## SEMESTER I

<table>
<thead>
<tr>
<th>S. No.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</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>
</tr>
<tr>
<td>1</td>
<td>PTMA7151</td>
<td>Applied Mathematics</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>PTPH7151</td>
<td>Engineering Physics</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>PTCY7151</td>
<td>Engineering Chemistry</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>PTGE7151</td>
<td>Computing Techniques</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>PTGE7154</td>
<td>Engineering Graphics</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL CREDITS</strong></td>
<td>15</td>
<td>0</td>
<td>0</td>
<td>15</td>
</tr>
</tbody>
</table>

## SEMESTER II

<table>
<thead>
<tr>
<th>S. No.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</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>
</tr>
<tr>
<td>1.</td>
<td>PTLT7201</td>
<td>Chemistry for Leather Technologists</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>PTLT7202</td>
<td>Instrumental Methods of Analysis for Leather Technologists</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>PTLT7203</td>
<td>Introduction to Leather Manufacture</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>PTLT7204</td>
<td>Principles of Electrical and Electronics Engineering</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>PTLT7205</td>
<td>Theory of Skin Proteins and Pre-tanning Processes</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL CREDITS</strong></td>
<td>15</td>
<td>0</td>
<td>0</td>
<td>15</td>
</tr>
</tbody>
</table>

## SEMESTER III

<table>
<thead>
<tr>
<th>S. No.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</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>
</tr>
<tr>
<td>1.</td>
<td>PTLT7301</td>
<td>Bovine Leather Manufacturing Technologies</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>PTLT7302</td>
<td>Leather Biotechnology and its Application in Leather</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>PTLT7303</td>
<td>Principles of Unit Operations and Processes in Leather and Leather Chemicals Manufacture</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>PTLT7304</td>
<td>Theory of Material Testing of Leathers</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>PTLT7305</td>
<td>Theory of Organic and Inorganic Tannages</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>TOTAL CREDITS</strong></td>
<td>15</td>
<td>0</td>
<td>0</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>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></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>PTLT7401</td>
<td>Environmental Science and Engineering for Leather Sector</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>PTLT7402</td>
<td>Leather Machineries</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>PTLT7403</td>
<td>Technology of Light Leather Manufacture from Skins</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>PTLT7404</td>
<td>Theory and Practice of Post Tanning Processes</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>Elective - I</td>
<td></td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL CREDITS</td>
<td></td>
<td></td>
<td>15</td>
<td>0</td>
<td>0</td>
<td>15</td>
</tr>
</tbody>
</table>

### SEMESTER V

<table>
<thead>
<tr>
<th>S. No.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></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>PTLT7501</td>
<td>Eco-benign Options for Leather Processing</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>PTLT7502</td>
<td>Leather Goods and Garments Technology</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>PTLT7503</td>
<td>Theory and Practice of Leather Finishing</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>Elective - II</td>
<td></td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>Elective - III</td>
<td></td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL CREDITS</td>
<td></td>
<td></td>
<td>15</td>
<td>0</td>
<td>0</td>
<td>15</td>
</tr>
</tbody>
</table>

### SEMESTER VI

<table>
<thead>
<tr>
<th>S. No.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></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>PTLT7601</td>
<td>Footwear Technology</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>PTLT7602</td>
<td>Organisation and Management of Leather Manufacture</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>PTLT7603</td>
<td>Science and Technology of Leather Auxiliaries</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>Elective - IV</td>
<td></td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>Elective-V</td>
<td></td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL CREDITS</td>
<td></td>
<td></td>
<td>15</td>
<td>0</td>
<td>0</td>
<td>15</td>
</tr>
</tbody>
</table>

### SEMESTER VII

<table>
<thead>
<tr>
<th>S. No.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></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>PTLT7701</td>
<td>Entrepreneurship for Leather Sector</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>PTGE7074</td>
<td>Total Quality Management</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PRACTICAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>PTLT7711</td>
<td>Project</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL CREDITS</td>
<td></td>
<td></td>
<td>12</td>
<td>0</td>
<td>0</td>
<td>12</td>
</tr>
</tbody>
</table>

**TOTAL: 102 CREDITS**
<table>
<thead>
<tr>
<th>S. No.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>PTGE7071</td>
<td>Disaster Management</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>PTGE7072</td>
<td>Engineering Ethics and Human Values</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>PTGE7073</td>
<td>Human Rights</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>4.</td>
<td>PTGE7075</td>
<td>Intellectual Property Rights</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>PTGE7076</td>
<td>Fundamentals of Nano Science</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>PTLT7001</td>
<td>Advanced Physics and Chemistry of Leather I (APCL I)</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>7.</td>
<td>PTLT7002</td>
<td>Advanced Physics and Chemistry of Leather II (APCL II)</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>8.</td>
<td>PTLT7003</td>
<td>CAD/CAM for Leather Products Design and Manufacture</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>9.</td>
<td>PTLT7004</td>
<td>Computer Applications for Leather Products</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>10.</td>
<td>PTLT7005</td>
<td>Consumer Behavior and Business Orientation</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>11.</td>
<td>PTLT7006</td>
<td>Engineering Economics and Finance Management</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>12.</td>
<td>PTLT7007</td>
<td>Enterprise Resource Planning for Leather Sector</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>13.</td>
<td>PTLT7008</td>
<td>Fashion Forecasting for Leather Products</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>14.</td>
<td>PTLT7009</td>
<td>Human Resources Development</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>15.</td>
<td>PTLT7010</td>
<td>International Marketing and Foreign Trade</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>16.</td>
<td>PTLT7011</td>
<td>Leather and Leather Products Costing</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>17.</td>
<td>PTLT7012</td>
<td>Leather and Product Merchandising</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>18.</td>
<td>PTLT7013</td>
<td>Leather Products Machinery</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>19.</td>
<td>PTLT7014</td>
<td>Polymer Science</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>20.</td>
<td>PTLT7015</td>
<td>Safety in Leather Industries</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>21.</td>
<td>PTLT7016</td>
<td>Science and Technology of Leather Supplements and Synthetics</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>22.</td>
<td>PTLT7017</td>
<td>Technology of Animal and Tannery Byproducts Utilisation</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>23.</td>
<td>PTLT7018</td>
<td>Value Engineering in Leather Sector</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>
OBJECTIVE:
- To facilitate the understanding of the principles and to cultivate the art of formulating physical problems in the language of mathematics.

UNIT I  MATRICES  
Characteristic equation – Eigen values and Eigenvectors of a real matrix – Properties of eigen values and eigenvectors – Cayley Hamilton theorem – Diagonalization of matrices - Reduction of a quadratic form to canonical form by orthogonal transformation.

UNIT II  FUNCTIONS OF SEVERAL VARIABLES  

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

UNIT IV  COMPLEX INTEGRATION  

UNIT V  LAPLACE TRANSFORMS  

TOTAL: 45 PERIODS

OUTCOMES:
- To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow the of electric current.
- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

TEXT BOOK:

REFERENCES:
OBJECTIVE:
- To introduce the basic physics concepts relevant to different branches of Engineering and Technology.

UNIT I  PROPERTIES OF MATTER  9

UNIT II  ACOUSTICS AND ULTRASONICS  9

UNIT III  THERMAL AND MODERN PHYSICS  9

UNIT IV  APPLIED OPTICS  9

UNIT V  CRYSTAL PHYSICS  9
Single crystalline, polycrystalline and amorphous materials – Single crystals: unit cell, crystal systems, Bravais lattices, ditections and planes in a crystal, Miller indices - interplanar distance for a cubic crystal - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - structure and significance of NaCl, CsCl, ZnS and graphite - crystal imperfections: point defects, line defects – Burger vectors, dislocations and stacking faults – Growth of single crystals: Bridgman and Czochralski methods.

TOTAL: 45 Periods
OUTCOME:
- The students will acquire knowledge on the basics of physics related to properties of matter, optics, acoustics etc., and they will apply these fundamental principles to solve practical problems related to materials used for engineering applications.

TEXTBOOKS:

REFERENCES:

PTCY7151 ENGINEERING CHEMISTRY L T P C
3 0 0 3

OBJECTIVES:
- To develop an understanding about fundamentals of polymer chemistry.
- Brief elucidation on surface chemistry and catalysis.
- To develop sound knowledge photochemistry and spectroscopy.
- To impart basic knowledge on chemical thermodynamics.
- To understand the basic concepts of nano chemistry.

UNIT I POLYMER CHEMISTRY 9
Introduction: Functionality-degree of polymerization. Classification of polymers- natural and synthetic, thermoplastic and thermosetting. Types and mechanism of polymerization: addition (free radical, cationic, anionic and living); condensation and copolymerization. Properties of polymers: Tg, tacticity, molecular weight-weight average, number average and polydispersity index. Techniques of polymerization: Bulk, emulsion, solution and suspension.

UNIT II SURFACE CHEMISTRY AND CATALYSIS 9

UNIT III PHOTOCHEMISTRY AND SPECTROSCOPY 9

UNIT IV CHEMICAL THERMODYNAMICS 9
Second law: Entropy-entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Free energy and work function: Helmholtzand Gibbs free energy functions; Criteria of spontaneity; Gibbs-Helmholtz equation; Clausius Clapeyron equation; Maxwell relations-Van’t Hoff isotherm and isochore. Chemical potential; Gibbs-Duhem equation-variation of chemical potential with temperature and pressure.
UNIT V  NANO CHEMISTRY

TOTAL: 45 PERIODS

OUTCOMES:
• Will be familiar with polymer chemistry, surface chemistry and catalysis.
• Will know the photochemistry, spectroscopy and chemical thermodynamics.
• Will know the fundamentals of nano chemistry.

TEXT BOOKS:

REFERENCES:

PTGE7151  COMPUTING TECHNIQUES
(Common to all branches of Engineering and Technology)  L  T  P  C
3  0  0  3

OBJECTIVES:
• To learn programming using a structured programming language.
• To provide C programming exposure.
• To introduce foundational concepts of computer programming to students of different branches of Engineering and Technology.

UNIT I  INTRODUCTION
Introduction to Computers – Computer Software – Computer Networks and Internet - Need for logical thinking – Problem formulation and development of simple programs - Pseudo code - Flow Chart and Algorithms.

