

**Maulana Abul Kalam Azad University of Technology, West Bengal**  
(Formerly West Bengal University of Technology)  
**Syllabus for B. Tech in Leather Technology**  
(Applicable from the academic session 2018-2019)

**Semester-VII**

<b>LT 701 Chemistry &amp; Technology of Leather Finishing Operations</b>
<b>OBJECTIVES:</b> To impart knowledge on materials and processes/operations involved in leather finishing.
<b>OUTCOMES:</b> 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 •Study various upgradation techniques •Methods of drying –Toggle drying, paste drying, vacuum drying etc. and preparing the crust
<b>1. Classification of finishes:</b> Characteristics of film. Theory of adhesion. Gloss and gloss retention. Different layers of finish coat. Theory of film formation. Nature of polymers used in finishing. Factors influencing the intermolecular forces of attraction. Plasticization and plasticizers. External and internal plasticization i.e. co-polymerisation, substitution branching. Function of different ingredients, gloss measurement.
<b>2. Pigments:</b> Its functions in leather finishing, classification, requirements in general. Insolubility, particle size and particle size distribution, determination of particle size distribution, interaction of pigments with the medium, surface properties, effect of different additives on the charge and dispersion properties of the pigment, stability properties, impact of pigment volume concentration on different properties. Method of preparation of aqueous pigments paste.
<b>3. Optical properties of pigments-</b> Origin of colour in inorganic compound- opacity, Hiding power and tinting strength. Light fastness and thermal resistance. Difference between inorganic pigments and organic pigments. General manufacturing procedure of pigments. Chemistry and properties of different pigments e.g. Titanium dioxide, Iron pigments, quinacridone pigments, Phthalocyanine pigments, Azo pigments, Carbon black. Extender pigments- their functions in surface coatings. Chemistry and properties of Luminescent pigments.
<b>4. Binders:</b>
Theory of film formation: different types of polymeric materials and their suitability as film formers, Different factors influencing film properties, Glass transition temperature, its importance in film formation.
<b>5. Chemistry &amp; properties of leading film forming polymers-</b>
Polyacrylates, polyurethanes, polyacrylate- Butadiene copolymers, Styrene- Butadiene copolymers. Chemistry and properties of Polyethylene, polypropylene, polystyrene, polyvinyl chloride, polyvinyl acetate, polyvinyl alcohol etc. in brief and reasons for their unsuitability in leather finishing- along with condensation resins- e.g. phenol formaldehyde, urea-formaldehyde, epoxy resins and alkyd resins. Chemistry and properties of casein film and modified casein film.
<b>6. Nitrocellulose lacquer:</b>
Chemistry and properties of N.C. lacquer, manufacturing process of N.C. lacquer and N.C. lacquer emulsion. Role of emulsifiers in producing a hydrophobic rough film, drawback of these top coating film formers. Crosslinking polymers- their suitability in leather coating and merits over conventional thermoplastic polymers. Requisites of a polymer for cross linking phenomena.
<b>7. Plasticization:</b>
Definition and classification- requirements of plasticization- mechanism- plasticization and glass transition temperature relationship- effect of plasticization on film forming properties- important type of plasticizer.
<b>8. Solvents &amp; Diluents:</b>
Definition- theoretical considerations of solvents- thermodynamical considerations- different important properties of solvent and diluent other properties- Individual properties of some solvents and diluents. Chemistry, properties and uses of other important auxiliaries in leather finishing e.g. Brightening dyes, formaldehyde, wax emulsion, silicon emulsion, other water proofing agents, matting agents, filler penetrator etc.
<b>Suggested Books:</b>
1. Chemistry of Tanning Processes- K.H. Gustavson, Academic Press, N.Y.
2. Introduction to the Principles of Leather Manufacture- S.S.dutta, 3rd edition. I.L.T.A.
3. Chemistry of synthetic dyes- K.Venkatraman, Academic Press, N.Y.
4. Synthetic Detergents- A. Davidson & B.M. Milidsky.
5. Chemistry & Technology of Leather vol.2 & 3 – Roddy , Flaherty & Lollar- Robert E.Krieger Publishing co., N.Y.
6. Treatise on Coatings- Myers & Long. 5 vol. Marcel Dekker, N.Y.
7. SBP Board of Consultants and Engineers- “synthetic resins and their industrial applications” – Small Business Publication No.57.
8. Modern surface Coatings- Mylen & Sunderland.

