1. Programme Educational Objectives (PEOs):
To enable the graduate students of Textile Technology and allied students to
a. Enhance their knowledge related to the theory of textile processes and textile
machinery
b. Enhance their knowledge on advances in textile processes
c. Design, conduct and interpret the results of the textile experiments
d. Design new textile processes and products
e. Engross in life-long learning to keep abreast with emerging technologies

2. Programme Outcomes (POs):
Upon completion of the programme, the student shall be able to
1. Effectively teach the students at the undergraduate level
2. Innovate new process or product at the textile industry or textile research
organizations.
3. Effectively carryout fundamental and applied research, and manage research and
development activities in industry and research organizations
4. Manage textile industry and solve technological problems
5. Use the advanced techniques, skills, and modern tools necessary for practicing in the
textile industry.
6. Communicate effectively and work in interdisciplinary groups.
7. Review, comprehend and report technological development.

PEO / PO Mapping

<table>
<thead>
<tr>
<th>PEO</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c</td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>
### 1. Semester Course wise PO Mapping

<table>
<thead>
<tr>
<th>Course Title</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory of Short Staple Spinning</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Process Control and Fabric Engineering</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Statistical Application in Textile Engineering</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polymer Physics</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clothing Science</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Colorations and Functional Finishes</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Textile Quality Evaluation</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Structural Mechanics of Yarns and Fabrics</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Textile Quality Evaluation Lab</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technical Seminar</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Course Title</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Work (Phase I)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Computer Aided Textile Design</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internship</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project Work (Phase II)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Course Title</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>--------------------------------------------------</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Alternative Spinning Systems</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Characterization of Textile Polymers</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medical textiles</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Theory of Drafting and Twisting</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High Performance and Specialty Fibres</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nano Technology in Textiles</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Process Control and Optimization in Yarn Spinning</td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enzyme Technology for Textile Processing</td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Financial Management in Textile Industry</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design Concepts in High Speed Fabric Formation</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Management of Textile Effluents</td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Textile Reinforced Composites</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control Systems and Automation in Textile Engineering</td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design and Analysis of Textile Experiments</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advances in Textile Printing</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protective Textiles</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project Planning and Management</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Process Control in Textile Wet Processing</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>COURSETITLE</th>
<th>CATEGORY</th>
<th>CONTACT PERIODS</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>THEORY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>TX5101</td>
<td>Theory of Short Staple Spinning</td>
<td>PC</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>TX5102</td>
<td>Process Control and Fabric Engineering</td>
<td>PC</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>3.</td>
<td>TX5103</td>
<td>Polymer Physics</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>TX5151</td>
<td>Statistical Application in Textile Engineering</td>
<td>PC</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>5.</td>
<td></td>
<td>Professional Elective I</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td></td>
<td>Professional Elective II</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td>21</td>
<td>21</td>
<td>0</td>
<td>21</td>
</tr>
</tbody>
</table>

### SEMESTER II

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>COURSE CODE</th>
<th>COURSETITLE</th>
<th>CATEGORY</th>
<th>CONTACT PERIODS</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>THEORY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>TX5201</td>
<td>Colorations and Functional Finishes</td>
<td>PC</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>TX5202</td>
<td>Textile Quality Evaluation</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>TX5203</td>
<td>Structural Mechanics of Yarns and Fabrics</td>
<td>PC</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>TX5251</td>
<td>Clothing Science</td>
<td>PC</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Professional Elective III</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>Professional Elective IV</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>PRACTICAL</strong></td>
<td></td>
<td></td>
<td>25</td>
<td>21</td>
<td>0</td>
<td>23</td>
</tr>
<tr>
<td>7</td>
<td>TX5211</td>
<td>Textile Quality Evaluation Lab</td>
<td>PC</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>TX5212</td>
<td>Technical Seminar</td>
<td>EEC</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td>25</td>
<td>21</td>
<td>0</td>
<td>23</td>
</tr>
</tbody>
</table>
## SEMESTER III

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>COURSE CODE</th>
<th>COURSETITLE</th>
<th>CATEGORY</th>
<th>CONTACT PERIODS</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>THEORY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>Professional Elective V</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Professional Elective VI</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>PRACTICAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>TX5311</td>
<td>Computer Aided Textile Design</td>
<td>PC</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>TX5312</td>
<td>Internship</td>
<td>EEC</td>
<td>-</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>TX5313</td>
<td>Project Work (Phase I)</td>
<td>EEC</td>
<td>12</td>
<td>0</td>
<td>0</td>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td>20</td>
<td>6</td>
<td>0</td>
<td>14</td>
</tr>
</tbody>
</table>

## SEMESTER IV

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>COURSE CODE</th>
<th>COURSETITLE</th>
<th>CATEGORY</th>
<th>CONTACT PERIODS</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>PRACTICAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>TX5411</td>
<td>Project Work (Phase II)</td>
<td>EEC</td>
<td>24</td>
<td>0</td>
<td>0</td>
<td>24</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td>24</td>
<td>0</td>
<td>0</td>
<td>24</td>
</tr>
</tbody>
</table>

TOTAL CREDITS: 70

### LIST OF ELECTIVES

#### SEMESTER I, PROFESSIONAL ELECTIVE I

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>COURSE CODE</th>
<th>COURSETITLE</th>
<th>CATEGORY</th>
<th>CONTACT PERIODS</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TX5001</td>
<td>Alternative Spinning Systems</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>TX5002</td>
<td>Characterization of Textile Polymers</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>TX5091</td>
<td>Medical Textiles</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

#### SEMESTER I, PROFESSIONAL ELECTIVE II

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>COURSE CODE</th>
<th>COURSETITLE</th>
<th>CATEGORY</th>
<th>CONTACT PERIODS</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TX5003</td>
<td>Theory of Drafting and Twisting</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>TX5092</td>
<td>High Performance and Specialty Fibres</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>TX5093</td>
<td>Nano Technology in Textiles</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>
### SEMESTER II, PROFESSIONAL ELECTIVE III

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>COURSE CODE</th>
<th>COURSETITLE</th>
<th>CATEGORY</th>
<th>CONTACT PERIODS</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>TX5004</td>
<td>Process Control and Optimization in Yarn Spinning</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>TY5071</td>
<td>Enzyme Technology for Textile Processing</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>TX5071</td>
<td>Financial Management in Textile Industry</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

### SEMESTER II, PROFESSIONAL ELECTIVE IV

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>COURSE CODE</th>
<th>COURSETITLE</th>
<th>CATEGORY</th>
<th>CONTACT PERIODS</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>TX5005</td>
<td>Design concepts in High Speed Fabric Formation</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>TX5006</td>
<td>Management of Textile Effluents</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>TX5094</td>
<td>Textile Reinforced Composites</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