UNIT II  C PROGRAMMING BASICS

UNIT III  ARRAYS AND STRINGS

UNIT IV  POINTERS
Macros - Storage classes –Basic concepts of Pointers– Pointer arithmetic - Example Problems - Basic file operations
UNIT V FUNCTIONS AND USER DEFINED DATA TYPES

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, the student should be able to:
• Write C program for simple applications
• Formulate algorithm for simple problems
• Analyze different data types and arrays
• Perform simple search and sort.
• Use programming language to solve problems.

TEXT BOOKS:

REFERENCES:

PTGE7154 ENGINEERING GRAPHICS

L T P C
3 0 0 3

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

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

UNIT I PLANE CURVES AND FREE HAND SKETCHING

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

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

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES

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

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS

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

COMPUTER AIDED DRAFTING (Demonstration Only)

Introduction to drafting packages and demonstration of their use.

TOTAL : 45 PERIODS

OUTCOME:

- On completion of the course the students are expected to have a thorough knowledge on design of various engineering products and technical drawings.

TEXT BOOK:


REFERENCES:


Publication of Bureau of Indian Standards:


Special points applicable to University Examinations on Engineering Graphics:

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

- This course aims at introducing fundamental chemistry required for leather manufacture.

UNIT I  INTRODUCTION TO INORGANIC COMPOUNDS  10
A brief survey of the ‘s’ block - binary compounds, complexes, alkalides and electrides. Features of the ‘p’ block and its elements - expansion of the octet, Lewis structures; ‘d’ and ‘f’ orbitals and transition metals; Coordination compounds – nomenclature, Theories - Coordination theory, Werner’s theory; Ligand field theory; Introduction to inorganic tanning materials

UNIT II  MOLECULAR BONDING  9
Shapes of molecules - Valence Shell Electron Pair Repulsion method; Valence bond approach and atomic orbital hybridizations. LCAO-MO theory, pictorial derivation of bonding and anti-bonding molecular orbitals. MO energy level diagrams for homo nuclear di-atomics; Redox reactions.

UNIT III  ORGANIC TANNIN CHEMISTRY  10
Chemistry of condensed and hydrolysable tannins proanthocyanidins, dimers, trimers and other oligomers. Chemistry of sulphonyl chloride, quinone, oxazolidine, phosphonium and other organic tanning agents. Methods of preparation of vegetable tannin extracts, spray dried vegetable tannins, synthetic and other organic tannages.

UNIT IV  COLLOIDS & SURFACTANTS  10
Chemical and Physico-chemical types, properties; Rheology: Viscosity. Non-Newtonian flow and Viscoelasticity, Birefringence: electrical and streaming; Various Diffusional aspects and applications.

UNIT V  APPLICATION TO LEATHER TECHNOLOGY  6
Use of inorganic and organic materials in leather manufacture; Wetting theory, Cohesion & Adhesion.

TOTAL: 45 PERIODS

OUTCOME:

- At the end of the course the students will have basic knowledge of organic, inorganic and physical chemistry related to leather science and technology.

TEXT BOOKS:
8. Introduction to Colloid and Surface Chemistry, Duncan J. Shaw, Butternorth, Hewemann, (1992)
UNIT I INTRODUCTION TO SPECTROSCOPICAL METHODS OF ANALYSIS

ELECTROMAGNETIC RADIATION: Various ranges, Dual properties, Various energy levels, Interaction of photons with matter, absorbance, and transmittance and their relationship, Permitted energy levels for the electrons of an atom and simple molecules, classification of instrumental methods based on physical properties.

UNIT II MOLECULAR SPECTROSCOPY

Various transitions in organic and inorganic compounds effected by UV, visible and infrared radiations, various energy level diagrams of saturated, unsaturated and carbonyl compounds, excitation by UV and Visible radiations, Effects of auxochromes and effects of conjugation on the absorption maxima, Applications of UV-Visible and IR spectroscopy.

QUANTITATIVE SPECTROSCOPY: Beer-Lambert’s Law, Limitations, Deviations (Real, Chemical, Instrumental) Nesslerimetry. Estimation of dyes, Cr and Fe using Beer-Lambert’s Law

UNIT III ATOMIC SPECTROSCOPY

Atomic Absorption Spectrophotometry; Principle, Instrumentation and Application, Various interferences observed in AAS (Chemical, radiation and excitation); Flame photometry; Principle, Instrumentation and applications

UNIT IV POLARIMETRY AND REFRACTOMETRY

Polarimetry and refractometry Principle, instrumentation and Applications

UNIT V THERMAL ANALYSIS

Thermogravimetry: Instrumentation, applications, thermograms of some important compounds; Differential thermal analysis: principle, Instrumentation and applications, Principles and applications of DSC, DTA in leather and leather chemicals

UNIT VI CHROMATOGRAPHIC METHODS

Classification of chromatographic methods, column, Thin layer, paper, Gas, GPC, High performance liquid chromatographical methods (principles, mode of separation, instrumentation and technique) for the analysis of leather auxiliaries

TOTAL: 45 PERIODS

OUTCOME:

- Students will gain fundamental knowledge on various physico-chemical analytical methods and understand the underpinning science behind various instrumental techniques.

TEXT BOOKS:


REFERENCES:


PTLT7203 INTRODUCTION TO LEATHER MANUFACTURE

L T P C

3 0 0 3

OBJECTIVE:

- This course aims at introducing the fundamentals of chemistry and technology of leather manufacture.
UNIT I  HIDES/SKINS AND PRESERVATION  10
Functions and properties of skins and hides: Histological characteristics of hides and skins - Cow, Ox, Buff, Cow Calf, Buff calf, Goat and Sheep: Chemical constituents of hides and skins; various fibrous and non-fibrous proteins; Standard flaying techniques; Hide/skin putrefaction and factors involved; Various preservation techniques and their principles; Defects in hides and skins; Raw material grading – Size, weight and surface defects as criteria.

UNIT II  PRE-TANNING PROCESSES  12
Principles and objectives of pre-tanning processes viz., soaking, liming, deliming, bating, pickling, depickling, degreasing and depickling.

UNIT III  TANNING PROCESSES  10
Various types of tanning materials; Organic and mineral tanning agents; Principles involved in vegetable and chrome tanning and their mechanism in brief; Combination tannages.

UNIT IV  POST TANNING PROCESSES  7
Principles and objectives of post tanning processes viz., rechroming, neutralisation, retanning, dyeing and fatliquoring; Various mechanical operations involved; Methods of drying.

UNIT V  FINISHING TECHNIQUES  6
Principles and objectives of leather finishing; Classification of leather finishing; Types of auxiliaries and finishes used; General machinery employed in leather finishing

TOTAL: 45 PERIODS

OUTCOME:
- Through this course the student gains a comprehensive view of the underpinning science and technology involved in the manufacture of leathers.

TEXT BOOKS:

PTLT7204  PRINCIPLES OF ELECTRICAL AND ELECTRONICS ENGINEERING  L T P C
3 0 0 3

OBJECTIVES:
To impart knowledge on
- Electric circuit laws, single and three phase circuits and wiring
- Working principles of Electrical Machines
- Various electronic devices and measuring instruments

UNIT I  ELECTRICAL CIRCUITS  9
Basic principles involved in power generation, transmission and distribution, Ohms Law, Kirchoff’s Law, steady state solution of DC circuits, Thevinin’s Theorem, Norton’s Theorem, Superposition Theorem.

UNIT II  AC CIRCUITS  9
Introduction to AC circuits – waveforms and RMS value – power and power factor, single phase and three-phase balanced circuits, housing wiring, industrial wiring, materials of wiring.
UNIT III  ELECTRICAL MACHINES  9
Principles of operation and characteristics of DC machines. Transformers (single and three phase ), Synchronous machines, three phase and single phase induction motors.

UNIT IV ELECTRONIC DEVICES & CIRCUITS  9

UNIT V MEASUREMENTS & INSTRUMENTATION  9
Introduction to transducers: pressure, temperature, position, electrical measurements, Classification of instruments – moving coil and moving iron Ammeter and Voltmeter – Multimeters – dynamometer type Wattmeter – three-phase power measurements – energy meter – megger – instrument transformers (CT and PT)

TOTAL: 45 PERIODS

OUTCOMES:
Ability to
- Understand electric circuits and working principles of electrical machines
- Understand the concepts of various electronic devices
- Choose appropriate instruments for electrical measurement for a specific application

REFERENCES:

PTLT7205 THEORY OF SKIN PROTEINS AND PRE-TANNING PROCESSES  L T P C
3 0 0 3

OBJECTIVE:
- To understand the basic structure and function of skin and its components and to understand the various pre-tanning processes/operations

UNIT I COMPONENTS, FUNCTIONS AND COMPOSITION OF SKIN  9
Organization of skin components in different animals; Structure and function of epidermis, dermis, cutaneous and subcutaneous tissues; hair; fat tissue; nerve; erectorpilii muscle; sweat glands; Functions and properties of hides and skins; Chemical constituents of hides and skins; Fibrous and non-fibrous proteins in skin; Structure and properties of complex carbohydrates and proteoglycons; Structure and properties of fatty acids,; Structure, function and properties of amino acids.

UNIT II STRUCTURE, FUNCTION, THERMAL TRANSITION AND DEGRADATION OF COLLAGEN  12
Structure, function and chemical features of collagen; Types of collagen; Tropocollagen molecules; Sub-units of collagen; Kinetics of fibril formation; Electron microscopy of the collagen fibre; Biosynthesis; Denaturation temperature; Mechanism of denaturation process; Thermal shrinkage; Factors influencing melting transition; Degradation of collagen – collagenase and its physico-chemical properties, and mechanism of action.
UNIT III  PRESERVATION AND PRE-TANNING PROCESSES  10
Principles of preservation of hides and skins - Defects due to parasitic diseases of livestock that affect leather quality. Chemistry and principles of different pretanning processes - Soaking, liming, deliming, bating, pickling, depickling and degreasing.

UNIT IV  CLEANER PROCESSING IN BEAMHOUSE PRACTICES  7
Salt-free curing options, sulphide free unhauling systems, ammonia-free deliming, salt free pickling systems, solvent and eco friendly degreasing systems. Strategies to bring down BOD, COD and TDS standards of tannery effluents.

