ANNA UNIVERSITY, CHENNAI
NON-AUTONOMOUS COLLEGES AFFILIATED ANNA UNIVERSITY
REGULATIONS – 2021
CHOICE BASED CREDIT SYSTEM
M.E. POWER ELECTRONICS AND DRIVES (FULL TIME)
I TO IV SEMESTERS CURRICULA AND I SEMESTER SYLLABUS

**SEMESTER I**

<table>
<thead>
<tr>
<th>S.NO</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>PERIODS PER WEEK</th>
<th>TOTAL CONTACT PERIODS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L    T    P</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>THEORY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>MA4106</td>
<td>Applied Mathematics for Power Electronics Engineers</td>
<td>FC</td>
<td>3    1    0</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>PX4101</td>
<td>Analysis of Electrical Machines</td>
<td>PCC</td>
<td>3    1    0</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>3.</td>
<td>PX4151</td>
<td>Analysis of Power Converters</td>
<td>PCC</td>
<td>3    1    0</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>4.</td>
<td>PX4102</td>
<td>Modeling and Design of SMPS</td>
<td>PCC</td>
<td>3    0    0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>RM4151</td>
<td>Research Methodology and IPR</td>
<td>RMC</td>
<td>2    0    0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>6.</td>
<td></td>
<td>Professional Elective I</td>
<td>PEC</td>
<td>3    0    0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>7.</td>
<td></td>
<td>Audit Course I*</td>
<td>AC</td>
<td>2    0    0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td><strong>PRACTICALS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>PX4161</td>
<td>Power Converters Laboratory</td>
<td>PCC</td>
<td>0    0    3</td>
<td>3</td>
<td>1.5</td>
</tr>
<tr>
<td>9.</td>
<td>PX4111</td>
<td>Analog and Digital Controllers for PE Converters Laboratory</td>
<td>PCC</td>
<td>0    0    3</td>
<td>4</td>
<td>2.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td></td>
<td>20   3    6</td>
<td>29</td>
<td>24</td>
</tr>
</tbody>
</table>

* Audit Course is optional

**SEMESTER II**

<table>
<thead>
<tr>
<th>S.NO</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>PERIODS PER WEEK</th>
<th>TOTAL CONTACT PERIODS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L    T    P</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>THEORY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>PX4201</td>
<td>Analysis of Electrical Drives</td>
<td>PCC</td>
<td>3    1    0</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>PX4202</td>
<td>Special Electrical Machines</td>
<td>PCC</td>
<td>3    0    0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>PX4251</td>
<td>Electric Vehicles and Power Management</td>
<td>PCC</td>
<td>3    1    0</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td>Professional Elective II</td>
<td>PEC</td>
<td>3    0    0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td></td>
<td>Professional Elective III</td>
<td>PEC</td>
<td>3    0    0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td></td>
<td>Audit course II*</td>
<td>AC</td>
<td>2    0    0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td><strong>PRACTICALS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>PX4211</td>
<td>Power Electronics and Drives Laboratory</td>
<td>PCC</td>
<td>0    0    3</td>
<td>3</td>
<td>1.5</td>
</tr>
<tr>
<td>8.</td>
<td>PX4212</td>
<td>Design Laboratory for Power Electronics Systems</td>
<td>PCC</td>
<td>0    0    3</td>
<td>3</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td></td>
<td>17   2    6</td>
<td>25</td>
<td>20</td>
</tr>
</tbody>
</table>

* Audit Course is optional
### SEMESTER III

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>PERIODS PER WEEK</th>
<th>TOTAL CONTACT PERIODS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L    T  P</td>
<td></td>
<td></td>
</tr>
<tr>
<td>THEORY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td></td>
<td>Professional Elective IV</td>
<td>PEC</td>
<td>3    0  0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td>Professional Elective V</td>
<td>PEC</td>
<td>3    0  0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td>Open Elective</td>
<td>OEC</td>
<td>3    0  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>
</tr>
<tr>
<td>4.</td>
<td>PX4311</td>
<td>Project Work I</td>
<td>EEC</td>
<td>0    0  12</td>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TOTAL</td>
<td></td>
<td>9    0  12</td>
<td>21</td>
<td>15</td>
</tr>
</tbody>
</table>

### SEMESTER IV

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>PERIODS PER WEEK</th>
<th>TOTAL CONTACT PERIODS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L    T  P</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PRACTICALS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>PX4411</td>
<td>Project Work II</td>
<td>EEC</td>
<td>0    0  24</td>
<td>24</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TOTAL</td>
<td></td>
<td>0    0  24</td>
<td>24</td>
<td>12</td>
</tr>
</tbody>
</table>

**TOTAL NO. OF CREDITS: 71**

### FOUNDATION COURSES (FC)

<table>
<thead>
<tr>
<th>S. NO</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>PERIODS PER WEEK</th>
<th>CREDITS</th>
<th>SEMESTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MA4106</td>
<td>Applied Mathematics for Power Electronics Engineers</td>
<td>3    1  0</td>
<td>4</td>
<td>I</td>
</tr>
</tbody>
</table>