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<b>LT 702 Eco - Benign Options for Leather Processing</b>
<b>CLEANER PROCESSING -BEAMHOUSE</b>
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 beam house processing.
<b>CLEANER PROCESSING: TANNING</b>
Less chrome and chrome-free tanning systems. Latest concepts and trends in leather processing. Eco-labelling. Integrated strategies to achieve permissible BOD, COD and TDS standards of tannery effluents.
<b>CLEANER PROCESSING: POST TANNING</b>
Formaldehyde, Phenol, AOX free post tanning systems; Latest concepts and trends in leather processing. Eco-labelling. Integrated strategies to achieve permissible BOD, COD and TDS standards of tannery effluents.
<b>CLEANER PROCESSING: FINISHING</b>
Cleaner processing and solvent free finishing systems; Eco-labelling. integrated strategies to achieve permissible BOD, COD and TDS standards of tannery effluents
<b>REFERENCES</b>
1.P.S.Briggs, "Gloving, Clothing and special leathers" products Institute, London, 1981.
2.J.H.Sharphouse, "Leather Technicians Hand Book", Leather Producers Association, Northampton NN3 1JD, Reprinted 1995.

<b>LT 703 Analytical Chemistry of Leather Auxiliaries –II</b>
<b>01. Analysis of lipids:</b> Principles underlying determination of
i) Acid value
ii) Saponification value by Reflux method
iii) Iodine value by Hanus method
iv) Unsaponifiables by extraction Method.
<b>02. Principles underlying examination &amp; analysis of sulphated oils and readymade fatliquors.</b>
<b>03. Principles underlying examination &amp; analysis of dyes used in leather manufacture.</b>
<b>04. Principles underlying examination &amp; analysis of readymade finishes and finishing materials used in leather manufacture</b>
<b>05. Principles underlying analysis of the followings of Chrome tanned leather:</b>
i) moisture
ii) Volatile matter
iii) Total ash
iv) Solvent extractable substances
v) Nitrogen and Hide substance
vi) Water soluble matter
vii) Chromic oxide content
viii) Difference figure of water-soluble matter.
<b>06. Principles underlying analysis of the followings of vegetable tanned leather:</b>
i) moisture
ii) volatile matter
iii) total ash
iv) solvent extractable substances
v) Nitrogen and Hide substance

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vi) Water soluble matter
vii) Water insoluble ash
viii) Bound organic substances
ix) Degree of tannage
x) Difference figure of water soluble matter
xi) Invert sugar
xii) Epsom salt
<b>07. Principles underlying analysis of the followings of Alum tanned leather:</b>
i) moisture
ii) total ash
iii) solvent extractable substances
iv) Difference figure of water soluble matter
v) Water soluble matter
vi) Aluminium as Alumina
<b>08. Principles underlying analysis of the followings of Combined tanned leather:</b>
i) moisture
ii) total ash
iii) solvent extractable substances
iv) Nitrogen and Hide substance
v) Water soluble matter
vi) Chromic oxide content
vii) Degree of tannage
viii) Difference figure of water soluble matter
<b>09. Principles underlying analysis of the followings of Zirconium tanned leather:</b>
i) moisture
ii) total ash
iii) solvent extractable substances
iv) Water soluble matter
v) Zirconium Content
<b>10. Principles underlying analysis of Formaldehyde tanned leather</b>
<b>11. Principles underlying analysis of oil tanned leather</b>
<b>12. Determination of iron, silicone, copper and phosphorous present in leather</b>
Suggested Books :
01. Analytical Chemistry of Leather Manufacture – P.K.Sarkar, 2nd edition, I.L.T.A., Calcutta, 1982.
02. The Chemistry & Technology of Leather, Vol. – IV – F.O' Flaherty, W.T.Roddy & R.M.Lollar, original edition, Krieger Publishing Co. Florida, U.S.A. Co., 1956.
03. Official Methods of Analysis, S. L. T. C., U.K, 1965.
04. Different Standards issued by B.I.S. from time to time.