UNIT V  PRACTICE AND QUALITY CONTROL  7
Different methods of pretanning processes as applied to light, heavy and industrial leathers. Process control in pretanning operations.  

TOTAL : 45 PERIODS

OUTCOMES:
The students will be able to understand
- the structure and properties of various biomolecules present in skin
- the nature, biosynthesis, characteristics, structure and functions of collagen and the role of temperature in the stability of collagen and collagen degradation
- the basic principles and technologies of various pre-tanning processes and operations.

TEXT BOOKS:

REFERENCES:

PTLT7301  BOVINE LEATHER MANUFACTURING TECHNOLOGIES  L T P C 
3 0 0 3

OBJECTIVE:
- This course aims at imparting knowledge in the technology of making different types of heavy leathers from hides.

UNIT I  PRODUCT BRIEF OF LEATHERS FROM HIDES  6
Product brief of various light and heavy leather manufacture from hides.

UNIT II  HEAVY LEATHER MANUFACTURE FROM HIDES  10
Property requirement of sole, harness, saddle and other industrial leathers from hides; Process design considerations; Choice of raw material; Traditional and modern methods; International standards required for the heavy leathers.

UNIT III  LIGHT LEATHER MANUFACTURE FROM HIDES  10
Property requirement of upper, garment and other light leathers from hides; Process design considerations; Choice of raw material; International standards requirements for the light leathers from hides.

14
UNIT IV  PROCESS TECHNOLOGY FOR LEATHERS FROM HIDES  12
Process details to achieve the specifications for the following leathers: Full chrome/Semi chrome/Chrome retan - uppers, suedes, nubuck, lining, nappa, shrunken grain, upholstery, burnishable, printed leathers; Upgradation technologies; Rectification of defects in hides.

UNIT V  SPORTS GOODS LEATHERS  7
Different types of raw materials used, physical and chemical properties required and process details to achieve the specifications for the following sports goods leathers: Leathers for football, volley ball, hockey ball and cricket ball. Glove leathers for wicket keepers and boxing.

TOTAL: 45 PERIODS

OUTCOME:
- At the end of the course, the students will be in a position to understand the property requirements of different kinds of heavy leathers and process aspects for the same.

TEXT BOOKS:

PTLT7302  LEATHER BIOTECHNOLOGY AND ITS APPLICATION IN LEATHER  L T P C  3 0 0 3
OBJECTIVE:
- To impart knowledge on biotechnological applications in processing of skins into leather.

UNIT I  PROTEINS AND NUCLEIC ACID & ENZYMEOLOGY  10

UNIT II  GENETIC ENGINEERING (RECOMBINANT DNA TECHNOLOGY)  10
Principles and methods: Essentials of biotechnology - products of biotechnology, Restriction enzymes, vectors, DNA cloning strategies.

UNIT III  BIOTECHNOLOGY FOR HIDES/SKINS IMPROVEMENT  13

UNIT IV  WASTE MANAGEMENT FOR LEATHER  8
General features of the organic and inorganic pollutants of tannery. Stabilisation and disposal of organic and chemical wastes and their biological treatment. Possible energy generation from wastes.

UNIT V  UTILISATION OF COLLAGENOUS TISSUES FOR BIOMEDICAL AND OTHER APPLICATIONS  4
Collagen and its application in food, cosmetic and medical fields.

TOTAL: 45 PERIODS
OUTCOME:

- At the end of the course, the student will understand basic biotechnology concepts and its relevance for application in leather processing.

REFERENCES:


PTLT7303 PRINCIPLES OF UNIT OPERATIONS AND PROCESSES L T P C
IN LEATHER AND LEATHER CHEMICALS MANUFACTURE 3 0 0 3

OBJECTIVE:

- To impart knowledge on basic concepts of chemical engineering unit operations and processes and application in leather and leather chemicals manufacture

UNIT I CONCEPTS & METERING OF FLUIDS 4

UNIT II HEAT TRANSFER AND MASS TRANSFER 16

UNIT III MECHANICAL SEPARATIONS 3

UNIT IV PRINCIPLES OF UNIT PROCESSES 17
General principles of unit operations and unit processes in leather & leather chemicals processing: General concepts of unit operations and unit processes in leather & leather chemicals processing. Development of process flow sheets with reference to leather and leather chemical industries design, control safety pollution abatement. Principles of
halogenation, esterification, hydrolysis, oxidation, hydrogenation. Polymerization, sulphation and sulphonation, diazotization and coupling.

**Tanning agents:** Vegetable tannins and Vegetable tannin extracts, Basic Chromium Sulphate, Aluminium, and Zirconium, salts for leather processing.

**Oils, fats and detergents:** Oils and fats; their nature and products derived from oils and fats, Fatty Acids and Alcohols, waxes and fatsliquors.

**Synthetic binders:** Binders based on acrylics, polyamides, polyesters, polyurethanes, polypropylene

**Dyes and intermediates & surface coating agents:** Raw materials; important unit processes; Types of dye intermediates and dyes; pigments, lacquers

**Recent developments in chemicals for leather manufacture:** Recent developments like REACH and its implications on leather chemicals; Alternate eco-benign leather chemicals and auxiliaries for leather manufacture.

**UNIT V WATER AND INORGANIC CHEMICALS**

Treatment of water for domestic and industrial purposes, manufacture of sodium chloride, sodium sulphide, sodium sulphite and bisulphite, soda ash, caustic soda, lime, sulphuric and hydrochloric acids.

**TOTAL: 45 PERIODS**

**OUTCOME:**

- At the end of the course, the student would understand the basic concepts of unit operations, material and energy balances, fluid dynamics mass and heat transfer in various unit operations such as distillation, extraction, drying and humidification size reduction and separation and mixing techniques technology of organic and inorganic chemicals involved in the processing of leather and leather chemicals

**REFERENCES:**

8. Dutta, S.S., An introduction to the principles of leather manufacture, ILTA.

**PTLT7304 THEORY OF MATERIAL TESTING OF LEATHERS**

**OBJECTIVE:**

- To impart knowledge on analytical methods for the analysis of leather, leather chemicals and process liquors generated during processing of leathers

**UNIT I ANALYSIS OF LEATHER CHEMICALS**

Principles of analytical methods employed in analysis of pretanning chemicals – Lime, unhairing, deliming and bating agents; Vegetable tanning materials and extracts; Aldehydes; Chrome extracts and liquors; Principles of analytical and instrumental methods employed in analysis of
syntans, dyes, oils and fats, fatliquor, finishing auxiliaries. Specifications recommended by standards organizations.

UNIT II ANALYSIS OF PROCESS LIQUORS AND EMISSIONS 8
Principles of analytical and instrumental methods employed in analysis of exhaustion liquors of pretanning, tanning and post tanning processes. Analysis of emissions - air pollutants from leather processing; Specifications recommended by standards organizations.

UNIT III ANALYSIS OF LEATHERS 8
Principles of analytical and instrumental methods employed in analysis of various chrome leathers, vegetable tanned leathers; Specifications recommended by standards organizations. Principles of analytical and instrumental methods employed in analysis of eco-sensitive substances- Pentachlorophenol (PCP), Formaldehyde, Hexavalent chromium [Cr(VI)], azodyes etc., present in finished leathers.

UNIT IV MICROBIOLOGY FOR LEATHER 8
Testing of bacterial action on raw hides and skins and in the different stages of Leather Manufacture. Effect of mould growth during processing of skins/hides, finished leathers, leather goods and during transportation. Testing and prevention of mould growth during processing, storage of finished goods and transportation.

UNIT V PHYSICAL TESTING OF LEATHERS 9
Orientation of fibre structure of skins/hides and leathers using various microscopes; Sampling position for physical testing of leathers. Different physical testing methods - principles involved. Static and Dynamic methods, Non-destructive testing of leathers.

TOTAL : 45 PERIODS

OUTCOMES:
At the end of the course, the student would understand
- The analytical chemistry behind testing of leather chemicals and leathers
- The principle used in instrumental techniques
- Various methods of analyses of leather chemicals, spent process liquors and pelts/leathers
- Quality Standards of various leather chemicals and leather end products

TEXT BOOKS:

PTLT7305 THEORY OF ORGANIC AND INORGANIC TANNAGES  L T P C
3 0 0 3

OBJECTIVE:
- To impart knowledge on the chemistry of various inorganic and organic tanning materials and systems

UNIT I CHROMIUM CHEMISTRY 10
Historical overview of mineral tanning. Electronic configuration and its implications, common oxidation states of chromium, redox stabilities of chromium (VI) and chromium (III) salts, redox
potentials and their interconversion, protolysis, kinetic inertness of chromium (III), basicity, oxolation and polymerisation, Stiasny’s series, McClandish precipitation point.

UNIT II FACTORS CONTROLLING CHROME TANNING
Preparation of basic chromium sulphate (BCS) salt, reaction parameters influencing composition of BCS, diffusion and complexation, effects of float volume, pH, basicity, masking, temperature, drum speed, ageing chrome tanned substrates.

UNIT III MECHANISM OF INORGANIC TANNAGES
Theories of chrome tanning; absorption, coating, electrostatic and hydrogen bond interactions and coordinative forces involved in chrome tanning, indirect evidence for chrome binding sites in protein, hydrothermal stability of chrome-collagen compound. Aqueous chemistry of aluminium (III), zirconium (IV), titanium (IV) and iron(III) and its relevance to mineral tanning, chemistry of silicates and phosphates and their tanning mechanisms and their relevance to combination tanning.

UNIT IV VEGETABLE TANNIN CHEMISTRY
Vegetable tannins - definition and classification, Occurrence; Chemistry of hydrolysable tannins - gallotannins, ellagitannins Tannins as well as non-tannins, polyphenolic constituents and their physico-chemical properties and their effect on the physical properties of leathers.

UNIT V MECHANISM OF VEGETABLE AND OTHER ORGANIC TANNAGES
Mechanism of reaction of vegetable tannins with collagen. Electrolytic equilibria, diffusion equilibria, fixation and absorption equilibria. Principles in pit, drum and E.I. tanning. Mechanism of tanning with aldehydes, oil, oxazolidine and other organic tanning agents; Synthetic tannins - Classification - properties, uses in leather industry.