### PROFESSIONAL CORE COURSES (PCC)

<table>
<thead>
<tr>
<th>S. NO</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>PERIODS PER WEEK</th>
<th>CREDITS</th>
<th>SEMESTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PX4101</td>
<td>Analysis of Electrical Machines</td>
<td>3    1  0</td>
<td>4</td>
<td>I</td>
</tr>
<tr>
<td>2</td>
<td>PX4151</td>
<td>Analysis of Power Converters</td>
<td>3    1  0</td>
<td>4</td>
<td>I</td>
</tr>
<tr>
<td>3</td>
<td>PX4102</td>
<td>Modeling and Design of SMPS</td>
<td>3    0  0</td>
<td>3</td>
<td>I</td>
</tr>
<tr>
<td>4</td>
<td>PX4161</td>
<td>Power Converters Laboratory</td>
<td>0    0  3</td>
<td>1.5</td>
<td>I</td>
</tr>
<tr>
<td>5</td>
<td>PX4111</td>
<td>Analog and Digital Controllers for PE Converters Laboratory</td>
<td>1    0  3</td>
<td>2.5</td>
<td>I</td>
</tr>
<tr>
<td>6</td>
<td>PX4201</td>
<td>Analysis of Electrical Drives</td>
<td>3    1  0</td>
<td>4</td>
<td>II</td>
</tr>
<tr>
<td>7</td>
<td>PX4202</td>
<td>Special Electrical Machines</td>
<td>3    0  0</td>
<td>3</td>
<td>II</td>
</tr>
<tr>
<td>S. No</td>
<td>Course Code</td>
<td>Course Title</td>
<td>Periods Per Week</td>
<td>Credits</td>
<td>Semester</td>
</tr>
<tr>
<td>-------</td>
<td>-------------</td>
<td>--------------------------------------------------</td>
<td>------------------</td>
<td>---------</td>
<td>----------</td>
</tr>
<tr>
<td>8</td>
<td>PX4251</td>
<td>Electric Vehicles and Power Management</td>
<td>3 1 0</td>
<td>4</td>
<td>II</td>
</tr>
<tr>
<td>9</td>
<td>PX4211</td>
<td>Power Electronics and Drives Laboratory</td>
<td>0 0 3</td>
<td>1.5</td>
<td>II</td>
</tr>
<tr>
<td>10</td>
<td>PX4212</td>
<td>Design Laboratory for Power Electronics Systems</td>
<td>1 0 3</td>
<td>1.5</td>
<td>II</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total Credits</strong></td>
<td></td>
<td><strong>29</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Research Methodology and IPR Courses (RMC)**

<table>
<thead>
<tr>
<th>S. No</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Periods Per Week</th>
<th>Credits</th>
<th>Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RM4151</td>
<td>Research Methodology and IPR</td>
<td>2 0 0</td>
<td>2</td>
<td>I</td>
</tr>
</tbody>
</table>

**Employability Enhancement Courses (EEC)**

<table>
<thead>
<tr>
<th>S. No</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Periods Per Week</th>
<th>Credits</th>
<th>Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PX4311</td>
<td>Project Work I</td>
<td>0 0 12</td>
<td>6</td>
<td>III</td>
</tr>
<tr>
<td>2</td>
<td>PX4411</td>
<td>Project Work II</td>
<td>0 0 24</td>
<td>12</td>
<td>IV</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total Credits</strong></td>
<td></td>
<td><strong>18</strong></td>
<td></td>
</tr>
</tbody>
</table>
## PROFESSIONAL ELECTIVES

### SEMESTER I

#### ELECTIVE I

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>PERIODS PER WEEK</th>
<th>TOTAL CONTACT PERIODS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PX4001</td>
<td>Power Semiconductor Devices</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>PX4002</td>
<td>System Design Using Microcontroller</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>PX4003</td>
<td>Electromagnetic Field Computation and Modelling</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>PX4004</td>
<td>Soft Computing Techniques</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>PS4151</td>
<td>System Theory</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

### SEMESTER II

#### ELECTIVE II & III

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>PERIODS PER WEEK</th>
<th>TOTAL CONTACT PERIODS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PX4005</td>
<td>Power Electronics for Renewable Energy Systems</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>PX4006</td>
<td>Modern Rectifiers and Resonant Converters</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>PX4007</td>
<td>Advanced Power Converters</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>PX4008</td>
<td>MEMS Design: Sensors and Actuators</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>PX4009</td>
<td>Control of Power Electronic Circuits</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>PS4073</td>
<td>Energy Storage Technologies</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>PX4071</td>
<td>Power Quality</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>ET4071</td>
<td>DSP Based System Design</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>ET4072</td>
<td>Machine Learning and Deep Learning</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>ET4251</td>
<td>IoT for Smart Systems</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>
### SEMESTER III

#### ELECTIVE IV & V

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>PERIODS PER WEEK</th>
<th>TOTAL CONTACT PERIODS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PX4010</td>
<td>Nonlinear Dynamics for Power Electronics Circuits</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>PX4011</td>
<td>Grid Integration of Renewable Energy Sources</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>PX4012</td>
<td>Renewable Energy Technology</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>PX4013</td>
<td>Wind Energy Conversion System</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>PX4014</td>
<td>Optimization Techniques</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>PS4071</td>
<td>Distributed Generation and Micro Grid</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>PS4072</td>
<td>Energy Management and Auditing</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>PS4075</td>
<td>Smart Grid</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>9</td>
<td>PS4351</td>
<td>HVDC and FACTS</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>ET4073</td>
<td>Python Programming for Machine Learning</td>
<td>PEC</td>
<td>3 0 0</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