### SEMESTER III, PROFESSIONAL ELECTIVE V

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>COURSE CODE</th>
<th>COURSETITLE</th>
<th>CATEGORY</th>
<th>CONTACT PERIODS</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>TX5007</td>
<td>Control Systems and Automation in Textiles Engineering</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>TX5072</td>
<td>Design and Analysis of Textile Experiments</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>TY5091</td>
<td>Advances in Textile Printing</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

### SEMESTER III, PROFESSIONAL ELECTIVE VI

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>COURSE CODE</th>
<th>COURSETITLE</th>
<th>CATEGORY</th>
<th>CONTACT PERIODS</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>TX5073</td>
<td>Protective Textiles</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>TX5074</td>
<td>Project Planning and Management</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>TX5008</td>
<td>Process Control in Textile Wet Processing</td>
<td>PE</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

### PROFESSIONAL CORE (PC)

<table>
<thead>
<tr>
<th>S. No</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>CONTACT PERIODS</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>TX5101</td>
<td>Theory of Short Staple Spinning</td>
<td>PC</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>TX5102</td>
<td>Process Control and Fabric Engineering</td>
<td>PC</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>3.</td>
<td>TX5151</td>
<td>Statistical Application in Textile</td>
<td>PC</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>4</td>
</tr>
</tbody>
</table>
### EMPLOYABILITY ENHANCEMENT COURSES (EEC)

<table>
<thead>
<tr>
<th>S. No</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>CONTACT PERIODS</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.</td>
<td>TX5103</td>
<td>Polymer Physics</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>TX5251</td>
<td>Clothing Science</td>
<td>PC</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>6.</td>
<td>TX5201</td>
<td>Colorations and Functional Finishes</td>
<td>PC</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>7.</td>
<td>TX5202</td>
<td>Textile Quality Evaluation</td>
<td>PC</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>8.</td>
<td>TX5203</td>
<td>Structural Mechanics of Yarns and Fabrics</td>
<td>PC</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>9.</td>
<td>TX5211</td>
<td>Textile Quality Evaluation Lab</td>
<td>PC</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>10.</td>
<td>TX5311</td>
<td>Computer Aided Textile Design</td>
<td>PC</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

**THEORY**

1. TX5212 Technical Seminar
   - EEC
   - Contact Periods: 2
   - L: 0, T: 0, P: 2, C: 1

2. TX5313 Project Work (Phase I)
   - EEC
   - Contact Periods: 12
   - L: 0, T: 0, P: 12, C: 6

3. TX5312 Internship
   - EEC
   - Contact Periods: -
   - L: 0, T: 0, P: 0, C: 1

4. TX5411 Project Work (Phase II)
   - EEC
   - Contact Periods: 24
   - L: 0, T: 0, P: 24, C: 12
OBJECTIVES

- To enable the students to learn the theory of various operations carried out at different stages of yarn spinning, which would be helpful them in understanding the influence of various parameters on quality and productivity of short staple yarn.

UNIT I FIBRE DISPERSION AND CLEANING 18
Necessity of fibre-individualization; fibre opening and cleaning in blow-room machinery; forces acting on the fibre during carding operation; the mechanism of fibre dispersion, fibre transfer, short fibre removal and trash removal; entanglement and disentanglement of fibres; theory of hook formation; the new approaches to improve fibre-dispersion in carding operation; mechanism of removal of short fibre, neps and trash in comber.

UNIT II ATTENUATION AND FIBRE STRAIGHTENING 18
Principle of roller drafting and its application in yarn production; ideal drafting; factors affecting drafting force, fibre dynamics during drafting, drafting irregularities and their causes and remedies; amount of draft and draft distribution on strand irregularity; the function of aprons in roller drafting; limitation of apron-drafting and the scope for improvement; mechanism of wire-point drafting and its application in yarn production; merits and demerits of wire-point drafting; comparison of wire-point drafting with roller drafting; influence of fibre-extent on yarn quality; improvement of fibre-extent by carding, drafting and combing actions.

UNIT III TWISTING 12
Twisted yarn geometry, forces acting on fibre and yarn during twisting, effect of fibre helix angle on strength, parameters affecting optimum twist level; balloon and spinning triangle formation and their effects on yarn quality and productivity; fundamental requirement to create real twist in a strand, mechanism of twisting principles in ring spinning; separation of twisting and winding actions of yarn; ply twisting, twist balance; modified twisting principles - open end twisting, false twisting, air-jet twisting, air-vortex twisting, up-twisting, two-for-one twisting, hollow-spindle twisting; merits and demerits of modern twisting system.

UNIT IV FIBRE BLENDING AND LEVELLING 12
Importance of achieving homogeneous blending in fibre-mix; types of mixing during spinning preparatory process; lateral and longitudinal fibre blending; analysis of fibre blend index values; process parameters of spinning machinery for processing blended material; influence of intermediate product uniformity on yarn uniformity; different methods of levelling adopted during spinning processes.

TOTAL : 60 PERIODS

OUTCOMES

Upon completion of this course, the student shall be able apply the knowledge gained for

- Selecting suitable machine and process variables at different processes of yarn spinning to produce better quality yarn with maximum productivity and
- Designing processes for producing yarn of required parameters and Innovating design and process modification.
REFERENCES

TX5102 PROCESS CONTROL AND FABRIC ENGINEERING

OBJECTIVES
To enable the students to learn the
- Theory of preparation of yarn for fabric formation and different types of fabric formation techniques and
- Selection and control of process variables during preparatory and fabric formation.

UNIT I WEAVING PREPARATION 12
Yarn quality requirements - weaving and knitting; winding - yarn faults, quality of splice/knot, knot factor and clearing efficiency, Optimum clearing of yarn; wound yarn package requirements for different weft insertion system and high speed knitting warping; control of ends break in warping, warp beam quality requirements; quality control in size recipe, size pick-up control, yarn stretch control, quality requirements of sized beam – defects and their causes and remedies. Control of productivity in winding, warping and sizing; Waste control in winding, warping and sizing.

UNIT II WEAVING 12
Loom accessories – quality requirements and its effects on loom performance; control of cross ends and missing ends. Loom shed productivity control – loom speed, loom efficiency, loom stops. Fabric quality control – fabric defects and their causes and remedies; process control for weaving filament, blend yarn and dyed yarn.
UNIT III  KNITTING  12
Types of stitches and their influence on knit fabric properties; weft knitting – method of setting the machine, factors affecting the formation of loops in weft knitting, performance of different yarns, Fabric defects- causes and remedies.