TOTAL: 45 PERIODS

OUTCOME:
- Students will gain knowledge of inorganic and organic tannages and their mechanism of interaction with emphasis on chromium and vegetable tanning.

TEXT BOOKS:

PTLT7401 ENVIRONMENTAL SCIENCE AND ENGINEERING FOR LEATHER SECTOR

OBJECTIVE:
- To educate students about the importance of studying environmental science and engineering in leather practicing and to create awareness in protection of environment.
UNIT I ENVIRONMENT, ECOSYSTEMS, BIODIVERSITY AND SUSTAINABLE DEVELOPMENT
8
Definition of environment and components in the environment - definition of an ecosystem, concept and functions of different ecosystems like (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)- biodiversity, threats to biodiversity and conservation of biodiversity- sustainable development and significance of sustainable development in environmental related issues.

UNIT II ENVIRONMENTAL POLLUTION AND CHEMISTRY 14
Definition of pollution- different types of environmental pollution- classification of pollutants in water and wastewater – characterization of pollutants in water and wastewater - environmental significance - types of sampling, significance of sampling, precautions to be taken while sampling and preservation of samples.
Atmospheric structure and composition - definition of air pollution – sources and classification of air pollutants and their effect on human health, vegetation, animals, property, aesthetic value and visibility- ambient air quality and emission standards –photochemical smog, ozone layer depletion, greenhouse gases, global warming, acid rain and their effect on environment.
Definition, types and sources of solid and hazardous wastes - need for solid and hazardous waste management – elements of integrated waste management and role of stakeholders – definition, types and sources of nuclear and radioactive wastes – waste management and disposal.

UNIT III TREATMENT OF TANNERY WASTEWATER 10
Unit operations and processes for the treatment of tannery wastewater - principles of physical treatment: screening, mixing, equalization, sedimentation, filtration - principles of chemical treatment: coagulation, flocculation, precipitation, flotation - objectives of biological wastewater treatment and various process - tertiary treatment – reverse osmosis.

UNIT IV ENVIRONMENTAL IMPACT & RISK ASSESSMENT 9

UNIT V ENVIRONMENTAL POLICIES AND LEGISLATION 4

TOTAL : 45 PERIODS

OUTCOME:
• At the end of this course, the students will be able to appreciate the importance of environmental science and technology in leather manufacture.

REFERENCES:
AIM:
- To impart theory and practical knowledge on the working principles, use and maintenance of machineries used in leather manufacture.

OBJECTIVES:
At the end of the course, the students would understand the
- General principles involved in various machineries used in leather manufacture.
- Salient features and purpose of the various machinery used
- Preventive maintenance and safety in the use of leather machinery
- Adjustment of machinery parts for proper functioning of different machines used in leather processing
- Design of optimal machinery layout of tannery

UNIT I PRINCIPLES AND MECHANISM OF LEATHER MACHINERY 12
General principles and mechanism involved in various tannery machines. Mechanism of cutting and shearing action of helical blade systems. Bush, ball, roller and ring oil bearing, cam springs glars and their application and function in tannery machinery.

UNIT II DESIGN, SELECTION AND CONSTRUCTION OF EQUIPMENT 8
Basic design, material selection and construction of pits, drums and paddles. Pneumatic steering mechanism and control as applied to dust control equipment, air compressor, auto spray, etc. Hydraulic steering mechanism in case of shaving, staking, embossing machines, etc.

UNIT III MECHANICAL FEATURES OF LEATHER MACHINERY 15
Salient features and purpose of the various machinery used in beam house, tanning and finishing yards- unhairing, fleshing, scudding, sammying, setting, shaving, staking, buffing, dedusting, glazing, machines, finiflex, hydraulic press, curtain coating, roller coating, transfer coating, autospray, driers measuring machine etc.
Tutorial/practical sessions on adjustment of machinery parts of above machines for proper functioning in leather processing.

UNIT IV TANNERY LAYOUT 5
Drawing a neat lay out for a small/medium tannery showing the wet yard and finishing yard by arranging the machines as per the sequence of operation for standard leather processing.

UNIT V PREVENTIVE MAINTENANCE AND SAFETY 5
Preventive maintenance and safety in the use of leather machinery

TOTAL: 45 PERIODS

OUTCOME:
- At the end of this course, the students will be able to understand the working principles of machineries used in leather manufacture and their use and maintenance.

REFERENCES:
UNIT I  PROPERTIES OF LEATHER 9
Classification of leathers, Definition of various leather properties, Understanding and measurement of properties, Relevance and significance of various leather properties in manufacture and usage for different end application.

UNIT II  UPPER AND LINING LEATHERS 8
Shoe upper, lining leathers: Choice of raw materials, relationship between each leather property and process parameter; Rational of preparation of the same.

UNIT III  GARMENT AND GLOVE LEATHERS 8
Garment nappa, fine glove leathers: Choice of raw materials, relationship between each leather property and process parameter; Rational of preparation of the same.

UNIT IV  OTHER SPECIALITY LEATHERS 8
Chamois, suede garment, glazed kid leathers etc: Choice of raw materials, relationship between each leather property and process parameter; Rational of preparation of the same.

UNIT V  LIGHT LEATHER MANUFACTURE 12
Process of manufacture of leathers such as glazed kid, nappa garment, fine glove, suede garment and lining; Quality control aspects with special reference to light leather manufacture

TOTAL: 45 PERIODS

OUTCOME:
- At the end of the course, the students will be in a position to understand the property variations of different leathers and suitable processing variations that are required in their manufacture from skins.

TEXT BOOKS:
3. CLRI Process Bulletins.

PTLT7404  THEORY AND PRACTICE OF POST TANNING PROCESSES  L  T  P  C  3  0  0  3

OBJECTIVE:
- To impart knowledge on chemicals and processes involved in post tanning operations of leather manufacture.

UNIT I  DYES AND DYEING OF LEATHER 10
Theory of colours, chromophoric groups and their optical absorption; Classification of dyes based on their chemical nature, application and colour index, properties; blending of dyes, theory and practice of colour matching, theory and mechanism of dyeing, chemistry and application of dyeing auxiliaries such as leveling agents, dispersing agents and dye fixatives.

UNIT II  FATLIQUORS AND FATLIQUORING OF LEATHER 10

UNIT III  SYNTANS AND RETANNING OF LEATHER 10
Classification of syntans, auxiliary, intermediate, replacement syntans and resin tanning agents Sulphonation of naphthalene, naphthols, phenol-formaldehyde condensation reactions, characterisation and photo oxidation mechanisms of phenolic syntans. Bleaching agents and
mordants. Light fast, amino resin, melamine, formaldehyde-free, acrylic and PU syntans. Chemistry and mechanism of retanning.

UNIT IV PRACTICE OF POST TANNING PROCESSES AND OPERATIONS 10
Practice of post tanning processes viz., re-chroming / semi-chroming, neutralization, retanning, dyeing, fatliquoring, fixing and Post tanning process technologies for products from different types of leathers.

UNIT V POST TANNING MECHANICAL OPERATIONS 5
Sammying, splitting and shaving, drying, staking, toggling, buffing etc operations – understanding and judicious application of these operations to meet the end product parameters;

OUTCOME:
• Students will be able to understand post tanning processes like neutralization and its importance to the manufacture of various types of leathers, chemistry of post tanning auxiliaries and mechanism of dyeing, fatliquoring and retanning.

TEXT BOOKS:

PTLT7501 ECO-BENIGN OPTIONS FOR LEATHER PROCESSING L T P C 3 0 0 3

AIM:
• To impart knowledge on ecofriendly options for leather processing.

OBJECTIVE:
• At the end of the course the students would have gained knowledge on the cleaner process technology in the leather processing during tanning, post tanning and finishing systems. The emphasis on the course content will be on the fundamentals of bio beam house processing.

UNIT I CLEANER PROCESSING - BEAMHOUSE 12
Eco-friendly process technologies: Salt free curing options, sulphide free unhairing systems, ammonia - free deliming, salt free pickling systems, solvent free degreasing systems. Paradigm shift from chemical processing of hides and skins to bio based beam house processing.

UNIT II CLEANER PROCESSING: TANNING 10
Less chrome and chrome-free tanning systems. Latest concepts and trends in leather processing.

UNIT III CLEANER PROCESSING: POST TANNING 8
Formaldehyde, Phenol, AOX free post tanning systems; Latest concepts and trends in leather processing.

UNIT IV INTEGRATED CLEANER PROCESSING 8
Cleaner processing based on Eco-labelling. Integrated strategies to achieve permissible BOD, COD and TDS standards of tannery effluents.
UNIT V  ADVANCED CLEANER FINISHING TECHNIQUES
Role of finishing equipments such as HVLP spray, foam finishing, etc in cleaner perspective. Aqueous finishing concepts and formulation; Other novel finishing techniques to reduce VOC.
Cleaner finishing of splits for shoe suede, garment suede, grain finished effect and specialty finishes - processing technologies and finishing techniques specially suited for the purpose. Upgradation of lower ends for better utilisation.

TOTAL: 45 PERIODS

REFERENCES:

OBJECTIVE:
• To impart knowledge on making leather goods and garments

UNIT I  OVERVIEW
Classification of Leather Goods and Garments; Selection of Materials, grading and assorting of leathers for leather goods & garments ; Property requirements for leather and other materials; Accessories for Leather goods & garments - Various types of fasteners, fittings and other accessories. Alternative materials and their adaptability for goods and garments. Operational sequences in leather goods and garments production.

UNIT II
i) Production planning - Nomenclature used for component identification in various leather garments skirts, jackets, trousers etc and various leather goods – Wallet, hand bags, Executive bags etc. Process scheduling and line balancing.
iii) Assembling - Pre assembly and assembly operations – skiving, splitting, folding, sewing etc. Various types of assembly techniques for leather goods and garments.
iv) Quality - Quality control measures in leather products manufacture.

UNIT III  MACHINERY
Machinery needs for leather goods and garments manufacture. Various types of sewing machines – flat bed, cylinder bed, post bed and other special sewing machines – different feed mechanisms. Clicking, splitting, skiving, folding, embossing, creasing machines – their working principles operation and maintenance.

