Transmission CPL, DCVSL, Dynamic CMOS logic, Domino logic.

UNIT III SEQUENTIAL LOGIC CIRCUITS 9
Static and Dynamic Latches and Registers, Timing Issues, Pipelines, Memory Architectures.

UNIT IV ARITHMETIC BUILDING BLOCKS 9
Data path circuits, Architectures for Adders, Accumulators, Multipliers, Barrel Shifters. Case study: Analysis of area, power and delay for 16 bit adder and 8 bit multiplier.

UNIT V IMPLEMENTATION STRATEGIES 9
Full Custom and Semicustom Design, Standard Cell design and cell libraries, FPGA building block architectures, FPGA interconnect routing procedures. Demo: Complete ASIC flow using Backend tool and fabrication flow Overall case study: Development of IC in commercial aspects (design, testing and fab cost)
COURSE OUTCOMES:
CO1: Ability to comprehend and appreciate the significance and role of this course in the present contemporary world
CO2: At the end of the course students will be in a position to apply the basics of VLSI design, testing and different FPGA architectures.

TEXT BOOK:

REFERENCES:

GE5073 FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT

OBJECTIVES:
- To understand the global trends and development methodologies of various types of products and services
- To 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
- To understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them into design specification
- To understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics
- To 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

UNIT I FUNDAMENTALS OF PRODUCT DEVELOPMENT
UNIT II REQUIREMENTS AND SYSTEM DESIGN


UNIT III DESIGN AND TESTING


UNIT IV SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT


UNIT V BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY


TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of the course, the students will be able to:
CO1: Define, formulate and analyze a problem.
CO2: Solve specific problems independently or as part of a team.
CO4: Work independently as well as in teams.
CO5: Manage a project from start to finish.

TEXTBOOKS:
1. Book specially prepared by NASSCOM as per the MoU.

REFERENCES:

<table>
<thead>
<tr>
<th>BM5022</th>
<th>VIRTUAL INSTRUMENTATION</th>
<th>L T P C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2 0 2 3</td>
</tr>
</tbody>
</table>

**OBJECTIVES**
- To introduce virtual instrumentation concepts and applications.
- To train to program virtual instrumentation software for biomedical applications

**UNIT I  INTRODUCTION**  9
History of Virtual Instrumentation(VI), advantages, block diagram and architecture of a virtual instrument, Programming paradigms – Virtual Instrumentation - LabVIEW software – LabVIEW basics – LabVIEW environment.

**UNIT II  VI USING LABVIEW**  9
Creating, Editing and debugging a VI in LabVIEW – Creating a sub VI – Loops and charts – Case and sequence structures – File I/O – VI customization.

**UNIT III  DATA ACQUISITION AND CONTROL IN VI**  9

**UNIT IV  INSTRUMENT INTERFACES**  9
Current loop, RS 232C/RS 485, GPIB, System basics, Interface basics: USB, PCMCIA, networking basics for office & industrial application VISA & VI, image acquisition & processing, Motion Control. ADC, DAC, DIO, DMM, waveform generator.

**UNIT V  APPLICATION OF VI IN BIOMEDICAL ENGINEERING**  9
Design of virtual applications for Electrocardiography (ECG), Electromyography (EMG), Air Flow and Lung Volume, Heart Rate variability analysis, Noninvasive Blood Pressure Measurement, Biofeedback, Virtual Reality & 3D graphical modeling, Virtual Prototyping.

**TOTAL : 60 PERIODS**

**COURSE OUTCOMES:**
At the end of the course, the student will be able to
- CO1: To comprehend and appreciate the significance and role of this course in the present contemporary world.
- CO2: Identify salient traits of a virtual instrument.
- CO3: Understand the use of VI for data acquisition.
- CO4: Experiment, analyze and document different types of interfaces.
- CO5: Apply the virtual instrumentation technologies for medical applications.

**TEXT BOOKS:**
BM5023  BIOSTATISTICS  L T P C  3 0 0 3

OBJECTIVES:
- To introduce the techniques used in statistical & regression analysis.
- To compare the various parameters used in statistical significance.

UNIT I  INTRODUCTION  9
Biostatistics - Statistical problems in Biomedical research – Basic concepts: Population, Samples and Variables - Basic probability, likelihood & odds, distribution variability.

UNIT II  STATISTICAL PARAMETERS  9
Statistical parameters p-values, computation and level chi square test and distribution.

UNIT III  REGRESSION ANALYSIS  9

UNIT IV  INTERPRETING DATA  9
Life table: Interpreting life tables clinical trails, epidemiical reading and interpreting of epidemical studies, application in community health.

UNIT V  META ANALYSIS  9
META analysis for research activities, purpose and reading of META analysis, Forest graph, Funnel plots, Radial plots, L’Abbe plots, Criticisms of Meta analysis.

TOTAL:45 PERIODS
COURSE OUTCOMES:
After the successful completion of this course, the student will be able to
CO1: Classify common statistical tests and tools.
CO2: Distinguish between p-values and confidence intervals as measures of statistical significance.
CO3: Interpret commonly used regression analysis.
CO4: Explain the data tables and its interpretations in community health.
CO5: Evaluate commonly used statistical and epidemiologic measures.