UNIT IV NON-WOVEN  12
Quality control in web preparation; Influence of material and process parameters on fabric quality and performance.

UNIT V UNCONVENTIONAL FABRIC FORMATION  12
3D Fabrics – Structure, Comparison of 2D and 3D fabrics, classifications; Multilayer fabrics – theory, weaving process, fabric properties, applications; 3D orthogonal weaving – weaving principles, properties and applications; 3D Braiding – 2D braiding, 3D braiding, multilayer interlock braiding, properties and applications of braided fabric ; concept of 3D multi axial warp knitting.

TOTAL : 60 PERIODS

OUTCOMES
• Upon completion of this course, the student shall be able to select and control the process variables at preparatory and fabric formation to achieve the fabric with required qualities.

REFERENCES
OBJECTIVES
To enable the students to learn about
- Fibre forming polymer characteristics and their related and models describing fibre structure.
- Conducting of experiments to characterize the polymers and fibres

UNIT I
Synthetic fibre forming polymers, definition, terms and fundamental concepts of polymerization; molecular architecture in polymers-configuration and conformation, random chain model and rms end-to-end distance of polymeric chain

UNIT II
Glass transition temperature (Tg), Factors affecting Tg, WLF equation; Rubber Elasticity; Melting and Crystallization, polymer solutions- solubility parameter and its significance to fibre spinning.

UNIT III
Newton’s law of viscosity, velocity distribution in flow systems Newtonian and non-newtonian fluids; mass transfer operations: Fick’s law of diffusion, solid-liquid extraction and drying operations with application to polymer chips.

UNIT IV
Deformation of elastic solid, viscoelasticity and its measurement, non-linear viscoelasticity, yield behavior of solids and breaking phenomena

UNIT V
Mechanical properties of natural and synthetic fibres, moisture sorption behaviour of natural and synthetic fibres. Models describing fibre structure, Fringed fibrillar and fringed micellar model, One phase model.

TOTAL: 75 PERIODS

OUTCOMES
Upon completion of this course, the student shall be
- able to correlate the physical properties of polymer to its microstructure
- able to characterize polymers and fibres

REFERENCES
OBJECTIVES:

- This course is designed to provide a solid foundation on topics in statistics that can be used to determine the capability of a textile material to meet the specified requirements by subjecting the item to a set of physical, chemical, environmental or operating actions, and conditions. It is framed to address the issues in textile engineering using statistical applications such as probability distributions, estimation theory, testing of hypothesis, analysis of variance, non-parametric tests and design an analysis of experiments.

UNIT I PROBABILITY DISTRIBUTION AND ESTIMATIONS

Applications of Binomial, Poisson, Normal, t, Exponential, Chi-square, F and Weibull distributions in textile engineering - Point estimates and interval estimations of the parameters of the distribution functions.

UNIT II HYPOTHESIS TESTING

Sampling distribution - Significance tests applicable to textile parameters – Normal test, t - test, Chi - square test and F - test - p-values - Selection of sample size and significance levels with relevance to textile applications - Acceptance sampling.

UNIT III ANALYSIS OF VARIANCE AND NON-PARAMETRIC TESTS

Analysis of variance for different models – Non - parametric tests - Sign test - Rank test - Concordance test.

UNIT IV PROCESS CONTROL AND CAPABILITY ANALYSIS

Control charts for variables and attributes - Basis, Development, Interpretation, Sensitizing rules, Average run length - Process capability analysis.

UNIT V DESIGN AND ANALYSIS OF EXPERIMENTS

$2^k$ full-factorial designs - Composite designs - Robust designs - Development of regression Models - Regression coefficients - Adequacy test - Process optimizations.

TOTAL : 60 PERIODS

OUTCOMES:

After completing this course, students should demonstrate competency in the following topics:

- Applications of distributions and estimation of parameters
- Use statistical tests in testing hypotheses on data.
- List the guidelines for designing experiments, recognize the key historical figures in Design of Experiments, conduct statistical tests and analyze the results.
- Analyze the significance of sampling and its techniques and different models using ANOVA
- Design and interpret the process control charts
- Analyze the experiments by applying suitable non-parametric tests

The students should have the ability to use the appropriate and relevant, fundamental and applied mathematical and statistical knowledge, methodologies and modern computational tools.
REFERENCES:


TX5201 COLOURATIONS AND FUNCTIONAL FINISHES

OBJECTIVES
- To enable the students to learn various finishes applied on the textile fabrics for different applications.

UNIT I INKJETPRINTING 12
Concept and, methods of inkjet printing; colour separation; selection of dyes and developments in inks; techno-economical features.

UNIT II ENZYMESINPROCESSING 12
Enzymes; Enzymes Kinetics; Enzymes in Chemical processing

UNIT III COATING 12
Coating polymers and auxillaries; Coating techniques and Coated fabric assessment.

UNIT IV SOILRELEASEANDANTISTATICFINISHING 12
Detergency and soil release concepts; soil release agents; applications of soil-release finishes and testing; antistatic finishes—measurement, mechanism and antistatic agents applied on substrates.

UNIT V UVPRETECTION ANDAPPLICATIONSOFNANOTECHNOLOGY 12
UV radiation; factors affecting UV protection; UV protection finishes; measurement of UV protection. Synthesis of Nanomaterials used in Textiles; Nanocoating methods on textile substrates.

TOTAL: 60 PERIODS

OUTCOME
- Upon completion of this course, the student shall be able to state the Need for functional finishes and methods of application of finishes and its evaluation

REFERENCES

TX5202 TEXTILE QUALITY EVALUATION L T P C
3 0 0 3

OBJECTIVES
To make the students to
- Understand different characteristics of yarns and fabrics
- Understand the effects of fabric characteristics on its end uses
- Test the yarn and fabric samples
- Analyze the various reports generated during quality evaluation of yarns and fabrics and
- Interpret the results obtained through these reports for process and quality control.