UNIT IV  DESIGN & DEVELOPMENT
Pattern design and development – measurement/ sizing for various types of garments, pattern design of leather goods and garments, pattern grading for leather garments. CAD applications for leather goods and garments. Fashion and material trends.

UNIT V  ORGANISATION & MANAGEMENT

TOTAL: 45 PERIODS

OUTCOMES:
Through this course students will be able to know
• various components for the manufacture of leather good and garments
• processing steps involved in the making of leather good and garments
• different machineries involved in the products manufacture
• techniques to design and develop leather goods and garments
• organisation and management of leather goods and garments manufacturing unit

REFERENCES:
6. A course manual on leather garment pattern designing.
8. Leather and sports goods – Pattern and Template marker, NIMI Publications, 2011

PTLT7503 THEORY AND PRACTICE OF LEATHER FINISHING L T P C 3 0 0 3

OBJECTIVE:
• To impart knowledge on materials and processes/operations involved in leather finishing.

UNIT I SURFACE COATING
Theory of surface coating; Characteristics of various components of coating system; Parameters of the process of coating and its influence on coating characteristics; Testing of coatings.

UNIT II PIGMENTS
Classification of pigments; Inorganic, organic, nacreous (pearlescent) and interference pigments - their representation code in the colour index. Different forms of pigments - powders and pastes. Evaluation and control of their brilliance, opacity, particle size, resistance to solvent, heat and light and colour matching.

UNIT III POLYMERIC MATERIALS AND THEIR DISPERSION FORMS
General introduction to addition and condensation polymerization; various methods of polymerisations, resins binders - acrylics, vinyls and urethanes, protein binders, cellulose nitrate, cellulose acetate butyrate, - protein binders - lacquers - emulsion and emulsifiers - evaluation and control - solvents and thinners.

UNIT IV PRINCIPLES OF FINISHING, FINISH FORMULATIONS AND THEIR APPLICATION
Impregnation: Terminology, types of impregnating binders, characteristics, selection of systems for corrected and full grain impregnation, formulations, application methods and precautions

Finishing: Definition, aims, film formation mechanisms, properties of films such as glass transition temperature / minimum film forming temperature, transparency, gloss and resistance to heat, light and solvent. Pigment volume concentration, plasticizer, wetting agents, role in dispersion and stability - requirements in multiple coat technique – such as clearing coat, sealer coat, base coat, top and feel coat. Single coat composition methods like spraying, curtain coating, roller coating etc. Cationic finishes and their relative merits. Foam finish; Eco-friendly finishing - Volatile Organic Compounds (VOC) reductions. Finish formulation for various types of leathers.

UNIT V VARIOUS FINISHING METHODS AND TECHNIQUES
Role of equipments like HVLP spray, Roller coats, Continuous embossing machines, Finiflex, etc. Methods such as oil pull-up, waxy, burnishable, antique, grain suede, screen printing, roller printing, tie and dye finishing. Pearl finishing, easy-care and patent finishing, cationic finishing, foam finishing, transfer foil, lamination, etc.

TOTAL: 45 PERIODS
OUTCOMES:
At the end of this course, the students would be in a position to
- Appreciate the role of various finishing agents and auxiliaries used in leather finishing
- Formulate strategies for finishing different types of leathers

REFERENCES:

PTLT7601 FOOTWEAR TECHNOLOGY

AIM:
- To impart knowledge of various materials and components used in footwear manufacture.

OBJECTIVE:
- To give focus on the manufacture, evaluation and application of materials and components used in footwear manufacture

UNIT I FOOTWEAR MATERIALS AND COMPONENTS
Different types of upper and lining leathers; Different types of soling materials; Different types of adhesives used in footwear industry; Kinds of insole boards, Grinderries; Fasteners; Shoe dressing materials etc.

UNIT II DESIGN AND PATTERN DEVELOPMENT
History of shoe; Purposes and styles; Fashion & designs; Preparation of standards and section for men, ladies & children; Classic and other types of shoes and boots.

UNIT III CUTTING, PRE-CLOSING AND CLOSING
Principles of cutting – Hand, machine; Clicking room design and management. Checking incoming work, stitchmaking, skiving, punching and gimping, heat embossing, flow moulding, toe puff attachment, attaching linings and scrims, trimming linings, finishing off closed seams. Top line and other edge treatments, local reinforcements, attaching fastners and trims.

UNIT IV PRELASTING AND LASTING
Principles and methods of pre-lasting and lasting for different types of construction; Sole attaching; Lasted margin; Upper preparation; Sole preparation; Sole cementing; Upper cementing; Bottom fillers and shanks; Adhesive drying, Heat activation, Spotting, Pressing, Last slipping, Health and safety, Quality control and fault finding problems- solving.

UNIT V METHODS OF SHOE CONSTRUCTION
Various methods of shoe construction; shoe room techniques.

OUTCOME:
- At the end of this course, the students will be able to understand the construction of a shoe and its components.

REFERENCES:
2. “Shoes and Leather News”, Published by bureau of foreign and domestic commerce, Dept of commerce, US, 1940.
UNIT I    TRENDS IN LIVESTOCK POPULATION  
Social relevance and historical growth of leather sector. Categories of livestock, global distribution, India’s share, distribution livestock in India, growth rates, trends and relative importance, projections.

UNIT II    AVAILABILITY AND MARKETING OF HIDES AND SKINS  
Concepts, global availability, India’s share in the world, trends in meat production and consumption practices, fallen animal recovery systems, off-take rates (slaughter and mortality rates), availability of hides and skins, projections  
Collection and mobilization of hides and skins, Origin and characteristics, Transportation, Grading systems, Pricing, major markets and sourcing of hides and skins, Broad features of marketing.

UNIT III    STRUCTURE OF TANNING INDUSTRY AND LEATHER PRODUCT INDUSTRIES IN INDIA  
Distribution of tanneries in India, scale of operation, type of ownership, line of specialization, capacity and production, employment pattern, industrial policy, environmental issues, leather complexes, Categories of products, distribution of footwear, leather garments, leather goods industries, scale of operation, ownership pattern, capacity and production, industrial policy, employment, exports and domestic market.

UNIT IV    INDIA’S FOREIGN TRADE AND POLICY  
Economic and social importance of leather sector, trade terms, trends in the exports, major importing countries, imports of India, review of trade policy and impact.

UNIT V    GLOBAL MARKET FOR LEATHER AND LEATHER PRODUCTS  
Shifts in production bases, structure of global market, trends in the global trade, major markets, competitors for India, dynamics of global leather trade.

EMERGING DIMENSIONS IN THE GLOBAL TRADE: Non- price Competition , Trade related Environmental and Social issues , Eco- labels and Social certification , E- Commerce, impact of World Trade Organisation .

STRATEGIES FOR EXPORT PROMOTION: Identification of critical factors, Role of various organizations, Planning and sustainable development , Trade policy, Developing market net-work and market intelligence, Resource and product related strategies.

TOTAL: 45 PERIODS

TEXT BOOKS AND REFERENCES:
1. Report of All India Survey on Raw Hides and Skins, CLRI, 1987 and 2004
2. Report on Capacity Utilisation and Scope for modernization of Indian tanning industry , CLRI, 1990
3. Report of the Committee on The Development of Leather and Leather Manufactures for Exports (Seetharamaiah Committee Report) , Govt of India 1972
6. Bulletins of India’s Foreign Trade in Leather and Leather Products , CLRI
AIM:
- This course aims to impart knowledge on the chemistry and properties of various auxiliaries used in leather processing.

UNIT I
Definition and function of leather auxiliaries, role of wetting agents, syntans, fatliquors, dyes, pigments, binder, top coats, feel modifiers and matting agents in leather processing. Surface tension and principles of wetting, importance of HLB, Chemical classification of wetting agents.

UNIT II
Introduction to chemical classification of syntans, sulphonation of naphthalene, phenols, Napthols, Phenol formaldehyde condensation reactions, chemistry of light fast syntans, chemistry of amino resins and PU. Unit operations in syntan manufacture.

UNIT III
Introduction to composition of fatliquors; Functionalisation of oils for surface active function, chemical classification natural and synthetic oils, sulphation, sulphonation, sulphitation reactions of oils. Role of double bonds and iodine value in functionalisation of oils, sulphochlorination, sulphoamidation, transesterification, phosphorylation reactions for fatliquor preparation. Stability of emulsions, grain and particle sizes of emulsions, factors controlling grain sizes of emulsions. Fatliquor manufacturing technology. Introduction to theory of colors, chromphoric groups, structural features of dyes; acid, basic and reactive dye classification. Chemistry and technology of dye manufacture.

UNIT IV
Introduction to definition of pigments, groups of polymer bases for colour. Classification, formulations of pigments, particle size, refractive index, density, opacity criteria for the choice of pigment bases. Different techniques in particle size reduction and importance of particle size on functional properties of pigment formulation. Introduction to definition of binders, chemical classification of binders, acrylic, protein, polyurethane. Manufacturing of binder formulations.

UNIT V
Different types of top coat formulations, choice of polymers for surface protection, role of plasticizers, internal and external plasticizers. Principles of feel modification of polymer surfaces, types of feel modifiers and matting agents. Manufacturing techniques.

OUTCOME:
- The students will be able to understand the structure and properties of various leather auxiliaries and its application in leather proceeding.

TEXT BOOKS AND REFERENCES:
AIM:
- This course aims to provide necessary knowledge and attitude to understand and appreciate the process of starting and developing a new venture.

OBJECTIVE:
- To gain knowledge of entrepreneurial tasks such as, generating an idea, planning a business based on the idea, conducting the feasibility study, pitching for the finance, taking risk, starting the venture and expanding while abiding by various rules and laws applicable to the business venture in leather sector.

UNIT I

UNIT II

UNIT III

UNIT IV
 Building Team – creating growth oriented organisational culture. Employee motivation, retention strategies. Organisational structure with clear roles, responsibilities, authorities and accountabilities. Attracting talent with ESOP and other incentives and benefits. Training development to enhance the quality of operators, supervisors and managers of the tannery.