TEXT BOOKS:

REFERENCES:

<table>
<thead>
<tr>
<th>COURSE OUTCOMES</th>
<th>PROGRAMME OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>PO1</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
</tr>
</tbody>
</table>

BM5024 INTERNET OF THINGS IN MEDICINE L T P C 3 0 0 3

OBJECTIVES:
- To understand Smart Objects and IoT Architectures
- To learn about various IOT-related protocols
- To build simple IoT Systems using Arduino and Raspberry Pi.
- To understand data analytics and cloud in the context of IoT
- To develop IoT infrastructure for popular applications

UNIT I FUNDAMENTALS OF IoT
Evolution of Internet of Things - Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT
Functional Stack — Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects

UNIT II   IoT PROTOCOLS  9
IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT

UNIT III   DESIGN AND DEVELOPMENT  9
Design Methodology - Embedded computing logic - Microcontroller, System on Chips - IoT system building blocks - Arduino - Board details, IDE programming - Raspberry Pi - Interfaces and Raspberry Pi with Python Programming.

UNIT IV   DATA ANALYTICS AND SUPPORTING SERVICES  9

UNIT V   APPLICATIONS OF IOT IN MEDICINE  9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of the course, the student will be able to
CO1: Explain the concept of IoT.
CO2: Analyze various protocols for IoT.
CO3: Design a PoC of an IoT system using Rasperry Pi/Arduino.
CO4: Apply data analytics and use cloud offerings related to IoT.
CO5: Analyze applications of IoT in real time scenario.

TEXTBOOKS:

REFERENCES:

Attested

VY
DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

<table>
<thead>
<tr>
<th>COURSE OUTCOMES</th>
<th>PROGRAMME OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>✓</td>
</tr>
<tr>
<td>CO2</td>
<td>✓</td>
</tr>
<tr>
<td>CO3</td>
<td>✓</td>
</tr>
<tr>
<td>CO4</td>
<td>✓</td>
</tr>
<tr>
<td>CO5</td>
<td>✓</td>
</tr>
</tbody>
</table>

AD5091 CONSTITUTION OF INDIA L T P C 3 0 0 0

OBJECTIVES:
- Teach history and philosophy of Indian Constitution.
- Describe the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- Summarize powers and functions of Indian government.
- Explain emergency rule.
- Explain structure and functions of local administration.

UNIT I INTRODUCTION 9
History of Making of the Indian Constitution-Drafting Committee- (Composition & Working) - Philosophy of the Indian Constitution-Preamble-Salient Features

UNIT II CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES 9

UNIT III ORGANS OF GOVERNANCE 9
Parliament-Composition-Qualifications and Disqualifications-Powers and Functions-Executive President-Governor-Council of Ministers-Judiciary, Appointment and Transfer of Judges, Qualifications Powers and Functions

UNIT IV EMERGENCY PROVISIONS 9
UNIT V  LOCAL ADMINISTRATION

District’s Administration head- Role and Importance-Municipalities- Introduction- Mayor and role of Elected Representative-CEO of Municipal Corporation-Pachayati raj- Introduction- PRI- Zila Pachayat-Elected officials and their roles- CEO ZilaPachayat- Position and role-Block level-Organizational Hierarchy (Different departments)-Village level- Role of Elected and Appointed officials-Importance of grass root democracy

TOTAL: 45 PERIODS

TEXTBOOKS:
4. The Constitution of India (Bare Act), Government Publication,1950

OUTCOMES:
CO1: Able to understand history and philosophy of Indian Constitution.
CO2: Able to understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
CO3: Able to understand powers and functions of Indian government.
CO4: Able to understand emergency rule.
CO5: Able to understand structure and functions of local administration.

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

AD5092  VALUE EDUCATION  L T P C

3 0 0 0

OBJECTIVES:
- Develop knowledge of self-development
- Explain the importance of Human values
- Develop the overall personality through value education
- Overcome the self destructive habits with value education
- Interpret social empowerment with value education

UNIT I  INTRODUCTION TO VALUE EDUCATION
Values and self-development –Social values and individual attitudes, Work ethics, Indian vision of humanism, Moral and non-moral valuation, Standards and principles, Value judgements

UNIT II  IMPORTANCE OF VALUES
Importance of cultivation of values, Sense of duty, Devotion, Self-reliance, Confidence, Concentration, Truthfulness, Cleanliness. Honesty, Humanity, Power of faith, National Unity, Patriotism, Love for nature, Discipline
UNIT III  INFLUENCE OF VALUE EDUCATION  9
Personality and Behaviour development - Soul and Scientific attitude. Positive Thinking, Integrity and discipline, Punctuality, Love and Kindness, Avoid fault Thinking, Free from anger, Dignity of labour, Universal brotherhood and religious tolerance, True friendship Happiness Vs suffering, love for truth.

UNIT IV  REINCARNATION THROUGH VALUE EDUCATION  9

UNIT V  VALUE EDUCATION IN SOCIAL EMPOWERMENT  9
Equality, Non violence, Humility, Role of Women, All religions and same message, Mind your Mind, Self-control, Honesty, Studying effectively

OUTCOMES:
CO1 – Gain knowledge of self-development
CO2 – Learn the importance of Human values
CO3 – Develop the overall personality through value education
CO4 – Overcome the self destructive habits with value education
CO5 – Interpret social empowerment with value education

TOTAL: 45 PERIODS

REFERENCES:

AD5093 PEDAGOGY STUDIES L T P C 3 0 0 0

OBJECTIVES:
- Understand the methodology of pedagogy.
- Compare pedagogical practices used by teachers in formal and informal classrooms in developing countries.
- Infer how can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy.
- Illustrate the factors necessary for professional development.
• Identify the Research gaps in pedagogy.