UNIT I MASS VARIATION OF TEXTILE STRANDS
Depiction of mass variation of textile strands in time and frequency domain; interpretation and significance of U% and CV% for textile strands; classification and analysis of yarn faults created by mass variation

VARIANCE LENGTH CURVES AND SPECTROGRAM OF TEXTILE STRANDS
Effect of specimen length and total length on mass variation measurements of textile strands; theory of construction of VL curve; analysis of variance length curves to understand and avoid the introduction of mass variation during the spinning operation; determination of periodic mass variation in the form of spectrogram; determination of theoretical wave length from spectrum; comparison between normal and ideal spectrum; type of faults and their representation in spectrogram; interpretation of superimposed waves in spectrogram

UNIT II TENSILE PROPERTIES OF YARN
Influence of testing factors on yarn tensile properties; measurement and application of yarn modulus; creep and stress relaxation of yarn; significance of estimating minimum yarn strength

UNIT III MECHANISM OF FABRIC FAILURE
Mode of fabric failure – tensile, tear, abrasion, slippage, bursting and fatigue; influence of fibre, yarn characteristics and fabric structure on fabric failure
UNIT IV  COMFORT AND LOW STRESS MECHANICAL PROPERTIES

Role of transmission properties on thermal properties and thermal comfort viz., air permeability, water vapour permeability, resistance to penetration of liquid water, resistance to flow of heat and electrical conductivity; low stress mechanical properties during tensile, compression, bending, shear and buckling deformation; influence of low stress mechanical properties of fabrics on fabric handle, tailorability and sewability

UNIT V  FABRIC APPEARANCE AND OTHER PROPERTIES

Study of fabric appearance in terms of drape, formability, crease recovery, wrinkle recovery and pilling resistance; influence of fibre, yarn characteristics and fabric structure on the fabric appearance; evaluation of fabric properties like dimensional stability, flammability, impact resistance, absorbency

OUTCOMES

Upon completion of this course, the student shall be able to apply the knowledge gained to

- Analyze and interpret the results obtained from quality evaluating systems of yarns and fabrics and
- Design fabrics with appropriate characteristics for the required end uses.

TOTAL : 45 PERIODS

REFERENCES

OBJECTIVES
To enable the students to learn about
- The structure of ideal and real yarn, migration of fibres in the yarn, breakage mechanism of yarn, mechanics of blended yarns and relationship between structure and property of yarns.
- Geometrical properties of fabrics and its relationship with the mechanical properties of fabric and

UNIT I
GEOMETRY OF TWISTED YARNS
Idealized helical yarn structure; yarn count and twist factors, twist contraction; Limits of twist.
Packing of Fibers in Yarns
Idealized packing; measurement of packing density and radial packing density of yarn; Packing in actual yarns; Specific volume of yarns; measurement of yarn diameter.

UNIT II
FIBRE MIGRATION
Ideal migration, tracer fibre technique, characterization of migration behavior, migration in spun yarns, mechanisms of migration, effect of various parameters on migration behavior.

UNIT III
MECHANICS OF CONTINUOUS FILAMENT YARNS
Analysis of tensile behavior; prediction of breakage; analysis of yarn modulus by energy method; observed extension and breakage of continuous filament yarns;
MECHANICS OF STAPLE FIBRE YARNS
Theoretical analysis of tensile behavior; deduction based on fiber obliquity and slippage; influence of fiber length, fineness and friction on tensile behavior ; strength prediction model for blended yarns.

UNIT IV
GEOMETRY OF CLOTH STRUCTURE
Geometry of Plain and Non-Plain weaves; Peirce and Olofsson models; crimp ratio and thread spacing; Jamming of threads; Crimp interchange; Balance of crimp.
FABRIC DEFORMATION
Fabric deformation under tensile stress; prediction of modulus; tensile properties in bias direction; other fabric deformation – compression, shear, bending and buckling; fabric handle; spiral and skewness formation and its control.

UNIT V
KNITTED FABRIC STRUCTURES
Geometry of weft and warp knitted structures, influence of friction on knit geometry; load extension of warp knit fabrics; biaxial stress behavior of plain-knit fabrics
NONWOVEN STRUCTURES
Structure of felts; mechanical behavior of needle felts; structure of stitch bonded fabrics
OUTCOME
Upon completion of this course, the student shall be able to apply the knowledge gained to
- Estimate the parameters related by structure of yarn and
- Engineer the structure of yarn with required properties and end uses.
- Determine the geometrical parameters of woven, knitted and bonded fabrics and
- Correlate the geometry of fabric with the mechanical properties of fabrics

REFERENCES

TX5251 CLOTHING SCIENCE L T P C
4 0 0 4

OBJECTIVES
To enable the students to learn about the
- Important characteristics of the fabric responsible for its comfort properties and
- Different phenomena which take place in the fabric related to the comfort properties of the fabric.

UNIT I CONCEPT OF CLOTHING
Need and selection of clothing - definition of comfort - components of clothing comfort - Subjective perception of comfort: Psycho-Physiological factors of clothing - Aesthetic concepts of clothing - Various aspects of clothing comfort: thermal comfort - sensorial comfort - body movement comfort. Comfort variables: Thermal and non-thermal comfort variables

UNIT II THERMAL MANAGEMENT IN CLOTHING

UNIT III MOISTURE MANAGEMENT IN CLOTHING
Moisture transport - Liquid water transfer: wicking and water absorption - Principles of moisture vapour transfer - Evaluation of moisture vapour transmission - Factors affecting heat and mass transfer through fabrics- Parameters expressing heat and mass transmission- Air permeability and measurement.
UNIT IV COMFORT PROPERTIES OF FIBERS, YARNS AND FABRICS 12

UNIT V COMFORT PROPERTY OF CLOTHING 12

OUTCOME
Upon completion of this course, the student shall be able to

- Understand different phenomena such as wetting, wicking and, heat and moisture interaction and
- Correlate the property of the fabric with comfort to the wearer.

REFERENCES:

TX5211 TEXTILE QUALITY EVALUATION LABORATORY L T P C
0 0 2 1

OBJECTIVE:
- To practice the students in testing of fibres, yarns and fabrics for important properties.

List of Experiments

1. Testing of neps in card web, sliver, roving and yarns
2. Testing of yarns for appearance, twist and diameter using microscope
3. Measurement of evenness and hairiness
4. Analysis of evenness, hairiness data, diagram, spectrogram and VL curve
5. Measurement of single yarn tensile properties
6. Analysis of tensile property values and stress strain diagrams
7. Measurement and classification of yarn faults
8. Analysis of yarn faults
9. Study of creep and stress relaxation behavior of yarns and fabrics

OUTCOMES:
After the completion this practical course, the students will be able to

- Evaluate fiber, yarn and fabric characteristics using different equipments
- Analyse the results generated from these equipments
- Apply statistical techniques for better explanation
Outcomes:
After the completion this practical course, the students will be able to
- Use different tools in computer aided textile design software
- Development of Dobby design, Jacquard design and various motifs using software tools

List of Equipments (1 each for 30 students)
Projection Microscope, Nep Count Template, Wrap Reel, Wrap Block, Yarn Twist Tester, Single Yarn Strength Tester, Yarn Unevenness tester, Weighing balance, Yarn appearance Board Winder, Yarn appearance Board (Standards), Yarn fault classifier (optional)

TOTAL: 30 PERIODS

TX5311 COMPUTER AIDED TEXTILE DESIGN
OBJECTIVE:
- To impart practical knowledge to the students in developing various textile designs using software.