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<b>LT 704 Science &amp; Technology of Polymer &amp; Synthetics as Leather Substitute</b>
<b>01. Science of Macromolecules:</b>
Basic concepts, molecular forces and chemical bonding in polymers, molecular weight and its distribution.
<b>02. Step Reaction Polymerisation:</b>
Classification of polymers and polymerisation mechanisms, mechanisms of step growth polymerisation, kinetics, polyfunctional step growth polymerization.
<b>03. Radical Chain polymerisation:</b>
Mechanism of vinyl polymerisation, kinetics of chain growth polymerisation, molecular weight and its distribution,
<b>04. Ionic and Co-ordination Chain Polymerisation:</b>
Similarity and contrasts in ionic polymerisation, mechanisms and kinetics of anionic, cationic and co-ordination polymerisations.
<b>05. Copolymerisation:</b>
Kinetics of copolymerisation, composition of copolymers, mechanism of copolymerisation, blocks and graft polymers.
<b>06. Polymerisation conditions and polymer reactions:</b>
Polymerisation in homogeneous and heterogeneous systems, polymerisation engineering, chemical reaction of polymers.
<b>07. Polymer solutions:</b>
Criteria for polymer solution, conformation of dissolved polymer chains, thermodynamics of polymer solution.
<b>08. Measurement of average molecular weight and size:</b>
End group analysis, measurement of colligative properties.
<b>09. Structure–property Relationship:</b>
Polymer folding, thermodynamic and kinetic flexibility, crystallisation and melting of polymers and the factors responsible, glass transition and phase transition of polymers.
<b>10. Plasticization and crosslinking of polymers:</b>
Theory and mechanisms of plasticization, kinds of plasticizers, crosslinking of polymers and its effect in the physical property of polymer network.
<b>TECHNOLOGY OF AUXILIARIES / SYNTHETICS</b>
<b>11.</b> Preparation and applications of some industrially important polymers for leather manufacturing: polyamides, phenol-formaldehyde resin/condensate, urea-formaldehyde resin/condensate, melamine-formaldehyde resin/condensate, polyacrylic acid, polyacrylates, polymethacrylates, polystyrene, polyurethane, silicones, polybutadiene, cellulose nitrate/nitrocellulose, cellulose acetate butyrate, styrene-maleic anhydride copolymer, styrene-butyl acrylate copolymer, butyl acrylate-acrylic acid copolymer
<b>12.</b> Testing of polymers: mechanical (tensile, tearing, compression), diffractometric (XRD), morphological (SEM and TEM) and thermal (DSC, DTA, TGA) properties.
<b>13.</b> Fabrication of polymeric material, compounding and mixing, casting, extrusion, fibre spinning, molding, coating, foam fabrication.\
<b>14.</b> Synthesis, characterization and application of homo-/co-/ter polymer based hydrogels and membranes.
<b>15.</b> Manufacture of rubber and elastomers. Natural rubber processing & vulcanizing synthetic elastomers; butadiene copolymer, polyisoprene polybutadiene - processing and vulcanizing.
<b>Suggested Books: -</b>
1. Textbook of Polymer Science-Billmeyer, F.W. Jr. (1994), 3rd Edn. Wiley Interscience Publication N.Y.
2. Polymer Science and Technology of Plastics and Rubbers -Ghosh, P.M. (1990), 2nd Edn.Tata McGraw-Hill Publishing Co. N.D.
3. The Chemistry and Physics of Polymers -Kuleznev, V.N. and Shershnev, V.A. (1990) Mir Publishers, Moscow.
4. Williams, D.J., " Polymer Science & Engineering ", Prentice Hall, New York, 1971.
5. Austin, G.T., Shrer's " Chemical Process Industries ", 5th Edition, McGraw-Hill International Book Co., Singapore, 1984.
6. Elrich F.R. " Science & Technology of Rubber ", Academic Press, New York, 1978.
7. Lubin, " Handbook of compsites ", Van Nostand Reinhold Co., New York.

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<b>LT 705 E-Commerce &amp; Application</b>
<b>Introduction to E-commerce:</b> Introduction, E-commerce or Electronic Commerce- An Overview, Electronic Commerce – Cutting edge, Electronic Commerce Framework
<b>Evolution of E-commerce:</b> Introduction, History of Electronic Commerce, Advantages and Disadvantage of E-commerce, Roadmap of e-commerce in India (only short description)
<b>Network Infrastructure:</b> Introduction, Network Infrastructure- An Overview, The Internet Hierarchy, Basic Blocks of e-commerce, Networks layers & TCP/IP protocols, The Advantages of Internet, World Wide Web
<b>E-commerce Infrastructure:</b> Introduction, E-commerce Infrastructure-An Overview, Hardware, Server Operating System, Software, Network Website
<b>e-Commerce Process Models:</b> Introduction, Business Models, E-business Models Based on the Relationship of Transaction Parties, e-commerce Sales Life Cycle (ESLC) Model
<b>Risks of Insecure Systems:</b> Introduction, An Overview of Risks Associated with Internet Transactions, Intranet Associated Risks, risks associated with Business Transaction Data Transferred between Trading Partners
<b>Management of Risk:</b> Introduction, Introduction to Risk Management, Disaster Recovery Plans, Risk Management Paradigm
<b>Electronic Payment Systems:</b> Electronic Payment Systems, Electronic Cash, Smart Cards and Electronic Payment Systems, Credit Card Based Electronic Payment Systems, Risks and Electronic Payment Systems
<b>Electronic Data Interchange(EDI):</b> The Meaning of EDI, History of EDI, EDI Working Concept, Financial EDI, EDI and Internet (Describe only with the diagram of EDI)
<b>E-Marketing:</b> The scope of E-Marketing, Internet Marketing Techniques
<b>Website Design Issues:</b> Factors that Make People Return to Your Site, Strategies for Website Development
<b>Consumer Oriented Business:</b> Consumer Market, One-to-One Marketing, Consumer Demographics, Maintaining Loyalty, Gaining Acceptance, Online Catalogue, the Pilot Catalogue, A Unique Search Engine
<b>Future Directions:</b> Software Agents, Technology Behind Software Agents, Types of Software Agents, Characteristics and Properties of Software Agents, Frame-work for Software Agent-based e-commerce, m-commerce, m-commerce Architecture, Areas of Potential Growth and Future for m-commerce
<b>Books:</b>
3. E-Commerce-Strategy, Technologies & Applications by David Whitley, TMH
4. E-Commerce- The cutting edge of business by Kamlesh K. Bajaj, TMH
5. E-Commerce through ASP by W Clarke- BPB
6. Beginning E-Commerce with VB, ASP, SQL Server 7.0 & MTS by Mathew Reynolds, Wrox Publishers
7. Global Electronic Commerce- Theory and Case Studies by J. Christopher Westland and Theodore H. K Clark, University Press
8. E-Commerce, Gupta & Gupta, Khanna Publishing House, New Delhi

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<b>LT 791 Tannery Practice IV</b>
Processing of Chrome tanned and vegetable tanned leather.
Finishing of chrome tanned and vegetable tanned crust.
Manufacture of Finished Leather from chrome tanned crust
Manufacture of Finished leathers from vegetable tanned crust

<b>LT 792 Analytical Chemistry of Leather Auxiliaries Lab-II</b>
<b>01. Analysis of lipids:</b> Determination of
i) Moisture
ii) Acid Value
iii) Saponification value
iv) Iodine Value
v) Unsaponifiables
<b>02. Analysis of Sulphated oils:</b> Determination of
i) Moisture
ii) pH
iii) Organically combined sulphates as sulphuric and sulphonic esters
iv) Total ash
<b>03. Examination of dyestuffs used in leather manufacture</b>
<b>04. Examination of readymade finishes and finishing materials used in leather Manufacture</b>
<b>05. Analysis of the followings of chrome tanned leather</b>
i) Moisture
ii) Ash
iii) Chromic Oxide Content
iv) Solvent extractable substances
v) Water soluble matter and difference figure
<b>06. Analysis of the followings of vegetable tanned leather</b>
i) Moisture
ii) Ash
iii) Water soluble matter & difference figure
iv) Solvent extractable substances
v) Hide substance
vi) Water insoluble ash
vii) Bound organic substances
viii) Degree of tannage
ix) Epsom salt
x) Invert sugar
<b>07. Analysis of the followings of Alum tanned leather:</b>
i) Moisture
ii) Total ash
iii) Solvent extractable substances
iv) Aluminium as Alumina
<b>08. Analysis of the followings of combined tanned leather:</b>
i) Moisture
ii) Ash
iii) Solvent extractable substances
iv) Hide substance

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v) Water soluble matter & difference figure
vi) Chromic oxide content
vii) Degree of tannage
<b>09. Analysis of Zirconium tanned leather for the followings:</b>
i) Moisture
ii) Ash
iii) Solvent extractable substances
iv) Zirconium Content
<b>10. Analysis of formaldehyde tanned leather</b>
<b>11. Analysis of oil tanned leather</b>
<b>12. Determination of iron, silicone, copper and phosphorous present in leather</b>
<b>Suggested Books:</b>
1. Analytical Chemistry of Leather Manufacture – P.K.Sarkar, 2nd edition, I.L.T.A., Calcutta, 1982.
2. The Chemistry & Technology of Leather, Vol. – IV – F.O’ Flaherty, W.T.Roddy & R.M.Lollar, original edition, Krieger Publishing Co. Florida, U.S.A. Co., 1956.
3. Official Methods of Analysis, S. L. T. C., U.K, 1965. Different Standards issued by B.I.S. from time to time.

<b>LT 793 E-Commerce &amp; Application Lab</b>
E-Commerce experiments (to be given by faculty) are to be implemented using either VB, ASP, SQL or JAVA, JSP, SQL.
Creation and presentation of a business and project plan.
Selection of implementation environment and tools.
Orientation of concepts and techniques in e-commerce and web-based systems, e.g., through student presentations.
Practical use of databases, web servers, scripting languages, electronic signatures and encryption.
Development of an e-commerce application.
Continuous monitoring and reporting of project work.
<b>Books:</b>
E-Commerce through ASP by W Clarke- BPB
Beginning E-Commerce with VB, ASP, SQL Server 7.0 & MTS by Mathew Reynolds, Wrox Publishers
Professional Java Server Programming J2EE 1.3 Edition By Allamaraju et al, SPD.