UNIT I  INTRODUCTION AND METHODOLOGY  
Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions - Overview of methodology and Searching.

UNIT II  THEMATIC OVERVIEW  
Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education.

UNIT III  EVIDENCE ON THE EFFECTIVENESS OF PEDAGOGICAL PRACTICES  
Methodology for the in depth stage: quality assessment of included studies - How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches - Teachers’ attitudes and beliefs and Pedagogic strategies.

UNIT IV  PROFESSIONAL DEVELOPMENT  
Professional development: alignment with classroom practices and follow up support - Peer support - Support from the head teacher and the community - Curriculum and assessment - Barriers to learning: limited resources and large class sizes.

UNIT V  RESEARCH GAPS AND FUTURE DIRECTIONS  
Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment - Dissemination and research impact.

TOTAL: 45 PERIODS

OUTCOMES:
• Understand the methodology of pedagogy.
• Understand Pedagogical practices used by teachers in formal and informal classrooms in developing countries.
• Find how can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy.
• Know the factors necessary for professional development.
• Identify the Research gaps in pedagogy.

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

AD5094 STRESS MANAGEMENT BY YOGA

OBJECTIVES:
- Develop healthy mind in a healthy body thus improving social health also improve efficiency
- Invent Do’s and Don’t’s in life through Yam
- Categorize Do’s and Don’t’s in life through Niyam
- Develop a healthy mind and body through Yog Asans
- Invent breathing techniques through Pranayam

UNIT I INTRODUCTION TO YOGA
Definitions of Eight parts of yog. (Ashtanga)

UNIT II YAM
Do’s and Don’t’s in life.
Shaucha, santosh, tapa, swadhyay, ishwarpriyanidhan

UNIT III Niyam
Do’s and Don’t’s in life.
Ahinsa, satya, astheya, bramhacharya and aparigraha

UNIT IV ASAN
Various yog poses and their benefits for mind & body

UNIT V PRANAYAM
Regularization of breathing techniques and its effects - Types of pranayam

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1 – Develop healthy mind in a healthy body thus improving social health also improve efficiency
CO2 – Learn Do’s and Don’t’s in life through Yam
CO3 – Learn Do’s and Don’t’s in life through Niyam
CO4 – Develop a healthy mind and body through Yog Asans
CO5 – Learn breathing techniques through Pranayam
AD5095 PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT L T P C
SKILLS 3 0 0 0

OBJECTIVES:
- Develop basic personality skills holistically
- Develop deep personality skills holistically to achieve happy goals
- Rewrite the responsibilities
- Reframe a person with stable mind, pleasing personality and determination
- Discover wisdom in students

UNIT I NEETISATAKAM-HOLISTIC DEVELOPMENT OF PERSONALITY - I 9
Verses- 19,20,21,22 (wisdom) - Verses- 29,31,32 (pride & heroism) – Verses- 26,28,63,65 (virtue)

UNIT II NEETISATAKAM-HOLISTIC DEVELOPMENT OF PERSONALITY - II 9
Verses- 52,53,59 (don'ts) - Verses- 71,73,75,78 (do's)

UNIT III APPROACH TO DAY TO DAY WORK AND DUTIES 9
Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48 - Chapter 3-Verses 13, 21, 27, 35
Chapter 6-Verses 5,13,17,23, 35 - Chapter 18-Verses 45, 46, 48

UNIT IV STATEMENTS OF BASIC KNOWLEDGE – I 9
Statements of basic knowledge - Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68
Chapter 12 -Verses 13, 14, 15, 16,17, 18

UNIT V PERSONALITY OF ROLE MODEL - SHRIMAD BHAGWADGETA 9
Chapter2-Verses 17, Chapter 3-Verses 36,37,42 - Chapter 4-Verses 18, 38,39 Chapter18 –
Verses 37,38,63

TOTAL: 45PERIODS
COURSE OUTCOMES:
CO1: To develop basic personality skills holistically
CO2: To develop deep personality skills holistically to achieve happy goals
CO3: To rewrite the responsibilities
CO4: To reframe a person with stable mind, pleasing personality and determination
CO5: To awaken wisdom in students

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

REFERENCES:

AD5097 ESSENCE OF INDIAN KNOWLEDGE TRADITION  L T P C
0 3 0 0

COURSE OBJECTIVES
The course will introduce the students to
- get a knowledge about Indian Culture
- Know Indian Languages and Literature religion and philosophy and the fine arts in India
- Explore the Science and Scientists of Ancient, Medieval and Modern India
- Understand education systems in India

UNIT I INTRODUCTION TO CULTURE 9
Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India.