LIST OF EXPERIMENTS
1. Different tools used in computer aided textile design software
2. Development of Dobby design with different weaves
3. Development of Jacquard design for any two designs
4. Development of various motifs using software tools

TOTAL: 30 PERIODS

Equipment required for 30 students
Licensed CAD textile design software – 6 licenses
Computer – 6 No.

OUTCOMES:
After the completion this practical course, the students will be able to
- Use different tools in computer aided textile design software
- Development of Dobby design, Jacquard design and various motifs using software tools

TX5001 ALTERNATIVE SPINNING SYSTEMS
OBJECTIVES
To enable the students to learn the
- Theory of yarn formation by rotor spinning, friction spinning, air-jet spinning and other spinning systems and
- Effect of process parameters used in the spinning system on yarn quality.

UNIT I ROTOR SPINNING
Principle of open end spinning; description of the working of the rotor spinning; requirements of the raw materials; preparation of the sliver for rotor spinning; yarn formation and its structure; yarn withdrawal and winding; design of rotor, opening roller, transport tube, navel and their implications on production and yarn quality; developments in rotor spinning machine; production limits; process control; techno economic comparison with ring spinning.
UNIT II  FRICITION SPINNING
Principle of yarn formation - DREF-2, DREF-3 spinning systems; developments in friction spinning systems; raw material requirement; effect of process variables on yarn quality; application of these machines for different end products; the economics; technological limitations.

UNIT III  AIR-JET SPINNING
Description of the yarn production in air jet spinning machine; feasibility of higher draft applied in this machine; structure and quality of the air-jet spun yarn; raw materials requirement; process variables; production of by Airvortex system.

UNIT IV  OTHER SPINNING TECHNOLOGIES
Production of yarn in PLYfil, self twist, electrostatic, Bobtex spinning systems; working details of the production of double-rove yarns, wrap yarns and core spun yarns; use of raw materials; economics of these methods of yarn production; yarn characteristics and their applications.

OUTCOMES
Upon completion of this course, the student shall be able to select
- Process parameters for producing better quality yarn and
- Spinning system to be used (a) for raw materials of different qualities and types and (b) to produce yarn for specific end use.

REFERENCES
5. Lord P.R., " Yarn Production; Science, Technology and Economics ", The Textile Institute, Manchester, 1999.

TX5002  CHARACTERIZATION OF TEXTILE POLYMERS  L T P C
3 0 0 3

OBJECTIVES
- To enable the students to learn about different characteristics of polymers used in the production of textile fibres and their evaluation.

UNIT I  MOLECULAR WEIGHT
Polymer solution thermo dynamics; molecular weight and molecular dimensions by end
group analysis, osmometry, light scattering, viscometry, gel permeation chromatography, high performance liquid chromatography.

UNIT II MOLECULAR STRUCTURE CHARACTERISATION 13
Infrared, NMR, UV-visible, Raman spectroscopy, mass spectroscopy

UNIT III THERMAL PROPERTIES 9
Thermal properties by differential scanning calorimetry, differential thermal analysis, thermo gravimetry, thermo-mechanical analyzer, dynamic mechanical and dielectric analysis

UNIT IV OTHER PROPERTIES 14
Optical and electron microscopy; TEM, SEM, AFM, X-ray scattering from polymers, birefringence, crystallinity by density measurements, Surface area, pore volume measurements by B.E.T. method, porosimetry, surface energy measurements and particle size measurement.

OUTCOMES
- Upon completion of this course, the student shall be able to interpret data obtained from various analytical instruments.

REFERENCES

TX5091 MEDICAL TEXTILES L T P C 3 0 0 3

OBJECTIVES
To enable the students to learn about
- Different types of biomaterials and
- Biomedical application of textile structures.

UNIT I 9
Biomaterials–introduction, types; natural, polymeric and biological biomaterials

UNIT II 9
Textile based healthcare and hygiene products; application of nano technology in medical hygiene textiles; advanced textile materials in healthcare; infection control and barrier materials; plasma treated barrier materials.
UNIT III
Bandages and pressure garments - elastic and non elastic compression bandages, support and retention bandages; bandaging textiles; evaluation of bandages; bandages for various end uses.

UNIT IV
Wound – types, healing process; requirements of wound dressing; wound care materials – types, advantages and limitations; Testing of wound dressings; advanced wound dressings

UNIT V
Implantable products; sutures – requirements, classifications, specifications, materials and their applications; vascular grafts, artificial ligaments, artificial tendons; scaffolds for tissue engineering; intelligent textiles for medical applications

OUTCOMES
Upon completion of this course, the student shall know the
- Types of materials available for biomedical applications
- Functional requirements of textile structures for specific end uses and
- Selection and characterization of textile materials used for biomedical applications.

TOTAL: 45 PERIODS

REFERENCES

TX5003 THEORY OF DRAFTING AND TWISTING L T P C
3 0 0 3

OBJECTIVES
- To enable the students to learn about theory of drafting, twist insertion in ring and alternate spinning systems.

UNIT I
Definition of ideal drafting; conditions required to achieve ideal drafting in a roller drafting system; deviations from ideal drafting situation during actual drafting conditions.
UNIT II
Drafting Wave – Condition for drafting wave formation during roller drafting, methods to avoid drafting wave formation, role of apron in controlling drafting wave formation.
Roller Slip – Conditions for the formation of forward and backward slips in the roller drafting systems, measures to avoid roller slip occurrence, causes and control of roller nip movement and roller speed variation during drafting.

UNIT III
Comparison of roller drafting system with wire point drafting system; application of wire point drafting in card and rotor spinning machine.

UNIT IV
Mechanics of imparting strength to a stable-fibre strand by twisting; twist multiplier and the basis of selection of required twist; principles of false twisting; fundamental requirements to create real twist in the strand.

UNIT V
Principle of twist insertion in ring spinning; limitation of ring twisting; principles of twist insertion in open-end spinning; application of this principle in rotor spinning and friction spinning machines; twist formation in air jet spinning and vortex spinning; principle of two-for-one twisting; operating principle involved in the twisting of wrap spun yarns.

OUTCOMES
Upon completion of this course, the student shall be able to
- understand the theory of drafting and principle of twist insertion in ring and other alternative spinning systems.