UNIT V

TOTAL: 45 PERIODS

REFERENCES:
PTGE7074 TOTAL QUALITY MANAGEMENT L T P C
3 0 0 3

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

OBJECTIVES
- To understand the need for quality, its evolution, basic concepts, contribution of quality gurus, TQM framework, Barriers and Benefits of TQM.
- To understand the TQM Principles.
- To learn and apply the various tools and techniques of TQM.
- To understand and apply QMS and EMS in any organization.

UNIT I INTRODUCTION
Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality –Definition of TQM-- Basic concepts of TQM –-Gurus of TQM (Brief introduction) -- TQM Framework- Barriers to TQM –Benefits of TQM.

UNIT II TQM PRINCIPLES

UNIT III TQM TOOLS & TECHNIQUES I

UNIT IV TQM TOOLS & TECHNIQUES II

UNIT V QUALITY MANAGEMENT SYSTEM

OUTCOMES:
- Ability to apply TQM concepts in a selected enterprise.
- Ability to apply TQM principles in a selected enterprise.
- Ability to apply the various tools and techniques of TQM.
- Ability to apply QMS and EMS in any organization.
TEXT BOOK:

REFERENCES:

PTGE7071 DISASTER MANAGEMENT L T P C 3 0 0 3

OBJECTIVES:
- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

UNIT I INTRODUCTION TO DISASTERS Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don’ts during various types of Disasters.

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

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

UNIT IV DISASTER RISK MANAGEMENT IN INDIA Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.
UNIT V  DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS  
Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL: 45 PERIODS

OUTCOMES:
The students will be able to
- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarious in the Indian context, Disaster damage assessment and management.

TEXTBOOKS:

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

PTGE7072  ENGINEERING ETHICS AND HUMAN VALUES  L  T  P  C  3 0 0 3

OBJECTIVES
- To emphasise into awareness on Engineering Ethics and Human Values.
- To understand social responsibility of an engineer.
- To appreciate ethical dilemma while discharging duties in professional life.

UNIT I  HUMAN VALUES

UNIT II  ENGINEERING ETHICS

UNIT III  ENGINEERING AS SOCIAL EXPERIMENTATION
Engineering as experimentation - engineers as responsible experimenters - codes of ethics – Importance of Industrial Standards - a balanced outlook on law – anticorruption- occupational crime -the challenger case study.

UNIT IV  ENGINEER’S RIGHTS AND RESPONSIBILITIES ON SAFETY
Collegiality and loyalty – Respect for authority – Collective Bargaining – Confidentiality- Conflict of

UNIT V GLOBAL ISSUES
Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors -moral leadership-Sample code of conduct.

TOTAL : 45 PERIODS

OUTCOMES:
• Students will have the ability to perform with professionalism, understand their rights, legal, ethical issues and their responsibilities as it pertains to engineering profession with engaging in life-long learning with knowledge of contemporary issues.

TEXTBOOKS

REFERENCES
and State Human Rights Commission – Judiciary – Role of NGO’s, Media, Educational Institutions, Social Movements.

TOTAL : 45 PERIODS

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

REFERENCES:

PTGE7075 INTELLECTUAL PROPERTY RIGHTS L T P C
3 0 0 3

OBJECTIVE:
- To give an idea about IPR, registration and its enforcement.

UNIT I INTRODUCTION
Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO – TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT II REGISTRATION OF IPRs
Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

UNIT III AGREEMENTS AND LEGISLATIONS

UNIT IV DIGITAL PRODUCTS AND LAW

UNIT V ENFORCEMENT OF IPRs
Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

TOTAL : 45 PERIODS

OUTCOME:
- Ability to manage Intellectual Property portfolio to enhance the value of the firm.

TEXTBOOKS

REFERENCES
OBJECTIVES:

- To learn about basis of nanomaterial science, preparation method, types and application

UNIT I  INTRODUCTION
Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II  GENERAL METHODS OF PREPARATION
Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III  NANOMATERIALS
Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, 92 Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO$_2$,MgO, ZrO$_2$, NiO, nanoalumina, CaO, AgTiO$_2$, Ferrites, Nanoclays-functionalization and applications-Quantum wires, Quantum dotspreparation, properties and applications

UNIT IV  CHARACTERIZATION TECHNIQUES
X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques-AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation

UNIT V  APPLICATIONS

TOTAL : 45 PERIODS

OUTCOMES:
Upon completing this course, the students

- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

TEXT BOOKS

REFERENCES
PTLT7001 ADVANCED PHYSICS AND CHEMISTRY OF LEATHER – I (APCL–I) L T P C 3 0 0 3

AIM:
- To impart knowledge on the advanced physical and chemical concepts of native collagen and collagen processed into leather.

OBJECTIVE:
- At the end of the course the students would have gained comprehensive knowledge on the chemistry and physics of molecular architecture, hydration, swelling, phase transitions, dimensional stability, relaxation, shrinkage and cross-linking phenomena of collagen/processed collagen/leather.

UNIT I 10
Histology and fibre packing in Skins. Techniques for study of macro-ultra and microstructural details of skins. Primary, secondary, tertiary and quaternary structure of collagen.

UNIT II 10
Molecular architecture of collagen. Inter and intra-change forces in the stabilisation and aggregation of collagen molecules. Three dimensional network of collagen fibres in skins and leather matrix.

UNIT III 7
Hydration, fibre swelling and phase transitions in collagen fibres and their role in dimensional stability of skin and leather matrix.

UNIT IV 9
Molecular mechanisms in relaxation and folding with special reference to native collagen and tanned collagen. Helix to coil transition and effects of thermo-mechanical stress on connective tissue fibres.

UNIT V 9
Shrinkage and cross linking phenomena in native, chrome tanned and vegetable tanned collagen. Influence of electromagnetic and high energy radiation on native collagen.

TOTAL: 45 PERIODS

TEXT BOOKS AND REFERENCES:

PTLT7002 ADVANCED PHYSICS AND CHEMISTRY OF LEATHER - II (APCL-II) L T P C 3 0 0 3

AIM:
- To attempt micro-level understanding of leather making

OBJECTIVES:
- To understand hydration of skin protein and its functional sites
- To understand diffusion and transport phenomena in collagenous matrices
- To understand molecular level changes and dimensional changes during various unit processes in leather making
- To relate surface science to leather making.
UNIT I
Macro and microporosity of skin and influence of hydration and water structure on the pore size pattern in skin. Functional sites in protein for interactions with vegetable and pre-tanning materials, Electrophilic and nucleophilic reactions at protein sites.

UNIT II

UNIT III
Molecular level processes and changes in soaking, liming/dehauling, deliming/bating, pickling, tanning, dyeing and fatliquoring.

UNIT IV
Dimensional changes and ultra and micro structural variations of skins during soaking, liming, deliming/bating, pickling, tanning, retanning, fatliquoring and drying as well as finishing with resin and casein finishes.

UNIT V
Surface science application to leather. Surface charge and energy of full chrome and chrome retanned leathers. Emulsions in leather processing and the surface charge and potential of leather finish films, adhesion, mechanisms, influence of opacity, refractive index and scattering coefficient of pigments and pigment formulations and factors controlling the stability of leather finish films.

TOTAL: 45 PERIODS

TEXT BOOKS AND REFERENCES:

PTLT7003 CAD/CAM FOR LEATHER PRODUCTS DESIGN AND MANUFACTURE

AIM:
- To impart knowledge on CAD/CAM for leather products design and manufacture.

OBJECTIVE:
- To focus on the computer applications in leather products sector, hardware in cad, pattern engineering, last and sole modelling for footwear and advanced computational techniques in cad, rapid prototyping.

UNIT I COMPUTER APPLICATIONS IN LEATHER AND PRODUCT SECTOR
Introduction to computer: Concepts of CAD/CAM. Capabilities and operation of graphical workstations, graphic terminals, input/output devices, interface and storage devices, net-working concepts of LAN and WAN, principles of digital and analog conversion.

UNIT II HARDWARE IN CAD
Introduction to special input/output systems required for CAD.
Digitization: 2D & 3D systems, input devices: Digitizer, pattern scanner
Output devices: Printer, Plotter, Spreader and cutters. Different types, working principles and applications.
Introduction to CAD software: Garment, Leather goods footwear.
UNIT III PATTERN ENGINEERING  8
Computerized techniques for pattern creation, grading, pattern nesting, consumption calculations and costing, pattern conversion techniques for Leather products, standard DXF, AMMA DXF.

UNIT IV LAST AND SOLE MODELLING FOR FOOTWEAR  7
Digitization with Microscribe; manipulation and optimization of digitized last; use of macros; last comparison; grading wizard; flattening; 3D visualization of last and styles; concept of e-last; introduction to sole and sole mould design.

UNIT V ADVANCED COMPUTATIONAL TECHNIQUES IN CAD, RAPID PROTOTYPING  6
Principles and practice; simulation – concepts and applications.

TOTAL: 45 PERIODS

REFERENCES:
6. Desai and Abel, “Introduction to FEM”. “Step by Step guide to CAD for footwear”: CAD Centre, SDDC, CLRI.

PTLT7004 COMPUTER APPLICATIONS FOR LEATHER AND LEATHER PRODUCTS  L T P C  3 0 0 3

AIM:
• To make students capable of using Computer and related technologies for an effective management of leather and leather products industry

OBJECTIVE:
• To expose the students to the Information Technology, application aspects of DBMS, Data communication principles, Web Designing, ERP, MIS, E-Commerce and CAD applications in leather/leather products manufacture.

UNIT I INTRODUCTION AND IT INFRASTRUCTURE  7
Concept of Data Communication, Modes of Transmission - Digital Vs Analog, Types of Communication - Simplex, Half Duplex, Full Duplex; Communication Protocols - FTP, HTTP, TCP/IP, WAP; Network topologies; Network Types (LAN, WAN and MAN); Need of IT Infrastructure; Form factor; Data Center & Disaster Recovery; Security & Threads;

UNIT II ROLE OF INFORMATION TECHNOLOGY IN LEATHER SECTOR  8
Introduction to System Development; System development life cycle- System Study; System Analysis; System Design (Input, output, files, procedure); Deployment (Implementation) and maintenance.
UNIT III DATABASE MANAGEMENT SYSTEMS AND ITS APPLICATIONS IN LEATHER SECTOR

Fundamental Concepts of Database Technology & Data Organization; Database Model Concepts; Data Security; Data Integration; Retrieving, Manipulating, Updating tables; Databases relevant to Leather Sector.