UNIT II INDIAN LANGUAGES AND LITERATURE 9
Indian Languages and Literature – I: Languages and Literature of South India, – Indian Languages and Literature – II: Northern Indian Languages & Literature

UNIT III RELIGION AND PHILOSOPHY 9
Major religions practiced in India and Understanding their Philosophy – religious movements in Modern India (Selected movements only)

UNIT IV  FINE ARTS IN INDIA (ART, TECHNOLOGY & ENGINEERING)  9
Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India

UNIT V  EDUCATION SYSTEM IN INDIA  9
Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India

TOTAL: 45 PERIODS

COURSE OUTCOMES
After successful completion of the course the students will be able to
- Understand philosophy of Indian culture.
- Distinguish the Indian languages and literature.
- Learn the philosophy of ancient, medieval and modern India.
- Acquire the information about the fine arts in India.
- Know the contribution of scientists of different eras.
- Understand education systems in India

REFERENCES:
5. Satya Prakash, “Founders of Sciences in Ancient India”, Vijay Kumar Publisher, 1989

AD5098  SANGA TAMIL LITERATURE APPRECIATION  L T P C
3 0 0 0

Course Objectives: The main learning objective of this course is to make the students an appreciation for:
1. Introduction to Sanga Tamil Literature.
2. ‘Agathinai’ and ‘Purathinai’ in Sanga Tamil Literature.
3. ‘Attruppadai’ in Sanga Tamil Literature.
4. ‘Puranaanuru’ in Sanga Tamil Literature.
5. ‘Pathithru paththu’ in Sanga Tamil Literature.
UNIT I  SANGA TAMIL LITERATURE AN INTRODUCTION  9

UNIT II  ‘AGATHINAI’ AND ‘PURATHINAI’  9

UNITIII  ‘ATTRUPPADAII’.  9

UNITIV  ‘PURANAANURU’  9
Puranaanuru on Good Administration, Ruler and Subjects–Emotion & its Effect in Puranaanuru.

UNITV  ‘PATHITRU PATHTHU’  9
Pathitrupaththu in‘Etthogai’–Pathitru paththu’s Parables–Tamil dynasty:Valor, Administration, Charity in Pathitru paththu- Message to Society from Pathitru paththu.

TOTAL (L:45) = 45 PERIODS

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

1. Appreciate and apply the messages in Sanga Tamil Literature in their life.
2. Differentiate ‘Agathinai’ and ‘Purathinai’ in their personal and societal life.
3. Appreciate and apply the messages in ‘Attruppadai’ in their personal and societal life.
4. Appreciate and apply the messages in ‘Puranaanuru’ in their personal and societal life.
5. Appreciate and apply the messages in ‘Pathitru paththu’ in their personal and societal life.

REFERENCES:

HSMC– ELECTIVES – HUMANITIES I (ODD SEMESTER)

HU5171 LANGUAGE AND COMMUNICATION LT P C 3 0 0 3

COURSE DESCRIPTION
This course offers an introduction to language and communication. The primary goal of this course is to familiarize students with key ideas related to communication using language as well as non-verbal means. Ideas related to the use of language and the underlying power structures are also examined. The course also examines the role of media in communication and in the dissemination of ideas as well as opinions.

Objectives
✓ To familiarize students with the concept of communication using linguistic and non-linguistic resources.
✓ To help students ask critical questions regarding facts and opinions.
✓ To provide students with the material to discuss issues such as language and power structures.
✓ To help students think critically about false propaganda and fake news.

Learning Outcomes
➢ Students will be able to use linguistic and non-linguistic resources of language in an integrated manner for communication.
➢ Students will be able to analyse communication in terms of facts and opinions.
➢ Students will be able to discuss, analyse and argue about issues related to language and power.

UNIT I LINGUISTIC AND NON-LINGUISTIC RESOURCE OF COMMUNICATION: 9
a) Writing and Speech
b) Distinction between language structure and language use, form and function, acceptability and grammaticality
c) Gestures and Body language, pictures and symbols, cultural appropriacy
d) Communicative Competency, context and situation, combination of linguistic and non-linguistic elements of communication

UNIT II  STRUCTURE OF WRITING/CONVERSATION:  9
a) Language skills and the communication cycle; speaking and listening, writing and reading
b) Initiating and closing conversations, intervention, turn taking
c) Writing for target reader, rhetorical devices and strategies
d) Coherence and Cohesion in speech and writing

UNIT III  POWER STRUCTURE AND LANGUAGE USE:  9
a) Gender and language use
b) Politeness expressions and their use
c) Ethical dimensions of language use
d) Language rights as part of human rights

UNIT IV  MEDIA COMMUNICATION:  9
a) Print media, electronic media, social media
b) Power of media
c) Manufacturing of opinion, fake news and hidden agendas

UNIT V  PERSUASIVE COMMUNICATION AND MISCOMMUNICATION:  9
a) Fundamentals of persuasive communication
b) Persuasive strategies
c) Communication barriers

TOTAL : 45 PERIODS

TEXT BOOKS:

HU5172  VALUES AND ETHICS  L T P C
3 0 0 3

OBJECTIVES:
- Teach definition and classification of values.
- Explain Purusartha.
- Describe Sarvodaya idea.
- Summarize sustenance of life.
- Conclude views of hierarchy of values.
UNIT I  DEFINITION AND CLASSIFICATION OF VALUES  
Extrinsic values- Universal and Situational values- Physical- Environmental-Sensuous- Economic-Social-Aesthetic-Moral and Religious values

UNIT II  CONCEPTS RELATED TO VALUES  
Purusartha-Virtue- Right- duty- justice- Equality- Love and Good

UNIT III  IDEOLOGY OF SARVODAYA  
Egoism- Altruism and universalism- The Ideal of Sarvodaya and Vasudhaiva Kutumbakam

UNIT IV  SUSTENANCE OF LIFE  
The Problem of Sustenance of value in the process of Social, Political and Technological Changes

UNIT V  VIEWS ON HIERARCHY OF VALUES  
The Problem of hierarchy of values and their choice, The views of Pt. Madan Mohan Malviya and Mahatma Gandhi

OUTCOMES:

CO1: Able to understand definition and classification of values.
CO2: Able to understand purusartha.
CO3: Able to understand sarvodaya idea.
CO4: Able to understand sustenance of life.
CO5: Able to understand views of hierarchy of values.

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

TEXTBOOKS:
2. Little, William : An Introduction of Ethics (Allied Publisher, Indian Reprint 1955)

HU5173  HUMAN RELATIONS AT WORK  
L T P C 3 0 0 3

OBJECTIVES:
- Illustrate human relations at work its relationship with self.
- Explain the importance of interacting with people at work to develop teamwork.
- Infer the importance of physical health in maintaining human relations at work.
- Describe the importance of staying psychologically healthy.
• Identify the essential qualities for progressing in career.

UNIT I  UNDERSTANDING AND MANAGING YOURSELF  9
Human Relations and You: Self-Esteem and Self-Confidence: Self-Motivation and Goal Setting; Emotional Intelligence, Attitudes, and Happiness; Values and Ethics and Problem Solving and Creativity.

UNIT II  DEALING EFFECTIVELY WITH PEOPLE  9
Communication in the Workplace; Specialized Tactics for Getting Along with Others in the Workplace; Managing Conflict; Becoming an Effective Leader; Motivating Others and Developing Teamwork; Diversity and Cross-Cultural Competence.

UNIT III  STAYING PHYSICALLY HEALTHY  9
Yoga, Pranayam and Exercise: Aerobic and anaerobic.

UNIT IV  STAYING PSYCHOLOGICALLY HEALTHY  9
Managing Stress and Personal Problems, Meditation.

UNIT V  DEVELOPING CAREER THRUST  9

TOTAL: 45 PERIODS

OUTCOMES:
Students will be able to
CO1: Understand the importance of self-management.
CO2: Know how to deal with people to develop teamwork.
CO3: Know the importance of staying healthy.
CO4: Know how to manage stress and personal problems.
CO5: Develop the personal qualities essential for career growth.

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

TEXT BOOK:

REFERENCES:
COURSE DESCRIPTION
Psychological Processes course is designed for students to be aware of the basic principles of psychology for the better understanding of people’s psyche and behaviour around them. This course enables learners to use the optimal use of different forms of thinking skills and thereby results in effective communication in diverse situations. Every unit of the syllabus highlights the psychological process of people, the most powerful and constructive use of perceptions.

OBJECTIVES
The major objectives of this course is
- To develop students’ awareness on psychology, learning behavior and usage of perception effectively.
- To learn to use the various kinds of thinking in a formal context.
- To critically evaluate content and comprehend the message on the bases of perception, personality and intelligence.

UNIT 1: INTRODUCTION

UNIT 2: SENSORY & PERCEPTUAL PROCESSES
Some general properties of Senses: Visual system – the eye, colour vision – Auditory system – Hearing, listening, Sounds - Other senses - Selective attention; physiological correlates of attention; Internal influences on perception learning – set - motivation & emotion - cognitive styles; External influences on perception figure and ground separation – movement – organization – illusion; Internal-external interactions: Constancy - Depth Perception- Binocular & Monocular Perception; Perceptual defense & Perceptual vigilance; Sensory deprivation - Sensory bombardment; ESP - Social Perception.

UNIT 3: COGNITION & AFFECT

UNIT 4: THINKING, PROBLEM-SOLVING & DECISION MAKING

UNIT 5: PERSONALITY & INTELLIGENCE
Psychological phenomena & Attributes of humans - cognition, motivation, and behavior - thoughts, feelings, perceptions, and actions – personality dimensions, traits, patterns - Specialized knowledge, performance accomplishments, automaticity or ease of functioning, skilled performance under challenge - generative flexibility, and speed of learning or behavior change.
References

HU5175 EDUCATION, TECHNOLOGY AND SOCIETY

COURSE DESCRIPTION
This course introduces students to multidisciplinary studies in Education, Technology and Society. Students will get an understanding of the relationship between education, technology and society. They will also learn about the long lasting impact of good education in a technologically advanced society.

COURSE OBJECTIVES:
The course aims
- To help learners understand the basics of different types of technology utilised in the field of education
- To make them realize the impact of education in society
- To make them evolve as responsible citizen in a technologically advanced society

LEARNING OUTCOMES
By the end of the course, learners will be able to
- Understand the various apps of technology apps and use them to access, generate and present information effectively.
- Apply technology based resources and other media formats equitably, ethically and legally.
- Integrate their technical education for betterment of society as well as their personal life.

UNIT I INDIAN EDUCATION SYSTEM
Gurukul to ICT education – Teacher as facilitator – Macaulay’s Minutes – English medium vs Regional medium – Importance of Education in Modern India - Challenges in Education

UNIT II LEARNING THEORIES
UNIT III TECHNOLOGICAL ADVANCEMENTS
Web tools – Social media in education – elearning – MOOCs – Mobile assisted learning – Learning Apps – Blended learning - Self-directed learning

UNIT IV EDUCATIONAL TECHNOLOGY
Technological implications on Education – Teaching, Learning & Testing with Technology - Advantages and drawbacks – Critical analysis on the use of technology

UNIT V ETHICAL IMPLICATIONS
Plagiarism – Online Copyright issues – Ethical and value implications of education and technology on individual and society.

TOTAL: 45 PERIODS

TEACHING METHODS
Teaching modes include guest lectures, discussion groups, presentations, visual media, and a practicum style of learning.

EVALUATION
As this is course is not a content based course, it focuses more on the ethical use of technology in education and society, and so, evaluation can be based on assignments and discussions. So there is no need for an end semester examination. Internals marks can be taken for the total marks.

INTERNAL (100 % WEIGHTAGE)
(a) Written Test (40 marks)
(b) Assignment: Write a real time report of the technology use in any school / college (15 marks)
(c) Presentation: Students choose any one of the technological tools and present its relevance to education and society (15 marks)
(d) Group discussion: Students discuss in groups on case studies relating to various challenges in education and technology use in society (20 marks)
(e) Blog entry: Making weekly blog posts in Class Blog on the topics related to the course posted by the instructor and commenting on others’ posts. (10 marks)

REFERENCES
1) Education and Social order by Bertrand Russel
2) Theories of learning by Bower and Hilgard
3) Technology and Society by Jan L Harrington

HU5176 PHILOSOPHY

OBJECTIVES
- To create a new understanding by teaching philosophy through a comparison of Indian and Western traditions.
- To Fosters critical thinking and imagination by dealing with inter-related concepts in literature and science.
- To bridge the gap between the sciences and humanities through introspective analyses.
- To nurture an understanding of the self and elucidates ways to progress towards a higher understanding of one’s self and others.
UNIT I KNOWLEDGE

UNIT II ORIGIN

UNIT III WORD

UNIT IV KNOWLEDGE AS POWER/OPPRESSION

UNIT V SELF KNOWLEDGE/BRAHMAN

TOTAL : 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Think sceptically, ask questions and to arrive at deductions.
2. Connect and relate different branches of thought.
3. Comprehends the relation between language, thought and action.
4. Arrive at a better understanding of self and others and forms a new outlook.

REFERENCES:
7. Bacon, Francis: Power as Knowledge
COURSE DESCRIPTION
This course offers an introduction to Gender Studies that asks critical questions about the meanings of sex and gender in Indian society. The primary goal of this course is to familiarize students with key issues, questions and debates in Gender Studies, both historical and contemporary drawing from Indian literature and media studies, to examine cultural assumptions about sex, gender, and sexuality. This course integrates analysis of current events through student presentations, aiming to increase awareness of contemporary and historical experiences of women, and of the multiple ways that sex and gender interact with class, caste and other social identities. This course also seeks to build an understanding of the concepts of gender, gender-based violence, sexuality, and rights and their impact on development through a number of discussions, exercises and reflective activities.
Objectives
- To familiarize students with the concepts of sex and gender through literary and media texts.
- To help students ask critical questions regarding gender roles in society.
- To provide students with the material to discuss gender issues such as gender based discrimination, violence and development.
- To help students think critically about gender based problems and solutions.

Learning Outcomes
- Students will be able to critically read literary and media texts and understand the underlying gender perspectives in them.
- Students will be able to analyse current social events in the light of gender perspectives.
- Students will be able to discuss, analyse and argue about issues related to gender and their impact on society, culture and development.

UNIT I: Introduction to Gender
- Definition of Gender
- Basic Gender Concepts and Terminology
- Exploring Attitudes towards Gender
- Social Construction of Gender

Texts:
1. Sukhu and Dukhu (Amar Chitra Katha)
2. The Cat who Became a Queen (Folk tale, J. Hinton Knowles, Folk-Tales of Kashmir. London: Kegan Paul, Trench, Trübner, and Company, 1893, pp. 8-10.)

UNIT II: Gender Roles and Relations
- Types of Gender Roles
- Gender Roles and Relationships Matrix
- Gender-based Division and Valuation of Labour

Texts:
1. Muniyakka (Short Story, Lakshmi Kannan, Nandanvan and Other Stories, Hyderabad: Orient Blackswan, 2011)

UNIT III: Gender Development Issues
- Identifying Gender Issues
- Gender Sensitive Language
- Gender, Governance and Sustainable Development
- Gender and Human Rights
- Gender and Mainstreaming

Texts:
2. Tell Us Marx (Poem, Mallika Sengupta, Translated by Sanjukta Dasgupta)
UNIT IV: Gender-based Violence
- The concept of violence
- Types of Gender-based violence
- The relationship between gender, development and violence
- Gender-based violence from a human rights perspective

Texts:
1. Lights Out (Play, Manjula Padmanabhan)
2. Lights Out (Video of play enacted)

UNIT V: Gender and Culture
- Gender and Film
- Gender, Media and Advertisement

Texts:
1. Mahanagar (Movie: Satyajit Ray)
2. Beti Bachao Beti Padhao Advertisements

READINGS: Relevant additional texts for readings will be announced in the class. Classes will consist of a combination of activities: dialogue-based lectures, discussions, collaborative learning activities, group work and in-class assignments.

ASSESSMENT AND GRADING:
Discussion & Classroom Participation: 20%
Project/Assignment: 30%
End Term Exam: 50%

HU5272 ETHICS AND HOLISTIC LIFE

OBJECTIVES:
- To emphasize the meaning and nature of ethics, human values and holistic life for leading a good, successful and happy life through continuous examination of thoughts and conduct in day to day life.
- To understand the status and responsible role of individual in abatement of value crisis in contemporary world in order to develop a civilized and human society. Understanding the process of ethical decision making through critical assessment of incidents/cases of ethical dilemmas in personal, professional and social life.
- To view the place of Ethics and Human Values in the development of individual and society through identification and cross examination of life values and world view of his/her role models in society.

UNIT I HUMAN LIFE, ITS AIM AND SIGNIFICANCE
The concept of a successful life, happy life and a meaningful life, Ethical and decision making capability and its development: Meaning of Ethical dilemma, sharing real life experiences.

UNIT II CREATIVE AND LEADERSHIP ABILITY AND THEIR DEVELOPMENT
Intellectual, Emotional, Creative, Ethico - spiritual development, Aesthetic sense, Self-dependency, Activeness, Development of positive attitude.

UNIT III HARMONY IN PERSONAL AND SOCIAL LIFE:
Concept of personal and group Ethics; Balance between - rights and duties-welfare of self and
welfare of all, Creating a value based work culture in hostel, classroom and other places in the campus and society.

UNIT IV CHARACTER, RIGHTEOUSNESS AND VIRTUES FOR A MEANINGFUL LIFE
Egolessness, Humility, Righteousness, Purity, Truthfulness, Integrity, Self-restraint, Self-control, Sense of responsibility, Empathy, Love, Compassion, Maitri / Comradeship, Cooperation, Tolerance.

UNIT V DILEMMA BETWEEN MATERIALISTIC DEVELOPMENT AND HUMAN WELFARE

TOTAL:45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Enable students to understand the concept of contemporary ethics at different levels: Individual, local and Global and enable them to cross examine the ethical and social consequences of the decisions of their life-view and world view.
2. Develop the ability of students to create a balance between their individual freedom and social responsibilities and enable them to identify the personal, professional and social values and integrate them in their personality after cross examination.
3. Enable students to cross examine their earlier decisions taken in life and understand the meaning of ethical dilemma to overcome the ethical dilemmas and engage in critical reflection.
4. Develop positive habits of thought and conduct and work cohesively with fellow beings who have variety of strengths, experiences, shortcomings and challenges, hence to enable them to handle diverse type of personalities.
5. Enable students to develop a method for making ethically sound decisions for themselves, within hostels, classrooms, university campus and society.

HU5273 LAW AND ENGINEERING

UNIT I THE LEGAL SYSTEM: SOURCES OF LAW AND THE COURT STRUCTURE 9
Enacted law -Acts of Parliament are of primary legislation, Common Law or Case law- Principles taken from decisions of judges constitute binding legal rules. The Court System in India and Foreign Courtiers. (District Court, District Consumer Forum, Tribunals, High Courts, Supreme Court) Arbitration: As an alternative to resolving disputes in the normal courts, parties who are in dispute can agree that this will instead be referred to arbitration.

UNIT II LAWS 9
Basic principles of contract law, sale of goods law, laws relating to industrial pollution, accident, environmental protection, health and safety at work, patent law, constitutional law: the supreme law of the land, Information technology law and cyber crimes.

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025
UNIT III    BUSINESS ORGANISATIONS
Sole traders (Business has no separate identity from you, all business property belongs to you). Partnerships: Types of Partnerships - Limited Liability Partnership, General Partnership, Limited Partnerships. Companies: The nature of companies, Classification of companies, Formation of companies, Features of a public company, Carrying on business, Directors—Their Powers and Responsibilities/Liabilities.

UNIT IV    LAW AND SOCIETY
Interdisciplinary nature of law, legal ideologies/philosophy/ schools of jurisprudence.

UNIT V    CASE STUDIES
Important legal disputes and judicial litigations

TOTAL: 45 PERIODS

HU5274    FILM APPRECIATION
L T P C
3 0 0 3

COURSE DESCRIPTION
This is an intensive course designed to promote comprehensive understanding and insights into the nature of cinema and other related forms and practices. Movies, though at times are used more as escapism, they are also a true art form and expressive tool used by writers, directors and actors. This course will explore the aesthetics of cinema, the concepts behind storytelling and various other elements of a film. It will also explore the impact of movies in our society and in our lives. It also encourages students to use films as a medium to analyse visual texts and read underlying messages.

OBJECTIVES:
- To help learners understand the various movie genres and its types.
- To understand various elements that contributes to film making.
- To make them realize the impact of film in society.
- To analyse the visual media and interpret the underlying messages.

UNIT I    THE COMPONENTS OF FILMS
Story, Screenplay & Script – Actors – Director – Crew Members – Mis En Scene – Structure of A Film – Narrative Elements – Linear & Non-Linear – Types of Movie Genres: Mysteries, Romantic Comedies, Horror Etc.

UNIT II    EVOLUTION OF FILM

UNIT III    FILMS ACROSS THE WORLD

UNIT IV    INDIAN FILMS
UNIT V  INTERPRETING FILMS

Film Criticism & Appreciation – Censorship in Movies – Cultural Representation in Movies – Television – New Media & Online Media – Films Beyond Entertainment.

TOTAL: 45 PERIODS

OUTCOMES
On completion of the course, the students will be able to:
- Recognize types of films, their impact on society and their roles in our lives.
- Have an understanding of the concepts of storytelling, Mise en Scene, and other elements of film making.
- Interpret the underlying messages in the movies.

Teaching Methods
- Each unit consists of reading materials, learning activities videos, websites. Students are expected to watch movies sometimes in class and at times at home and discuss in class.

Evaluation
- As this is course is critical appreciation course on films, there is no written end semester examination. The course is more on learning how to critically analyse a movie and appreciate its finer elements. Therefore evaluation can be based on assignments and discussions. Internals marks can be taken for the total marks.

Internal (100 % weightage)
- Assignment 1: Write a movie review with critical analysis (20 marks).
- Assignment 2: Write a script for a scene taken from a short story / novella (20 marks).
- Presentation: Students choose any one topic related to films and present it to the audience. (25 marks)
- Group discussion: Students discuss in groups on the various aspects of movies and its impact on society. (25 marks)
- Blog entry: Making weekly blog posts in Class Blog on the topics related to the course posted by the instructor and commenting on others’ posts. (10 marks)

REFERENCES
1. A Biographical Dictionary of Film by David Thomson, Secker & Warburg, 1975
2. Signs and Meaning in the Cinema by Peter Wollen, Secker & Warburg, 1969
3. The World Viewed by Stanley Cavell 1971
4. Film Style and Technology: History and Analysis by Barry Salt, Starword, 1983

HU5275  FUNDAMENTALS OF LANGUAGE AND LINGUISTICS  L T P C
3 0 0 3

OBJECTIVES
- To broadly introduce students to the formal and theoretical aspects of linguistics.
- To enable learners to understand the various practical applications of language and recent findings in the field of applied linguistics.
CONTENTS :

UNIT I LANGUAGE AND LINGUISTICS: AN OVERVIEW 9

UNIT II MORPHOLOGY - WORDS OF LANGUAGE 9

UNIT III SYNTAX- THE SENTENCE PATTERNS OF LANGUAGE AND SEMANTICS-THE MEANING OF LANGUAGE 9

UNIT IV PHONETICS – THE SOUNDS OF LANGUAGE 9

UNIT V APPLIED LINGUISTICS - THE PRACTICAL APPLICATIONS OF LANGUAGE 9
Language learning and teaching (ELT)- lexicography-translation studies-computational linguistics-neurolinguistics (speech pathology and language disorders)- forensic linguistics – sociolinguistics.

TOTAL : 45 PERIODS

Teaching Methods :
Lectures, discussion.

Evaluation Internal and External :
Internal: 2 written tests + assignments, seminars, project (50+15+15+20).
External: A 3 hour written exam (50 marks)

REFERENCES :

HU5276 UNDERSTANDING SOCIETY AND CULTURE THROUGH LITERATURE L T P C 3 0 0 3

OBJECTIVES
- To internalize the importance of language by understanding its role in the transformation of man.
- To look at language, literature and culture as locus of identity and change.
- To extract meaning from existing literatures and cultures.
- To identify meanings in modern life by reconnecting with lost cultures.
UNIT I  INTRODUCTION
Why study literature? Tracing the origin – pictures. Tokens as precursors of writing. Movement from three dimensions to two dimensions- Pictography. From visual to oral - Logography. Reading out literature to young children- Edmund J Farrell.

UNIT II  READING CULTURE
Reading culture through language, signs and consumables- Roland Barthes. Culture through poems- Nissim Ezekiel’s ‘The night of the Scorpion’. ‘Nothing’s Changed’- Tatamkhulu Afrika- Apartheid. Ruskin Bond- ‘Night train at Deoli’- How real life is different from movies.

UNIT III  IDENTIFYING MEANING
Searching and locating meaning through literature. Looking for order in a chaotic world. The Myth of Sisyphus (Albert Camus) and Adi Shankar’s ‘Jagat Mithya’- the world as an illusion. The Indian version as ‘meaningless meaning’.

UNIT IV  POST MODERNISM
‘If on a winter’s night a traveler’- Italo Calvino. The book about the reader- the experience of reading as reading. Metafiction. Selfie Culture. Visual Culture as purpose of modern life.

UNIT V  RETURNING TO PICTURES

Reading list
1. Bond, Ruskin: ‘Night train at Deoli’
2. Ezekiel, Nissim: ‘The Night of the Scorpion’
3. Afrika, Tatamkhulu: ‘Nothing’s Changed’
4. Barthes, Roland: Mythologies
5. Shankaracharya: Viveka Chudamani
6. Camus, Albert- The Myth of Sisyphus
7. Calvino, Italo: If on a winter’s night a traveler

OUTCOME
- Can identify the connections among language, literature and culture.
- Is able to relate between seemingly different aspects of life.
- Understands the fractions in modern life and can assimilate meanings.