REFERENCES

TX5092 HIGH PERFORMANCE AND SPECIALITY FIBRES L T P C 3 0 0 3

OBJECTIVES
To enable the students to learn about
- Advanced spinning technology for manufacturing high performance fibres, their properties and applications
UNIT I  ADVANCED SPINNING TECHNOLOGY
Advances in conventional fibre forming process; gel spinning; liquid crystal spinning; electro-spinning

UNIT II  HIGH PERFORMANCE FIBRES FOR工業 APPLICATIONS
Manufacturing, properties and applications of glass fibres, basalt fibres; carbon fibres, high performance polyethylene fibres; ceramic fibres

UNIT III  HIGH PERFORMANCE FIBRES FOR MEDICAL APPLICATIONS
Manufacturing, properties and applications of alginate fibres; chitosan fibres; regenerated silk and wool protein fibres; synthetic biodegradable fibres

UNIT IV  SPECIALITY FIBRES
Hollow and profile fibres; blended and bi-component fibres; film fibres and functionalized fibres for specific applications; manufacturing, properties and applications of chemical and thermal resistant fibres

TOTAL: 45 PERIODS

OUTCOMES
Upon completion of this course, the student shall be able to
- Understand the method of producing high performance fibres
- Select a high performance fibres for right type of end uses

REFERENCES

TX5093  NANO TECHNOLOGY IN TEXTILES  L T P C
3 0 0 3

OBJECTIVES
- To enable the students to study about
- basic concepts of Nano Technology, preparation, characterization and application of various particles on textile substrates and principle and factors involved in electrospinning

UNIT I
Nano Technology: definition and basic concepts, particle size, nano particles; Different types of process: Top down approach, bottom up approach; Synthesis of nano materials used in textiles.

UNIT II
Preparation, characterization, and application of silver, iron, ZnO, TiO₂, MgO, SiO₂, Al₂O₃. Indium-tin oxide on textile substrates
UNIT III 9
Preparation, Characterisation and application of Ceramic, Carbon black, Clay, and CelluloseNanowhiskers; Self- assembled nanolayer films; Nano structuring of polymers with cyclodextrins,

UNIT IV 9
Preparation, Characterization and properties of CNT, application of CNT in polymer and textiles. Effect of process conditions upon CNT structure and properties

UNIT V 9
Principle of electrospinning. Factors involved in electrospinning of nanofibres; methods to produce nanoyarns,Ecological considerations of nanoparticles and nanofibres

TOTAL: 45 PERIODS

OUTCOMES
Upon completion of this course, the student shall be able to know about
- Basic concepts of Nano Technology preparation,
- Characterization and application of various particles on textile substrates
- Principle and factors involved in Electrospinning

REFERENCES:

TX5004 PROCESS CONTROL AND OPTIMIZATION IN YARN SPINNING L T P C
3 0 0 3

OBJECTIVES:
To enable the students to understand
- The process control at different stages of spinning preparatory and ring spinning process to achieve yarn of required quality

UNIT I BLOWROOM PROCESS 9
Opening and cleaning efficiency-assessment and control; optimization of trash removal, control of lint in waste; causes for nep generation, control; role of blowroom accessories; assessment and control of blowroom output quality, its influence on yarn quality; process changes for processing manmade fibres
UNIT II CARDING PROCESS
Optimization of trash removal – its influence on quality, control of lint in waste; nep removal efficiency, cleaning efficiency – factors, control; hooks formation; levelling – optimization; assessment and control of card sliver quality, its influence on yarn quality; process changes for processing manmade fibres

UNIT III DRAWFRAME PROCESS AND COMBING PROCESS
Levelling in drawframe-optimization; blended yarn production- blending irregularity assessment and control; hooks straightening in roller drafting arrangement; quality of drawframe sliver-assessment and control, its influence on yarn quality; quality of comber lap - control of comber preparatory process; noil%, combing efficiency and neps removal efficiency of comber – assessment and control; hooks removal

UNIT IV ROVING AND YARN PRODUCTION PROCESSES
Roving quality-assessment and control, its influence on yarn quality; ring spinning- control of end breakage rate; quality of yarn-assessment and control; changes for processing manmade fibres; classification of yarn defect, control of yarn defects

UNIT V PRODUCTION CONTROL
Factors affecting the production limits of the spinning machinery; new concepts in achieving higher production in the spinning machinery; role of humidity and machinery maintenance- production and quality; computation of the labour and machine productivity indices

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to
• Understand the process variables and their control at different stages of ring yarn production
• Analyse the test results and hence control the process
• Compute different indices of machine and labour productivity

REFERENCES
4. Lord P.R., “Yarn Production; Science, Technology and Economics”, The Textile Institute, Manchester, 1999
OBJECTIVES
To enable the students to learn about

- Enzymes, types and kinetics of enzyme reaction on textile fibres
- Application of enzymes on different fibres and
- Treatment of enzyme effluents.

UNIT I  ENZYMES
Nomenclature and classification of enzymes; characteristic features of enzymes; modifiers of enzyme activity - activators and inhibitors; specificity of enzyme action; extraction and purifications of enzymes.

UNIT II  ENZYME KINETICS
Kinetics of single-substrate enzyme-catalysed reactions; Basics of kinetics of multi-substrate enzyme-catalysed reactions.

UNIT III  ENZYMES FOR COTTON FIBRE
Chemistry and structure of cotton fibre; enzymes in pretreatment of cotton substrates – desizing, scouring, bleaching and bio finishes.

UNIT IV  ENZYMES FOR OTHER FIBERS
Enzymes for processing and functionalizing protein fibres; enzymatic modification of polyester, polyamide, polyacrylonitrile and cellulose acetate fibres.

UNIT V  ENZYMES IN EFFLUENT TREATMENT
Enzyme technology and biological remediation, Enzyme decolourisation and decolouration by biosorption and enrichment cultures.

TOTAL : 45 PERIODS

OUTCOMES
Upon completion of this course, the student shall be able to

- Give the rationale for selecting enzymes for particular processing and
- Appreciate limitations of existing processing operations using chemicals.

REFERENCES
OBJECTIVES
To enable the students to learn about
- Costing of textile products
- Different sources of finance, cost of capital and investment appraisal techniques
- Financial statements

UNIT I
Goals and functions of finance; types of costs; costing – concepts, classification; preparation of
cost sheet; costing of yarn, fabric and garments; breakeven analysis

UNIT II
Investment appraisal; Payback period method, Accounting Rate of Return; DCF methods - IRR,
NPV, PI; depreciation - concept, methods

UNIT III
Capital structure; sources of finance-debt, equity; cost of capital; working capital
management; estimation of working capital

UNIT IV
Tools of financial analysis and control – profit and loss account, balance sheet; financial ratio
analysis; analysis of operating and financial leverage; dividend policy; illustrations for
spinning mill, composite mill and garment industry

OUTCOMES
Upon completion of this course, the student shall be able to
- Calculate the cost of yarn, fabric and garment
- Identify the sources for capital and calculate cost of capital
- Calculate depreciation and carryout investment appraisal
- Interpret and analyze financial statements

TOTAL: 45 PERIODS

REFERENCES
2000.
2. Bhave P.V. and Srinivasan V., “Costing accounting to textile mills”, ATIRA, Ahmadabad,
1976.
5. Khan and Jain, “Basic financial management and practice”, Tata McGraw Hill, New Delhi,
Delhi, 1988.

TX5005 DESIGN CONCEPTS IN HIGH SPEED FABRIC FORMATION L T P C
3 0 0 3

OBJECTIVES
- To enable the students to study about developments in preparatory processes, 3D fabric formation and machineries of technical fabric production.

UNIT I
Developments in the design of winding, warping and sizing machines for improving quality of preparation and productivity of preparatory processes.

UNIT II
Theoretical analysis of weft Insertion in shuttleless looms – rapier, projectile movement, jet profile in air jet loom; developments in the design of pick insertion systems, shed forming mechanisms, developments in other auxiliary mechanisms

UNIT III
Developments in 3D fabric formation, different principles involved in 3D fabric formation

UNIT IV
Developments in narrow width fabric, carpets and braids manufacturing

UNIT V
Developments in weft knitting and warp knitting machines for technical fabrics

TOTAL: 45 PERIODS

OUTCOMES
Upon completion of this course, the student shall be able to know about
- Improving productivity in the preparatory processes and developments in technical fabric production.

REFERENCES:

TX5006 MANAGEMENT OF TEXTILE EFFLUENTS

OBJECTIVES
To enable the students to learn about
- Pollutants from textile chemical processing industry, treatment and Government regulations.

UNIT I
Industrial policy of India; pollution monitoring and control; functions and activities of Ministry of environment; Central and State pollution control boards; environmental clearance and guidelines for industries; environment impact assessment; fiscal incentives for environmental protection; environmental auditing.

UNIT II
Wastewater characteristics; wastewater treatment - objectives, methods and implementation considerations; recycling of effluents.

UNIT III
Identification and reduction of pollution sources in textile wet processing; pollution control in man-made fibre industry; analysis of textile processing effluents – colour, odour, pH, total solids, suspended solids, total dissolved solids, BOD, COD, total alkalinity, chloride, sulphates, calcium and chromium; tolerance limits for effluents; bio-degradability of textile chemicals and auxiliaries.

UNIT IV
Technical regulations on safety and health aspects of textile materials – banned dyes and chemicals; eco labeling, eco friendly textile processes - machines and specialty chemicals; natural dyes and environmental considerations.

UNIT V
Need for solid and hazardous waste management in textile industry, types and sources of solid and hazardous wastes, storage, collection and transport of wastes, waste processing technologies, waste disposal

TOTAL : 45 PERIODS
OUTCOMES
Upon completion of this course, the student shall know
- The hazards due to pollutants from textile chemical processing industry
- Method of treatment of pollutants
- Managing pollutants as per Government regulations and Methods of green processing.

REFERENCES

TX5094 TEXTILE REINFORCED COMPOSITES L T P C
3 0 0 3

OBJECTIVES
To enable the students to learn about
- Reinforcements, matrices used for the composites
- Manufacture and testing of composites and
- Mechanics of failure of composites

UNIT I REINFORCEMENTS
Manufacturing, properties and applications of Glass, Quartz, Boron, Silicon carbide, Carbon, HPPE and Aramid fibers.

UNIT II MATRICES
Preparation, Chemistry, Properties and applications of thermoplastic and thermoset resins-Unsaturated Polyester, Vinyl Ester, Epoxy, Phenolics, polyimides, polyurethanes, polyamides, Polypropylene, PEEK and Polycarbonate

UNIT III COMPOSITE MANUFACTURING
Composites manufacturing for both thermoplastics and thermosets- Hand layup, Filament
Winding, Resin transfer moulding, preregs and autoclave moulding, pultrusion, vacuum impregnation methods, compression moulding; post processing of composites and Composite design requirements

UNIT IV TESTING
Fibre volume and weight fraction, specific gravity of composites, tensile, flexural, impact, compression, interlaminar shear stress and fatigue properties of thermoset and thermoplastic composites.

UNIT V MECHANICS
Micro mechanics, macro mechanics of single layer, macro mechanics of laminate, classical lamination theory, failure theories and prediction of interlaminar stresses using software

TOTAL: 45 PERIODS

OUTCOMES
Upon completion of this course, the student shall be able to

- Select different types of textile reinforcements and matrices for the manufacture of composites for getting different characteristics and
- Evaluate the characteristics of composites

REFERENCES

TX5007 CONTROL SYSTEMS AND AUTOMATION IN TEXTILE ENGINEERING L T P C
3 0 0 3

OBJECTIVES
To enable the students to know about the

- Automation and control systems in spinning, weaving and processing textile machinery.

UNIT I INTRODUCTION ABOUT CONTROL SYSTEM
Instrumentation and Transducers: Functional Description of Instruments; Types and applications of Instrumentation - generalized configuration - Tribo electric pick-up, Infrared Transducers - Torque Measurement Elastic transducers - sound level meter - vibration measurements. Control System Components: Basics of control system – Control system examples - Stepper motors - Hydraulic valves - Pneumatic switches, proximity switches and flapper valves - Hydraulic and Pneumatic automation in textile machines- simple sequential logic circuit design - Programmable Logic
Controllers (PLC), Block diagram – programming methods – programs – applications of PLC in textile machinery.

UNIT II   INDUSTRIAL AUTOMATION  9

UNIT III  CONTROL SYSTEM & AUTOMATION IN SPINNING INDUSTRY  9

UNIT IV  CONTROL SYSTEM & AUTOMATION IN WEAVING INDUSTRY  9

UNIT V   COMPUTERISED PROCESSING IN TEXTILES  9

TOTAL : 45 PERIODS

OUTCOMES
• Upon completion of this course the student shall be able to know about the Need and techniques of automation in spinning , weaving and processing textile machinery.

REFERENCES:
OBJECTIVES

To make the students to learn about the

- Fundamentals of experimental design and
- Selection of suitable design and analysis of the results

UNIT I  EXPERIMENTAL DESIGN FUNDAMENTALS  9
Importance of experiments, experimental strategies, basic principles of design, terminology, ANOVA, steps in experimentation, sample size, normal probability plot, linear regression model.

UNIT II  SINGLE FACTOR EXPERIMENTS  9
Completely randomized design, Randomized block design, Latin square design. Statistical analysis, estimation of model parameters, model adequacy checking, pair wise comparison tests, in respect of textile process, machine and quality parameters.

UNIT III  MULTIFACTOR EXPERIMENTS  9
Two and three factor full factorial experiments, 2K factorial Experiments, Confounding and Blocking designs; application in textile experiments.

UNIT IV  SPECIAL EXPERIMENTAL DESIGNS  9
Fractional factorial design, nested designs, Split plot design, Introduction to Response Surface Methodology, Experiments with random factors, rules for expected mean squares, approximate F-tests for textile applications.

UNIT V  TAGUCHI METHODS  9
Steps in experimentation, design using Orthogonal Arrays, data analysis, Robust design control and noise factors, S/N ratios, parameter design, case studies related to textile engineering.

TOTAL: 45 PERIODS

OUTCOME
Upon completion of this course, the student shall be able to

- Design the experiment suitable for a given study and
- Conduct statistical tests and analyze the results to arrive at the conclusions.

REFERENCES

TY5091 ADVANCES IN TEXTILE PRINTING

OBJECTIVES
- To enable the students to study about
- evolution of digital printing, digital image and colour management, pre treatments for inkjet printing, quality evaluation and special printing techniques

UNIT I
Ink jet printing-evolution of digital printing, Comparision with conventional printing techniques, theoretical foundations for inkjet technologies- Continuous and drop on demand technologies

UNIT II
Digital image design, editing and data storage systems, Pixel and image formation in digital printers, Digital colour management- Colour gamut and rendering intent, Colour communication.

UNIT III
Pretreatment of substrates for inkjet printing; Ink jet heads;Inks used for printing- dye fibre interaction, surface energy of inks, dye ink formulation; fixation procedures for inks on substrates; washing of ink jet prints; heat and sublimation printing.

UNIT IV
Quality evaluation of textile substrates used for ink jet printing and inks used for inkjet printing, advantages and limitation in inkjet printing, technoecnomics of ink jet printing.

UNIT V
Special printing techniques- Developments in Photo printing, Blast printing with Indigo, Developments in Xerox printing and Laser printing for fancy effects; Yarn printing; printing of carpets, velvets and knits; Ecofriendly alternatives for auxillaries used in conventional printing

TOTAL :45 PERIODS

OUTCOMES
- Upon completion of this course the student shall be able to know about evolution of digital printing, digital image and colour management
- Pre treatments for inkjet printing
- Quality evaluation and special printing techniques

REFERENCES
OBJECTIVES:
To enable the students to understand about
  • Functional requirements of protective clothing
  • Selection of fibre, yarn and fabric for developing protective clothing
  • Evaluation of protective clothing

UNIT I  FIBRE REQUIREMENTS  9
Suitability and properties of high performance fibres for various protective clothing – chemical composition and physical structure

UNIT II  YARN AND FABRIC REQUIREMENTS  9
Types of yarns; woven, knitted and non - woven fabric structures, methods of production, effect of structure on their performance

UNIT III  CLOTHING CONSTRUCTION  9
Method of construction of garments according to various protective end uses like protection against cold, ballistic protection, use of different fabric type (knitted, woven, and Non-woven), coated / laminated in different places; use of inter lining and composites; 3D structures; high tech textiles – variable electronics; protective garments for industrial and apparel end uses

UNIT IV  FINISHING OF PROTECTIVE CLOTHING  9
Types of finishes - fire retardant finishes, water repellant finishes, anti - microbial finishes; chemical finishes against radiation and chemicals; method of application of finishes; protective finishes for health care garments

UNIT V  QUALITY EVALUATION  9
Evaluation of protective fabrics; desirable properties of protective textiles, method of testing for thermal protective performance, abrasion and wear resistance, evaluation of resistance to mildew, ageing, sunlight, chemical, electrostatic and electrical resistivity, impact properties; ASTM standards for protective garments

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to
  • Select fibre, yarn and fabric for developing protective clothing for different applications
  • Understand different types of finishes given to develop protective clothing
  • Understand the evaluation of protective clothing

REFERENCES:

PROJECT PLANNING AND MANAGEMENT

OBJECTIVES

- To enable the students to study about
- the introduction to project management, planning and budgeting process, scheduling and resource allocation, control and completion, project organization and conflict management

UNIT I

INTRODUCTION TO PROJECT MANAGEMENT: Project Management – Definition, Goal; Lifecycles; project selection methods; project formulation; project manager – roles, responsibilities and selection; project teams

UNIT II

PLANNING AND BUDGETING: Planning process – work break down structure, role of multidisciplinary teams; budgeting the project – Methods; cost estimating and improvement; budget uncertainty and risk management

UNIT III

SCHEDULING & RESOURCE ALLOCATION: PERT & CPM Networks, crashing; project uncertainty and risk management; simulation, Gantt charts, expediting a project – resource loading and leveling; allocating scarce resources, Goldratt’s Critical Chain
UNIT IV

CONTROL AND COMPLETION: Plan-Monitor-Control cycle; data collecting and reporting; project control; designing the control system; project evaluation, auditing and termination

UNIT V

PROJECT ORGANISATION & CONFLICT MANAGEMENT: Formal organisation structure; Organisation design, types of project organizations; conflict – origin & consequences; managing conflict, team methods for resolving conflict.

OUTCOMES
Upon completion of this course the student shall be able to know

- Introduction to project management, planning and budgeting process
- Scheduling and resource allocation
- Control, Completion, Project organization and Conflict management

REFERENCES


TX5008 PROCESS CONTROL IN TEXTILE WET PROCESSING  L T P C
3 0 0 3

OBJECTIVES
To enable the students to study about

- the process control at machinery involved in the chemical processing, familiarize the importance of process and quality control and various quality control tests involved in chemical processing

UNIT I

UNIT II
Determination of ash content – Determination of Whiteness and Whiteness retention - Determination of Barium Activity number – Shrinkage of fabric – Determination of Light fastness by xenon Arc lamp – Determination of fastness to Washing – Determination of fastness to Dry and Wet rubbing –
Determination fastness to Alkaline and Acidic Perspiration – Determination fastness to Hotpressing – Determination fastness to Dry cleaning and sublimation.

UNIT III

UNIT IV

UNIT V

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to
- Measure the quality particulars of textile material at different stages of chemical processing and know the standards
- carry out the various process and quality control measures during the chemical processing of textile materials

REFERENCES:
1. AATCC Technical manual, 2008 Association of Textile chemists and Colorists. USA.