UNIT IV CONCEPTS FOR WEB BASED APPLICATIONS

Tools for Web Designing, Management Information System, ERP System for Leather Processing – Material Management and Inventory Control, Production Planning.

UNIT V E-COMMERCE AND CAD SYSTEMS

E-Commerce-Definition; Traditional Commerce V/s E-Commerce; Benefits of e-commerce; Various e-commerce models-B2B, B2C; Introduction to special input/output systems required for CAD. CAD Systems for Leather & Leather Products: Computerized techniques for pattern creation, grading, pattern nesting, consumption calculation costing. Pattern conversion techniques for leather products, standard DXF, AMMA DXF; Computerised color matching systems – its principle and application.

TOTAL: 45 PERIODS

TEXT BOOK:

REFERENCES:
4. Kendall & Kendall, Systems Analysis and Design (Prentice Hall India)
6. Understanding SQL (BPB Publications)
7. Hands-on HTML(BPB Publications)
10. Reference Manuals for CAD systems for Footwear and Garments.

PTLT7005 CONSUMER BEHAVIOUR AND BUSINESS ORIENTATION L T P C 3 0 0 3

AIM:
- To enable the students to understand the science behind various marketing activities.

OBJECTIVE:
- The purpose of this course to give an overview on consumer purchase decision making process, the factors that influence the consumers’ buying behaviour and the process by which this knowledge can be used in marketing products and service.

UNIT I Consumer, Shopper and Buyer. Consumer decision making process – problem recognition, information search, alternative evaluation, choice, transaction and consumption, post purchase behavior, cognitive dissonance.

UNIT II Psychological influence - symbolic consumption, self image, personality, personal values, lifestyle, psychographics, groups. Memory and learning, perception and cognition, motivation, emotion, mood, self image, belief, attitude, intention, gender, age.
UNIT III
Sociological influence – cultural, sub cultural, cross cultural, social class, ethnic, religion, club, group, family.

UNIT IV
Consumer Research - Identifying research opportunity, developing the research questionnaire, selecting the research design – quantitative, qualitative, sample size and type. Data collection, data analysis, reporting.

UNIT V

REFERENCES:
3. Research for Marketing decisions- Paul, Donald, Herald- Prentice Hall (India) Zikmund: Exploring Marketing Research, 8e, Thomson 2006

PTLT7006 ENGINEERING ECONOMICS AND FINANCE MANAGEMENT

AIM:
- To impart knowledge on financial management concepts and principles of engineering economics

UNIT I FINANCIAL ACCOUNTING

UNIT II PROFIT VALUE ANALYSIS

UNIT III WORKING CAPITAL MANAGEMENT

UNIT IV CAPITAL BUDGETING
Significance of capital budgeting – payback period – present value method – Accounting rate of return method.
UNIT V    ENGINEERING ECONOMICS

TOTAL : 45 PERIODS

TEXT BOOKS:

REFERENCES:
2. Charles T. Homgren, Cost Accounting, PHI 1985

PTLT7007    ENTERPRISE RESOURCE PLANNING FOR LEATHER SECTOR   L T P C
3 0 0 3

AIM:
- To introduce enterprise resource planning principles to leather technologists.

OBJECTIVE:
- The objective of this course is to teach the principles of ERP technologists involved in enterprise resource and various case studies in the pre and post implementation of ERP, that will enable the students to perform as an efficient entrepreneur.

UNIT I    INTRODUCTION
1. What is ERP?
2. Need of ERP
3. Advantages of ERP
4. Growth of ERP

UNIT II    ERP AND RELATED TECHNOLOGIES
1. Business process Reengineering (BPR)
2. Management Information System (MIS)
3. Decision Support Systems (DSS)
4. Executive Support Systems (ESS)
5. Data Warehousing, Data Mining
6. Online Analytical Processing (OLTP)
7. Supply Chain Management (SCM)
8. Customer Relationship Management (CRM)

UNIT III    ERP MODULES & VENDORS
1. Finance
2. Production planning, control & maintenance
3. Sales & Distribution
4. Human Resource Management (HRM)
5. Inventory Control System
6. Quality Management
7. ERP Market

UNIT IV    ERP IMPLEMENTATION LIFE CYCLES
1. Evaluation and selection of ERP package
2. Project planning
3. Implementation team training & testing
4. End user training & Going Live
5. Post Evaluation & Maintenance

UNIT V ERP CASE STUDIES
Post implementation review of ERP Packages in Manufacturing, Services, and other Organizations

REFERENCES:

PTLT7008 FASHION FORCASTING FOR LEATHER AND LEATHER PRODUCTS

AIM:
• To impart knowledge on fashion forecasting for leather and leather products.

OBJECTIVES:
• To give focus on the historical evaluation & international trends, fashion considerations, product development, presentation techniques and fashion forecasting of leather and leather products.

UNIT I HISTORICAL EVALUATION & INTERNATIONAL TRENDS
Historical evaluation of leather and leather products styling. Seasonal influences on fashion, cultural and geographical instances on leather and products fashion. Market research and track record

UNIT II FASHION CONSIDERATIONS
Design Criteria through effect of shape, colour, pattern, texture and decorative materials. Life cycle of fashion

UNIT III PRODUCT DEVELOPMENT

UNIT IV PRESENTATION TECHNIQUES
Organisation of shows and preparation of art portfolios; advertising; effect of foreign languages in the presentation and promotional activities.

UNIT V FASHION FORECAST
Direction of fashion trends in leather and leather products production and marketing.

REFERENCES:
3. “Shoes and Leather News”, Published by bureau of foreign and domestic commerce, Dept of commerce, US, 1940.

PTLT7009 HUMAN RESOURCES DEVELOPMENT

AIM:
• To impart human resource management skills to the students.
OBJECTIVE:
- The purpose of this course is to provide an overview of human resource management concepts and relate them to contemporary issues.

UNIT I MANAGEMENT AND GENERAL EMPLOYMENT PRACTICES 15
Human resource planning, Organizational design, HR budgeting, Motivation, Leadership, Employee involvement, Ethics, International issues, Job design: Job analysis-Job description, Performance management: Performance appraisals, Workplace behaviour problems

UNIT II STAFFING 6
Equal employment opportunity, recruitment, selection, career planning, organizational exit

UNIT III HUMAN RESOURCE DEVELOPMENT 7
HRD role clusters: Analysis/Assessment roles- Evaluator, Needs analyst, Researcher Development roles - Evaluator, HRD materials developer, Program designer Strategic roles – HRD manager, Marketer, Organization – Change agent, Individual – Career development advisor, Instructor/Facilitator, Administrator

Competency development: Technical competence, Managerial competence, Process competence, Helping Competence and Coping Competencies; Training and Development; Organizational Development, Career Development;

Contemporary issues: Knowledge management and learning organizations, BPR, TQM and Intellectual capital management.

UNIT IV COMPENSATION AND BENEFITS 5
Job evaluation, Pay structures, Benefit programs, Pay delivery administration.

UNIT V HEALTH, SAFETY, SECURITY AND LABOUR RELATIONS 12
Employee assistance programs, safety programs, theft, fraud, investigations, corrections; Labour laws, unfair labour practices, collective bargaining

TOTAL : 45 PERIODS

TEXT BOOKS AND REFERENCES:

PTLT7010 INTERNATIONAL MARKETING AND FOREIGN TRADE

AIM:
- To impart knowledge on international marketing and foreign trade aspects of leather industry

OBJECTIVE:
- At the end of the course the students would understand the basics of international trade, government policies in export aspects of world trade related to leather sector, custom tariff and international marketing.

UNIT I Basics of International trade - India’s trade policy, International trade and Monetary Systems-Marketing Services in International trade Pricing and trade cycles-Precautionary measures to prevent fraud in International trade - International trade Multimodal Transport Operations-Consumer Behavior and Role of international Marketing- Indian market Analysis.

India's new foreign trade Policy - Legal framework of foreign trade policy - Special focus - General provision on Import and Export - Promotional Measures - Duty exemption/ Duty remission scheme - EPCG Scheme - EOU/ EHTP/ STP/ BTP - SEZs.

UNIT III
Marketing concepts and Import - Forms of organization in Import and domestic Trade - Products, Sales forecasting and sales Management - Pricing, Promotion, Branding and Advertising. Retail Management - Introduction to Logistics - Parameters of Supply Chain Management - Management of logistics and Supply Chain - Consumer Supply Chain Relationship.

UNIT IV
The Customs Tariff Act - Exemptions in Import - by UN and its agencies and their officials - Import by UN or international organizations for execution of projects in India - Imports by Government Diplomats, Trade representatives etc. - Customs Tariff

UNIT V

TOTAL: 45 PERIODS

TEXT BOOKS:
1. Wagdre, H. International Marketing Management, Adhyayan Publisher, 2007

PTLT7011 LEATHER AND LEATHER PRODUCTS COSTING

UNIT I
Cost accounting, elements of cost, classification of cost elements – examples from textile industry, methods of costing

UNIT II
Cost profit volume analysis, breakeven analysis; standard costing, analysis of variance

UNIT III
Costing of leather and leather products – material, labour, power and overhead expenses

UNIT IV
Foreign exchange mechanisms, exchange rates; foreign exchange exposure management – risks, strategies to reduce risk

UNIT V
Budget, types of budgets, budgeting and control in tanneries and leather products industry

TOTAL: 45 PERIODS

REFERENCES:
AIM:
- To impart knowledge on leather products merchandising that relates to the domestic and global leather and leather product merchandising.