#### AUDIT COURSES - I

REGISTRATION FOR ANY OF THESE COURSES IS OPTIONAL TO STUDENTS

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>PERIODS PER WEEK</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AX4091</td>
<td>English for Research Paper Writing</td>
<td>2 0 0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>AX4092</td>
<td>Disaster Management</td>
<td>2 0 0</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>AX4093</td>
<td>Constitution of India</td>
<td>2 0 0</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>AX4094</td>
<td>என்றுலை தலைசுடன் விளக்கம்</td>
<td>2 0 0</td>
<td>0</td>
</tr>
</tbody>
</table>
# SUMMARY

<table>
<thead>
<tr>
<th>SUBJECT AREA</th>
<th>CREDITS PER SEMESTER</th>
<th>CREDITS TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
<td>II</td>
</tr>
<tr>
<td>1. FC</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>2. PCC</td>
<td>15</td>
<td>14</td>
</tr>
<tr>
<td>3. PEC</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>4. OEC</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5. EEC</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6. RMC</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>7. Non Credit/Audit Course</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>24</td>
<td>20</td>
</tr>
</tbody>
</table>
MA4106  APPLIED MATHEMATICS FOR POWER ELECTRONICS ENGINEERS  L T P C  3 1 0 4

OBJECTIVES:
- To develop the ability to apply the concepts of matrix theory in Electrical Engineering problems.
- To familiarize the students in the field of differential equations to solve boundary value problems associated with engineering applications.
- To develop the ability among the students to solve problems using Laplace transform associated with engineering applications.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.
- To develop the ability among the students to solve problems using Fourier series associated with engineering applications.

UNIT I  MATRIX THEORY  12
The Cholesky decomposition - Generalized Eigenvectors - Canonical basis - QR factorization - Singular value decomposition - Pseudo inverses - Least square approximation.

UNIT II  CALCULUS OF VARIATIONS  12
Concept of variations and its properties - Euler's theorem - Functional dependent on first and higher order of derivatives - Functionals dependent on functions of several independent variables - Variational problems with moving boundaries - Isoperimetric problems - Direct methods : Rayleigh Ritz method and Kantorovich problems.

UNIT III  LAPLACE TRANSFORM TECHNIQUES FOR PARTIAL DIFFERENTIAL EQUATIONS  12

UNIT IV  Z - TRANSFORM TECHNIQUES FOR PARTIAL DIFFERENTIAL EQUATIONS  12

UNIT V  FOURIER SERIES  12
Fourier Trigonometric series : Periodic function as power signals - Convergence of series - Even and odd functions : Cosine and sine series - Non periodic function - Extension to other intervals - Power signals : Exponential Fourier series - Parseval's theorem and power spectrum - Eigenvalue problems and orthogonal functions - Regular Sturm –Liouville systems - Generalized Fourier series.

TOTAL : 60 PERIODS

OUTCOMES:
- Able to apply the concepts of matrix theory in Electrical Engineering problems.
- Able to solve boundary value problems associated with engineering applications.
- Able to solve problems using Laplace transform associated with engineering applications.
- Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.
- Able to solve problems using Fourier series associated with engineering applications.
REFERENCES:

PX4101 ANALYSIS OF ELECTRICAL MACHINES LT P C 3 1 0 4

OBJECTIVES:
1. To understand the principles of electromechanical energy conversion in electrical machines and to know the dynamic characteristics of DC motors
2. To study the concepts related with AC machines, magnetic noise and harmonics in rotating electrical machines.
3. To interpret the principles of reference frame theory
4. To study the principles of three phase, doubly fed and ‘n’ phase induction machine in machine variables and reference variables.
5. To understand the principles of three phase, synchronous machine in machine variables and reference variables.

UNIT I ELECTROMECHANICAL ENERGY CONVERSION and DC MACHINES 12
Magnetic circuits, permanent magnet, Energy conservation - stored magnetic energy, co-energy - force and torque in singly and doubly excited systems – Elementary DC machine and analysis of steady state operation - Voltage and torque equations – dynamic characteristics - DC motors – Time domain block diagrams - solution of dynamic characteristic by Laplace transformation

UNIT II AC MACHINES -CONCEPTS 12

UNIT III REFERENCE FRAME THEORY 12
Historical background – phase transformation and commutator transformation – transformation of variables from stationary to arbitrary reference frame – transformation of balanced set-variables observed from several frames of reference.

UNIT IV INDUCTION MACHINES 12
UNIT V  SYNCHRONOUS MACHINES 12
Three phase synchronous machine and analysis of steady state operation - voltage and torque equations in machine variables and rotor reference frame variables (Park’s equations) – analysis of dynamic performance for load torque variations – Krons primitive machine

TOTAL : 60 PERIODS

OUTCOMES:
After completion of this course, student will be able to
- Understand the principles of electromechanical energy conversion and characteristics of DC motors
- Know the concepts related with AC machines and modeling of ‘n’ phase machines
- Interpret the concepts of reference frame theory.
- Apply procedures to develop induction machine model in both machine variable form and reference variable forms
- Follow the procedures to develop synchronous machine model in machine variables form and reference variable form.

REFERENCES:
5  R. Ramanujam, Modeling and Analysis of Electrical Machines, I.K. International Publishing House Pvt.Ltd, 2018

PX4151  ANALYSIS OF POWER CONVERTERS LT P C
3 1 0 4

OBJECTIVES:
- To provide the mathematical fundamentals necessary for deep understanding of power converter operating modes.
- To introduce the electrical circuit concepts behind the different working modes of power converters so as to enable deep understanding of their operation.
- To impart required skills to formulate and design inverters for generic load and for machine loads.
- To equip with required skills to derive the criteria for the design of power converters starting from basic fundamentals.
- To inculcate knowledge to perform analysis and comprehend the various operating modes of different configurations of power converters

UNIT I  SINGLE PHASE AC-DC CONVERTER 12
UNIT II THREE PHASE AC-DC CONVERTER

UNIT III SINGLE PHASE INVERTERS
Introduction to self-commutated switches : MOSFET and IGBT - Principle of operation of half and full bridge inverters – Performance parameters – Voltage control of single phase inverters using various PWM techniques – various harmonic elimination techniques – Design of UPS - VSR operation

UNIT IV THREE PHASE INVERTERS
180 degree and 120 degree conduction mode inverters with star and delta connected loads – voltage control of three phase inverters: single, multi pulse, sinusoidal, space vector modulation techniques – VSR operation-Application – Induction heating, AC drive system – Current source inverters.

UNIT V MODERN INVERTERS

TOTAL : 60 PERIODS

OUTCOMES:
After completing the above course, students will be able to
CO1 : Acquire and apply knowledge of mathematics in power converter analysis
CO2: Model, analyze and understand power electronic systems and equipments.
CO3 :Formulate, design and simulate phase controlled rectifiers for generic load and for machine loads
CO4 : Design and simulate switched mode inverters for generic load and for machine loads
CO5 : Select device and calculate performance parameters of power converters under various operating modes

REFERENCES:
OBJECTIVES:
1. To inculcate knowledge on steady state analysis of Non-Isolated DC-DC converter
2. To perform steady state analysis of Isolated DC-DC converter
3. To educate on different converter dynamics
4. To impart knowledge on the design of controllers for DC-DC converters
5. To familiarize the design magnetics for SMPS applications

UNIT I  ANALYSIS OF NON-ISOLATED DC-DC CONVERTERS  9
Buck, Boost, Buck- Boost and Cuk converters: Principles of operation – Continuous conduction mode – Concepts of volt-sec balance and charge balance – Analysis and design based on steady-state relationships – Introduction to discontinuous conduction mode - SEPIC topology - design examples - Applications to Battery operated vehicle, PV system.

UNIT II  ANALYSIS OF ISOLATED DC-DC CONVERTERS  9
Introduction - classification- forward- flyback- pushpull – half bridge – full bridge topologies-design of SMPS - Applications to Battery operated vehicle

UNIT III  CONVERTER DYNAMICS  9

UNIT IV  CONTROLLER DESIGN  9
Review of P, PI, and PID control concepts – gain margin and phase margin – Bode plot based analysis – Design of controller for buck, boost, buck-boost and cuk converters

UNIT V  DESIGN OF MAGNETICS  9
Basic magnetic theory revision – Inductor design – Design of mutual inductance – Design of transformer for isolated topologies – Ferrite core table and selection of area product – wire table – selection of wire gauge

OUTCOMES:
After completing the above course, students will be able to
CO1 : Analyse and design Non-Isolated DC-DC converter
CO2: Analyse and design Isolated DC-DC converter
CO3: Derive transfer function of different converters
CO4 : Design controllers for DC-DC converters
CO5 : Design magnetics for SMPS application

TEXT BOOKS:
REFERENCES:
1. John G. Kassakian, Martin F. Schlecht, George C. Verghese, “Principles of Power Electronics”, Pearson, India, New Delhi, 2010
6  V.Ramanarayanan, “Course material on Switched mode power conversion”, 2007

RM4151 RESEARCH METHODOLOGY AND IPR L T P C
2 0 0 2

UNIT I RESEARCH DESIGN 6
Overview of research process and design, Use of Secondary and exploratory data to answer the research question, Qualitative research, Observation studies, Experiments and Surveys.

UNIT II DATA COLLECTION AND SOURCES 6
Measurements, Measurement Scales, Questionnaires and Instruments, Sampling and methods. Data - Preparing, Exploring, examining and displaying.

UNIT III DATA ANALYSIS AND REPORTING 6
Overview of Multivariate analysis, Hypotheses testing and Measures of Association. Presenting Insights and findings using written reports and oral presentation.

UNIT IV INTELLECTUAL PROPERTY RIGHTS 6

UNIT V PATENTS 6

TOTAL : 30 PERIODS
REFERENCES
OBJECTIVES:
- To provide the basic understanding of the dynamic behavior of the power electronic switches
- To make the students familiar with the digital processors used in generation of gate pulses for the power electronic switches
- To make the students acquire knowledge on the design of power electronic circuits and implementing the same using simulation tools
- To facilitate the students to design gate drive circuits for power converters
- To provide the fundamentals of DC-AC power converter topologies and analyze the harmonics.

LIST OF EXPERIMENTS:
1. Study of switching characteristics of Power MOSFET & IGBT.
4. Circuit Simulation of Three-phase Voltage Source Inverter in 180 and 120 degree mode of conduction
5. Circuit simulation of Three-phase PWM inverter and study of spectrum analysis for various modulation indices.
6. Simulation of Four quadrant operation of DC Chopper.
10. Simulation of a five-level cascaded multilevel inverter with R load.
11. Simulation of a Flyback DC-DC converter

TOTAL: 45 PERIODS

OUTCOMES:
- Comprehensive understanding on the switching behaviour of Power Electronic Switches
- Comprehensive understanding on mathematical modeling of power electronic system and ability to implement the same using simulation tools
- Ability of the student to use arduino/microcontroller for power electronic applications
- Ability of the student to design and simulate various topologies of inverters and analyze their harmonic spectrum
- Ability to design and fabricate the gate drive power converter circuits. Analyze the three-phase controlled rectifiers and isolated DC-DC converters for designing the power supplies
OBJECTIVES:
- To understand the concepts related with analog and digital controllers.
- To design and understand the op-amp circuits and microcontroller circuits for power electronics.
- To study and design the driving circuits, sensing circuits, protection circuits for power converters.
- To design and select the appropriate digital controller for power converters along with control strategy

LIST OF EXPERIMENTS:
1. Amplifiers and buffer design and verification by using Opamp
2. Filter design and verification by using Opamp
3. ON/OFF controller design and verification by using analog circuits
4. Design of Driver Circuit using IR2110
5. Waveform generation by using look up table
6. Generation of PWM gate pulses with duty cycle control using PWM peripheral of microcontroller (TI-C2000 family/PIC18)
7. Duty cycle control from IDE
8. Duty Cycle control using a POT connected to ADC peripheral in a standalone mode
9. Generation of Sine-PWM pulses for a single and three phase Voltage Source Inverter with control of modulation index using PWM peripheral of microcontroller (TI C2000 family/PIC 18)
10. Design and testing of signal conditioning circuit to interface voltage/current sensor with microcontroller (TI-C2000 family/PIC18)
11. Interface Hall effect voltage and current sensor with microcontroller and display the current waveform in the IDE and validate with actual waveform in DSO
12. Design of closed loop P, I and PI controllers using OP-AMP

TOTAL : 60 PERIODS

OUTCOMES:
After completing the above course, students will be able to
CO1: Identification of suitable analog and digital controller for the converter design.
CO2: Know the advantages of gate driver, sensing and protection circuits in power converters.
CO3: Hands on with different controller with strategies for design.
CO4: Design and testing the proper driving circuits and protection circuits.
CO5: Fabrication of analog and digital controllers for various real time applications.
OBJECTIVES:
- To understand the concepts related with power switches and its requirements.
- To know about the developments and characteristics of Silicon Carbide (SiC) and Galium Nitride (GaN) devices.
- To understand the working, steady state and switching characteristics of current controlled and voltage controlled silicon devices.
- To study the working of driving circuits, protection circuits for power devices.
- To understand the thermal characteristics of power devices and the ability to design heat sink for the power devices.

UNIT I INTRODUCTION
Power switching devices overview – Attributes of an ideal switch, application requirements, circuit symbols; Power handling capability – (SOA); Power diodes - Types, forward and reverse characteristics, switching characteristics – rating. Features and Brief History of Silicon Carbide-Promise and Demonstration of SiC Power Devices- Physical Properties of Silicon Carbide devices -Unipolar and Bipolar Diodes- GaN Technology Overview.

UNIT II CURRENT CONTROLLED DEVICES
BJT’s – Construction, static characteristics, switching characteristics; Negative temperature coefficient and second breakdown; - Thyristors – Construction, working, static and transient characteristics, types, series and parallel operation; comparison of BJT and Thyristor – steady state and dynamic models of BJT &Thyristor- Basics of GTO, SiC based Bipolar devices-Applications- Building a GaN Transistor -GaN Transistor Electrical Characteristics

UNIT III VOLTAGE CONTROLLED DEVICES
Power MOSFETs and IGBTs – Principle of voltage controlled devices, construction, types, static and switching characteristics, steady state and dynamic models of MOSFET and IGBTs - and IGCT. New semiconductor materials for devices – Intelligent power modules- study of modules like APTGT100TL170G, MSCSM70TAM05TPAG. Integrated gate commutated thyristor (IGCT) - SiCbased unipolar devices-applications

UNIT IV DEVICE SELECTION, DRIVING and PROTECTING CIRCUITS
Device selection strategy – On-state and switching losses – EMI due to switching. Necessity of isolation, pulse transformer, optocoupler – Gate drive integrated circuit: Study of Driver IC – IRS2110/2113. SCR, MOSFET, IGBTs and base driving for power BJT. - Over voltage, over current and gate protections; Design of snubbers

UNIT V THERMAL PROTECTION
Heat transfer – conduction, convection and radiation; Cooling – liquid cooling, vapour – phase cooling; Guidance for heat sink selection – Thermal resistance and impedance -Electrical analogy of thermal components, heat sink types and design – Mounting types- switching loss calculation for power device

TOTAL : 45 PERIODS
OUTCOMES:
After completing the above course, students will be able to
CO1: Identification of suitable device for the application.
CO2: Know the advantages of Silicon Carbide devices and Galium Nitride devices.
CO3: Understand the principles and characteristics of Silicon devices, Silicon Carbide devices and
Galium Nitride devices.
CO4: Design proper driving circuits and protection circuits.
CO5: Construct a proper thermal protective devices for power semiconductor devices.

REFERENCES:
1. Rashid M.H., " Power Electronics Circuits, Devices and Applications ", Pearson,
Application and design”, 3rd edition Wiley, 2007
3. Tsunenobu Kimoto and James A. Cooper , Fundamentals of Silicon Carbide
2014 John Wiley & Sons Singapore Pte Ltd
4. Alex Lidow, Johan Strydom, Michael de Rooij, David Reusch, GaN
TRANSISTORS FOR EFFICIENT POWER CONVERSION, Second Edition,
Wiley, 2015
5. Biswanath Paul, Power Electronics, Universities Press 2019
OBJECTIVES:
- To get introduced to the fundamentals of microcontroller based system design.
- To learn I/O and other built-in features available in microcontroller.
- To know microcontroller based system design, applications.
- To learn I/O interface in system design
- To involve discussions/practice/exercise onto revising & familiarizing the concepts acquired for improved employability skills.

UNIT I 8051 ARCHITECTURE

UNIT II 8051 PROGRAMMING

UNIT III PIC 16 MICROCONTROLLER
Architecture - memory organization - addressing modes - instruction set - PIC programming in Assembly & C - I/O port, Data Conversion, RAM & ROM Allocation, Timer programming, practice in MP-LAB.

UNIT IV PERIPHERAL OF PIC 16 MICROCONTROLLER

UNIT V SYSTEM DESIGN - CASE STUDY
Interfacing LCD Display - Keypad Interfacing - Generation of Gate signals for converters and Inverters - Motor Control - Controlling DC/AC appliances - Measurement of frequency - Stand alone Data Acquisition System

TOTAL: 45 PERIODS

OUTCOMES:
1. Ability to understand the features of microcontroller 8051.
2. Ability to write programs using 8051 assemble language, utilizing its built-in features.
3. Ability to understand the features of PIC microcontroller.
4. Ability to use the peripherals built-in the PIC microcontroller through programming.
5. Ability to grasp the interfacing concepts involving in the design of microcontroller based systems.

TEXTBOOKS:
REFERENCES:

PX4003 ELECTROMAGNETIC FIELD COMPUTATION AND MODELLING

OBJECTIVES:
- To refresh the fundamentals of Electromagnetic Field Theory
- To provide foundation in formulation and computation of electromagnetic field equations using analytical methods
- To impart knowledge in the concept of problem formulation and computation of electromagnetic field equations using numerical methods.
- To compute and analyze the field quantities using FEM.
- To formulate, solve, analyze and optimize the design of electrical components.

UNIT I INTRODUCTION
Review of basic field theory – Maxwell’s equations – Constitutive relationships and Continuity equations – Laplace, Poisson and Helmholtz equation – principle of energy conversion – force/torque calculation

UNIT II BASIC SOLUTION METHODS FOR FIELD EQUATIONS
Limitations of the conventional design procedure need for the field analysis based design, problem definition, boundary conditions, solution by analytical methods - direct integration method – variable separable method – method of images.

UNIT III SOLUTION BY NUMERICAL METHODS

UNIT IV COMPUTATION OF BASIC QUANTITIES USING FEM PACKAGES
UNIT V  DESIGN APPLICATIONS

TOTAL : 45 PERIODS

OUTCOMES:
• Ability to understand the field theory concepts
• Ability to formulate and compute Electromagnetic Fields from Maxwell’s equations.
• Ability to formulate FEM problems from the fundamental concepts
• Ability to compute the respective field using FEM (post processing)
• Ability to check and optimize the design of electrical power equipment

REFERENCES:
OBJECTIVES
To educate the students on
- Design of ANN and fuzzy set theory.
- Analysis and implementation of ANN and Fuzzy logic for modeling and control of Non-linear system and to get familiarized with the Matlab toolbox.
- Impart the knowledge of various optimization techniques and hybrid schemes with the ANFIS tool box.

UNIT I INTRODUCTION AND ARTIFICIAL NEURAL NETWORKS 9

UNIT II ARTIFICIAL NEURAL NETWORKS AND ASSOCIATIVE MEMORY 9

UNIT III FUZZY LOGIC SYSTEM 9
Introduction to crisp sets and fuzzy sets- basic fuzzy set operation and approximate reasoning. Introduction to fuzzy logic modeling and control- Fuzzification inferencing and defuzzification- Fuzzy knowledge and rule bases-Fuzzy modeling and control schemes for nonlinear systems. Self organizing fuzzy logic control- Fuzzy logic control for nonlinear time delay system.

UNIT IV GENETIC ALGORITHM 9
Evolutionary programs – Genetic algorithms, genetic programming and evolutionary programming - Genetic Algorithm versus Conventional Optimization Techniques - Genetic representations and selection mechanisms; Genetic operators- different types of crossover and mutation operators - Optimization problems using GA-discrete and continuous - Single objective and multi-objective problems - Procedures in evolutionary programming.

UNIT V HYBRID CONTROL SCHEMES 9

TOTAL : 45 PERIODS
OUTCOMES:
Ability to
- Understand the basic architectures of NN and Fuzzy sets
- Design and implement ANN architectures, algorithms and know their limitations.
- Identify and work with different operations on the fuzzy sets.
- Develop ANN and fuzzy logic based models and control schemes for non-linear systems.
- Understand and explore hybrid control schemes and PSO

TEXT BOOKS:

OBJECTIVES:
1. To educate on modeling and representing systems in state variable form.
2. To train on solving linear and non-linear state equations.
3. To illustrate the properties of control system.
4. To classify non-linearities and examine stability of systems in the sense of Lyapunov’s theory.
5. To educate on modal concepts, design of state, output feedback controllers and estimators.

UNIT I   STATE VARIABLE REPRESENTATION         9
Introduction-Concept of State-Space equations for Dynamic Systems -Time invariance and linearity-
Non uniqueness of state model- Physical Systems and State Assignment - free and forced responses-
State Diagrams.

UNIT II   SOLUTION OF STATE EQUATIONS          9
Existence and uniqueness of solutions to Continuous-time state equations - Solution of Nonlinear and
Linear Time Varying State equations - State transition matrix and its properties – Evaluation of matrix
exponential- System modes- Role of Eigen values and Eigen vectors.

UNIT III  PROPERTIES OF THE CONTROL SYSTEM      9
Controllability and Observability-Stabilizability and Detectability-Test for Continuous time Systems-
Time varying and Time invariant case-Output Controllability-Reducibility-System Realizations.

UNIT IV   NON-LINEARITIES AND STABILITY ANALYSIS 9
Equilibrium Points-Stability in the sense of Lyapunov-BIBO Stability-Stability of LTI Systems-Types of
nonlinearity – Phase plane analysis – Singular points – Limit cycles – Construction of phase
trajectories – Describing function method – Derivation of describing functions. Equilibrium Stability of
Nonlinear Continuous Time Autonomous Systems - Direct Method of Lyapunov and the Linear
Continuous-Time Autonomous Systems- Lyapunov Functions for Nonlinear Continuous Time
Autonomous Systems-Krasovskii and Variable-Gradiant Method

UNIT IV  MODAL ANALYSIS                        9
Controllable and Observable Companion Forms - SISO and MIMO Systems – Effect of State
Feedback on Controllability and Observability-Pole Placement by State Feedback for both SISO and
MIMO Systems-Full Order and Reduced Order Observers.

TOTAL: 45 PERIODS

OUTCOMES:
Students able to
CO1 Understand the concept of State-State representation for Dynamic Systems
CO2 Explain the solution techniques of state equations
CO3 Realize the properties of control systems in state space form
CO4 Identify non-linearities and evaluate the stability of the system using Lyapunov notion
CO5 Perform Modal analysis and design controller and observer in state space form
REFERENCES:
2. Z. Bubnicki, ”Modern Control Theory”, Springer, 2005
3. K. Ogatta, “Modern Control Engineering”, PHI, 2002
OBJECTIVES
- Teach how to improve writing skills and level of readability
- Tell about what to write in each section
- Summarize the skills needed when writing a Title
- Infer the skills needed when writing the Conclusion
- Ensure the quality of paper at very first-time submission

UNIT I  INTRODUCTION TO RESEARCH PAPER WRITING  6
Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT II  PRESENTATION SKILLS  6

UNIT III  TITLE WRITING SKILLS  6
Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check

UNIT IV  RESULT WRITING SKILLS  6
Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

UNIT V  VERIFICATION SKILLS  6
Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first-time submission

TOTAL: 30 PERIODS

OUTCOMES
CO1 – Understand that how to improve your writing skills and level of readability
CO2 – Learn about what to write in each section
CO3 – Understand the skills needed when writing a Title
CO4 – Understand the skills needed when writing the Conclusion
CO5 – Ensure the good quality of paper at very first-time submission

REFERENCES
OBJECTIVES

• Summarize basics of disaster
• Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
• Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
• Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
• Develop the strengths and weaknesses of disaster management approaches

UNIT I INTRODUCTION
Disaster: Definition, Factors and Significance; Difference between Hazard And Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

UNIT II REPERCUSSIONS OF DISASTERS AND HAZARDS

UNIT III DISASTER PRONE AREAS IN INDIA
Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides And Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post-Disaster Diseases and Epidemics

UNIT IV DISASTER PREPAREDNESS AND MANAGEMENT
Preparedness: Monitoring Of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT V RISK ASSESSMENT
Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People’s Participation in Risk Assessment. Strategies for Survival

TOTAL : 30 PERIODS

OUTCOMES

CO1: Ability to summarize basics of disaster
CO2: Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
CO3: Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
CO4: Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
CO5: Ability to develop the strengths and weaknesses of disaster management approaches
REFERENCES

AX4093 CONSTITUTION OF INDIA

L T P C
2 0 0 0

OBJECTIVES
Students will be able to:
- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

UNIT I HISTORY OF MAKING OF THE INDIAN CONSTITUTION
History, Drafting Committee, (Composition & Working)

UNIT II PHILOSOPHY OF THE INDIAN CONSTITUTION
Preamble, Salient Features

UNIT III CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES

UNIT IV ORGANS OF GOVERNANCE
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 V LOCAL ADMINISTRATION
UNIT VI  ELECTION COMMISSION
Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners - Institute and Bodies for the welfare of SC/ST/OBC and women.

TOTAL: 30 PERIODS

OUTCOMES
Students will be able to:
- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party[CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of 1956.

SUGGESTED READING
1. The Constitution of India, 1950(Bare Act), Government Publication.
UNIT I

சங்கிலி ஒருகுறியில்

1. தொழில்வாத்தாகத் தான் தகருக்குப்பிள்ளை
   - உருண்டை, முடச்சு, பெப்பர்

2. அச்சாலை (82)
   - ஓபேரெட் சிங்கல்கு அந்தம்

3. கிருட்டம் பலியத்தல் மூன்றுக்குறியில்

4. பாண்டபுரு (95,195)
   - பின்னர் திற்களியும் செயல்பாற

UNIT II

அறெந௣த் தமிழ்

1. அநியன் சகோதர சின்னமொன்றான
   - அதன் குறிப்பிட்டுணர், அச்சகோதரம், சென்றை அதிகான், மாக, பெப்பர்

2. பின் அச்சாலை - பின்னர் மூன்று
   - குளியா, கிருட்டம் பலியத்தல், கிருட்டம், கிருட்டம் பலியத்தல் (தமிழ்நாடு
   குறிப்பிட்டுணர் குளியா)

UNIT III

இலக்கியக் கப்பலியக்கல்

1. கணினியில் பார்வை
   - கீழ்ப்பிட்டுணர் அதிகக்குறியில்

2. முக்கோண குறிப்பிட்டுணர் மூன்றுக்குறியில்
   - கீழ்ப்பிட்டுணர் அதிகக்குறியில்
UNIT IV  அளனநிக துறைமை

1. திற்பாணத்தற்போல
   - பருள் பரிமாறும் துறை, ஒளையான மைதானம்
   - பருள் பரிமாறும் துறை, மூஸ்சோக வெளியைக் கைவிட்டது
   - காண்டுத்தொலை, அரசிண பாதுகாப்பு

2. நூற்றொலை
   - அளனநிகத் துறை பண்ணைப் பிறப்பு

3. கிளைகிைம் (617, 618)
   - தேசிய விளையாட்டு பிரிவு

4. குறுக்குணகத் துறையின அமைப்பு

5. பாட்டகாலம்
   - திற்பாணத் துறைக்காலம்

6. அகசைலவு (4)
   - மண்டல
   - தேரிவு (11)
   - முழுமானம்
   - குறிப்பிட்டத் (11)
   - மாத்தம், புரா
   தேவதை தேடு 50 (27)

அமைப்பு பாதுகாப்பு துறைக்காலம்

UNIT V  நீர் குழு துறைமை

1. தேர் குழு துறைமை
   - தேர் விளையாட்டு பிரிவு
   - தேர் விளையாட்டு திணுக்காலம்
   - காண்டு திணுக்காலம்
   - பாதுகாப்பு திணுக்காலம்
   - சாலை

30

www.binils.com
Anna University, Polytechnic & Schools
2. தமிழ் விதித்துக்கொள்ளப்பட்ட நூறு தோற்றகமை,

3. செயல்பாடு விதித்துக்கொள்ளப்பட்ட நூறு தோற்றகமை,

4. பட்டட விதித்துக்கொள்ளப்பட்ட தினமிக்கிறது விளகியுள்ள நூறு தோற்றகமை,

5. அறிவியல் நூறு,

6. தொலைவிப்பை நூறு,

7. காந்தலூர் தொலைவு நூறு தோற்றகமை.

தமிழ் விதிக்கப்பட்ட வகைப்பாடுகள் / புக்குண்டக்கள்

1. தமிழ் விமான கல்விக்கமை (Tamil Virtual University)
   - www.tamilvu.org

2. தமிழ் விகிடம்பாடு (Tamil Wikipedia)
   - https://ta.wikipedia.org

3. தமிழ் வித்துக்கொள்ளப்பட்ட அட்டியல்

4. வேலைவளம் வகைப்பாடு
   - தமிழ் பல்கலைக்கழகம், குற்றகத்

5. தமிழ் வகைப்பாடு வகைப்பாடு
   - தமிழ் வாழ்க்கைச் செயல் (thamilvalarchithurai.com)

6. அறிவியல் வகைப்பாடு
   - தமிழ் பல்கலைக்கழகம், குற்றகத்

TOTAL: 30 PERIODS