OBJECTIVES:
To understand
- Fundamentals of purchasing
- Retail sector
- Global Market

UNIT I PRINCIPLES OF MARKETING MANAGEMENT

UNIT II PURCHASING PRINCIPLES AND MANAGEMENT
Purchasing scope and development - Strategic aspects of purchasing - Key purchasing -variables consideration - Purchasing negotiations & competitive – Bidding - Outsourcing -purchasing operation - Buying capital goods & services - Purchasing for resale - Purchasing systems and technology - Evaluation of purchasing performance - Purchasing ethics and legal issues

UNIT III PRINCIPLES AND PRACTICE OF MERCHANDISING
Merchandising concepts, technology, systems, planning - Merchandise pricing and budgeting, sample handling - Managing merchandise assortments - Developing and - presenting product lines - Introduction to shipping operation

UNIT IV RETAIL SECTOR OF LEATHER
Overview of retailing; Changing retail environment - Typology of retail buying - Understanding the consumer - Competitive strategies in the retail industry - Retail location strategy; Store layout & Design - Product planning and selection; Inventory management - Retail pricing; Retail communication - Customer Service

UNIT V GLOBAL SOURCING OF LEATHER
Globalization and its influences - The role and importance of global sourcing - Global sourcing process and strategy - Investigation and tendering - Supplier selection and development - Operationalization of global sourcing strategy - Performance Measurement - The benefits and challenges of global sourcing - Coping with custom clearance uncertainties - Sourcing on the Internet - Supplier relationship development - Merchandising language for sourcing

REFERENCES:
1. Apparel Product Design and Merchandising Strategies by Cynthia L. Regan. Publisher: Prentice Hall

TOTAL: 45 PERIODS
AIM:
- To impart knowledge on leather products machinery used in leather product sector.

OBJECTIVE:
- To focus on the hand tools and machines, machines for shoe and footwear construction, system, automation in leather product machines and modular manufacturing and layout.

UNIT I  HAND TOOLS AND MACHINES  8
Hand tools and machinery used in leather and leather products making and other auxiliaries operations – General constructions - Principles involved in their working - Power transmissions systems. The machinery: clicking Press, splitting, skiving, edge-folding, stamping, sewing, punching, crimping, eyeleting, Seam-rubbing and taping, thermo-cementing, Pre-forming, etc.

UNIT II  MACHINES FOR SHOE AND FOOTWEAR CONSTRUCTION  8
Machines used in cemented, stitch down, welted, string lasted, DVP & DIP and other types of construction. Principles involved in their working - trouble shooting and & preventive maintenance. Spare parts planning and inventing control.

UNIT III  TRANSPORT SYSTEM  5
Different types of material handling system in leather products industry. Manual, semi-automatic and automatic conveyors.

UNIT IV  AUTOMATION IN LEATHER PRODUCT MACHINES  11
Application of computer/microprocessor base leather products making machines, principle and operation technique, safety measurements computerized controls, micro-processor links, and used of Robotics  Die Less Cutting Systems. CAM for automatic stitching and other advance footwear machinery.

UNIT V  MODULAR MANUFACTURING AND LAYOUT  13
Productivity improvements: scheduling, Simulation, Toyota and rink system and Lean manufacturing system.
Factors affecting plant location and construction of factory building for balancing the production line in footwear Industry. Application of Neural-network software in layout preparation.

TOTAL: 45 PERIODS

REFERENCES:
Techniques of chain polymerization; Bulk, solution, emulsion, microemulsion and suspension polymerization; chemical modification of fibres; Polymer solution, Flory's theory; Interaction parameter.

UNIT III
Molecular weight and its distribution by: End group analysis, osmometry, light scattering, ultra centrifugation, gel permeation chromatography, intrinsic viscosity; Spectroscopic methods of polymer characterization such as, FTIR, UV, NMR and others.

UNIT IV
Compounding of polymers - fillers, plasticizers, antioxidants, UV stabilizers, colouring agents and flame retardants. Polymer processing - compression, moulding, injection, extrusion, calendering and film casting; Preparation and properties of polyesters, polyamides, epoxy and silicone polymers; Conductive polymers, super absorbent polymers.

UNIT V
Recycling, remoulding, depolymerisation, incineration, biodegradable polymers.

REFERENCES:

PTLT7015 SAFETY IN LEATHER INDUSTRIES L T P C 3 0 0 3

AIM:
- To impart knowledge on Occupational Safety and Hazard aspects in leather manufacture

OBJECTIVES:
To understand
- legal framework of safety & health in India and international conventions
- hazard identification and assessment
- productive machine safety in the leather industry
- work ecology and ergonomics
- emergency prevention and preparedness safety & health management

UNIT I SAFETY PHILOSOPHY, HAZARD IDENTIFICATION AND ASSESSMENT 10
Legal framework of safety & health in India International conventions and trends; Responsibilities and enforcement mechanism. Need for safety & health (cost/benefit rational; safety, environment and productivity triangle); Role of industrial hygiene, Hazard classification (hazard categories and groups), Hazard identification and assessment (tools and methods).
UNIT II  SAFETY IN USE OF HAZARDOUS SUBSTANCES AT WORK  8
Chemical and biological hazards in the work place in the leather industry; Health effects of chemical and biological exposure Hazard information systems on hazardous substances (material safety data sheets, labelling) Workplace exposure monitoring and evaluation Hazard prevention and control measures (storage, handling and disposal) in the leather industry.

UNIT III  PRODUCTIVE MACHINE SAFETY IN THE LEATHER INDUSTRY, WORK ECOLOGY AND ERGONOMICS  17
Safety hazards of machinery, machine tools and electrical installations; Hazard prevention and safeguarding of machinery (guards, machine controls, ergonomics); Role of preventive maintenance; Safe workstation design and layout, Manual handling of material; Lighting (standards, use of natural and artificial illumination); Climate control (standards, temperature/humidity, improving general ventilation); Noise management (standards, prevention and protection); Safety of factory premises and installations (railings, flooring, safe structures); Welfare measures; Personal protection and hygiene (selection, use, maintenance);

UNIT IV  EMERGENCY PREVENTION AND PREPAREDNESS  7
Planning for emergencies; Control of fire and explosion; Dealing with medical emergencies

UNIT V  SAFETY & HEALTH MANAGEMENT AND PROMOTION  3
Promoting safety & health practices at the workplace (training, safety and warning signs); Role and responsibilities of managers, supervisors and workers.

TOTAL: 45 PERIODS

REFERENCES:

PTLT7016  SCIENCE AND TECHNOLOGY OF LEATHER SUPPLEMENTS AND SYNTHETICS  L T P C
SUPPLEMENTS AND SYNTHETICS  3 0 0 3

AIM:
- To impart knowledge on the use of leather supplements used as substitutes for leather in the manufacture of leather products

OBJECTIVE:
- At the end of the course the students would have gained knowledge on the chemistry of most common polymeric materials used in leather industry as supplements. The emphasis on the course content will be on the fundamentals of polymerization of various polymers used. Analytical skills on testing of polymers will be emphasized that will enable them to understand various polymer properties and manufacturing methods.

UNIT I  6
Technology of the most common polymeric materials used in leather industry as supplements. Polymer and Rubber industries in India.

UNIT II  15
Manufacture of industrially important polymers for plastics, fibres and lastomer - Polyethylene, polypropylene, polyvinyl chloride, polyvinyl alcohol, polycrorylonitrile, polystyrene, polyurethane, fluoro-carbon polymers, epoxy resins, polyamides, polyesters, alkyd resins, silicone polymers, cellulosics.

UNIT III  6
Fabrication of polymeric materials, compounding and mixing, casting, extrusion, fibre spinning, molding, coating, foam fabrication.
UNIT IV
Testing of polymers. Mechanical and Thermal testing.

UNIT V
Manufacture of rubber and elastomers. Natural rubber, processing, vulcanizing synthetic elastomers, butadiene copolymer, neutral rubber, polyisoprene polybutadiene. Polymer and rubber industries in India.

REFERENCES:

PTLT7017 TECHNOLOGY OF ANIMAL AND TANNERY BY PRODUCTS UTILISATION

AIM:
- To impart knowledge on the preparation and use of tannery by-products that emerge during the preservation and manufacture of leather and leather products.

OBJECTIVE:
- At the end of the course the students would have gained knowledge on the preparation of several by-products emerging out of the leather and leather products sector.

UNIT I INTRODUCTION
Types of animal byproducts - from abattoirs, meat processing plants, poultry, fishing and other sources including fallen animals. Present methods of collection, processing and utilisation in developing countries vis a vis developed countries: conservation techniques and concept of two tier technology. Protein meals from animal by-products including fallen animals and their significance in livestock feeds.

UNIT II DIFFERENT METHODS OF RENDERING
Bone products and their utilisation. Keratinous proteins - various sources keratinous based products and their uses.

UNIT III ANIMAL BLOOD, ITS PRODUCTS AND THEIR UTILISATION

UNIT IV UTILISATION OF ORGANS AND GLANDS FROM SLAUGHTERED ANIMALS
Anaerobic digestion, its significance for the preparation of animal feed, fuel gas, fertilizer, etc. Quality control including microbiological aspects of products processed from animal by-products.

UNIT V PRESENT STATUS OF VARIOUS BY-PRODUCTS IN INDIA
Process studies on Glue making from tannery wastes - Bone glue and deproteinisation of bone - Horn and hoof meal - Protein meals by different methods

TOTAL: 45 PERIODS

REFERENCES
AIM:
- To impart knowledge of value engineering and reengineering and relating them to leather industry.

OBJECTIVES:
- To address value engineering through the objectives, different stages, procedures and implementation of reengineering.
- To make students apply the learned concepts in a case study/project.

UNIT I  FUNDAMENTALS OF VALUE ENGINEERING AS APPLIED TO LEATHER MANUFACTURE  8
Value- Types –How to add value-Job plan – techniques employed- Who will do value engineering- Organizing the value engineering study-Benefits in leather and allied industries

UNIT II  STEP BY STEP APPLICATION OF JOB PLAN IN LEATHER RELATED INDUSTRIES  10

UNIT III  WORK SHEETS AND GUIDE LINES FOR LEATHER AND ALLIED INDUSTRIES  9

UNIT IV  REENGINEERING PRINCIPLES IN LEATHER PROCESSING AND IN LEATHER PRODUCT SECTOR  10

UNIT V  IMPLEMENTATION OF REENGINEERING  IN LEATHER SECTOR  8

TOTAL: 45 PERIODS

TEXT BOOKS:
2. Del L. Younker, “Value Engineering” Marcel Dekker, Inc. 2003

REFERENCE: