

**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-IV

<b>M(CS) 401 Numerical Methods</b>
Approximation in numerical computation: Truncation and rounding errors, Fixed and floating-point arithmetic, Propagation of errors. (4)
Interpolation: Newton forward/backward interpolation, Lagrange's and Newton's divided difference Interpolation. (5)
Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, Expression for corresponding error terms. (3)
Numerical solution of a system of linear equations: Gauss elimination method, Matrix inversion, LU Factorization method, Gauss-Seidel iterative method. (6)
Numerical solution of Algebraic equation: Bisection method, Regula-Falsi method, Newton-Raphson method. (4)
Numerical solution of ordinary differential equation: Euler's method, Runge-Kutta methods, Predictor-Corrector methods and Finite Difference method. (6)
<b>Text Books:</b>
1. C.Xavier: C Language and Numerical Methods.
2. R.S. Salaria: Computer Oriented Numerical Methods, Khanna Publishing House (AICTE Recommended Textbook)
3. Dutta & Jana: Introductory Numerical Analysis.
4. J.B.Scarborough: Numerical Mathematical Analysis.
5. Jain, Iyengar , & Jain: Numerical Methods (Problems and Solution).
<b>References:</b>
1. Balagurusamy: Numerical Methods, Scitech.
2. Baburam: Numerical Methods, Pearson Education.
3. N. Dutta: Computer Programming & Numerical Analysis, Universities Press.
4. Soumen Guha & Rajesh Srivastava: Numerical Methods, OUP. Srimanta Pal: Numerical Methods, OUP

<b>LT 401 Thermodynamics</b>
<b>1. Concept of thermodynamics:</b>
Concept of thermodynamics, system, surrounding, closed system, open system, isolated system. Properties of system, isothermal process, adiabatic process, isochoric process, isobaric process, quasistatic process, internal energy, state of a system, 1st law of thermodynamics, reversible, irreversible process, work done in isothermal reversible process for ideal real gases, enthalpy and its physical significance, relation between internal energy and enthalpy, Cp and Cv and its relation, Kirchoff's equation, adiabatic changes.
<b>2. Second law of thermodynamics:</b>
Second law of thermodynamics, Carnot cycle, Carnot theorem, Joule- Thomson and throttling process and its application for vander Waals gases, Clausius inequality, entropy and its characteristic and expression, entropy change, in reversible and irreversible cyclic process, entropy relation with internal energy and enthalpy. Temperature dependence of entropy, entropy of an ideal gas and mixture of gases.
<b>3. Gibb's free energy:</b>
Gibb's free energy and Helmholtz free energy, mathematical expression for ideal and real gases, standard and free energy, Gibbs-Helmholtz equation, Maxwell relations. Condition of spontaneity and equilibrium, Nernst heat theorem, the third law of thermodynamics, partial molal quantities, chemical potential, Gibbs-Duham relation, effect of pressure and temperature on chemical potential. Partial heat capacity, partial molal volume, activity and activity coefficient, fugacity, Nernst distribution law, Raoult's law.
<b>4. Clapeyron equation:</b>
Clapeyron equation, clausius-clapeyron equation, relation between the entropy and the chemical constant.
<b>Suggested Books:</b>
1. Engineering Thermodynamics – P.K. Nag
2. Thermodynamics for chemists- S. Glasstone.
3. Thermodynamics – P.C. Rakshit.
4. Thermodynamics- Zeemansky.

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<b>LT 402 Chemistry &amp; Technology of Inorganic Tannage</b>
<b>1. Tanning:</b>
Theory, chemistry, factors and objectives of following Inorganic Tanning operations:
(A) Chrome Tannage,
(B) Aluminium Tannage,
(C) Iron Tannage,
(D) Zirconium Tannage,
(E) Titanium Tannage,
<b>2. Ligands available in Collagen:</b>
Their suitability in practical conditions – Stability of Metal-Ligand Bonds in Collagen – Characteristics of a Tanning Agent – Specificity of a metal Tanning agent in Tanning of leather – Cross linking and Tanning – Helix Coil transition – Shrinkage phenomenon – Degree of Tannage, the most important phenomena for leather properties – Background of Chrome tanning -- Aqueous Chemistry and Ligand-Substitution reactions of Transition and non-transition metal Complexes – Protolysis and Formation of Basic Chrome Complexes – Tanning Processes & Principles – Effect of Neutral salts like sodium chloride and sodium sulfate on chrome liquor and on chrome tanning – Effect of Alkalies on the Basicity of chrome complexes – Effect of Complexing Agents on Tanning Faculty of Chromium. Factors governing Tanning effect – Nature of anion – basicity of chromium salt – concentration of chromium salt – effect of pH – effect of temperature – influence of tan liquor volume -- influence of Previous History of collagen viz. effect of lyotropic agents – effect of weak acids – effect of liming – effect of swelling pretreatments – effect of detergents. Isoelectric point of chrome tanned leather.
<b>3. Masking agents:</b>
Masking agents and their requirements for use in chrome tanning – effect of masking on chrome tanned leather & on chrome liquor – evaluation of masking agent in practical tanning – recycling of chrome tan liquor – detanning of chrome tanned leather.
<b>4. Classical theories of Metal-Ligand Complexes:</b>
Their Limitations – Crystal Field & Ligand field Theories of the Co-ordination Complexes – Magnetic Properties of complexes – Ligand Field Stabilization Energy & Stereochemistry of Complexes – Thermodynamic & Kinetic Effects on Stability of Complexes – Ligand Substitution Reaction of Octahedral Complexes & their Mechanisms of Substitution – Factors Affecting Rate of Reactions – Trans Effect, Theories of Ligand substitution reactions -- Manufacturing Principles & Methods of Basic Chrome Sulfate for Leather Tanning.
<b>Stability of complexes and their quantitative evaluation:</b>
Stability correlations – Chelate effect – Theory of Hard and Soft Acids and Bases – Valence Shell Electron Pair Repulsion model for structural aspects of compound. Ionization potential – Electron Affinity – Electronegativity – Lattice Energy and Solvation Energy – Variable valency – structure of complex ionic crystals – Absorption spectra of complexes.
<b>Suggested Books :</b>
1. Introduction to the Principles of Leather Manufacture- S. S. Dutta, 4 <sup>th</sup> Edn. I. L. T. A., Calcutta.
2. Chemistry & Technology of Leather-Roddy, O' Flaherty & Lollar, Vol. 3. Robert E. Krieger Publishing Co., N. Y.
3. Chemistry of Tanning Processes – K. H. Gustavson, Academic Press N. Y.
4. Fundamentals of Leather Manufacture – Eckhart Hidemann
5. Leather Technician's Handbook – J. H. Sharphouse, Vernon Lock Ltd., 125 High Holborn, London W-C1.
6. Theory and Practice of Leather Manufacture – K. T. Sarkar, Macmillan India Press, Madras.
7. Practical Leather Technology – Thomas C. Thorstenson, Robert E. Krieger Publishing Co. INC. N.Y.
8. Advanced Inorganic chemistry -- F A Cotton & G Wilkinson Wiley – Interscience
Fundamental principles of inorganic chemistry -- D. Banerjee. Sultan Chand & Co., New Publication.

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<b>LT 403 Analytical Chemistry of Leather Auxiliaries – I</b>
<b>01. Analysis of water:</b>
Principles underlying determination in water of
a) Chlorine by silver nitrate method
b) Iron by colorimetric method
c) Sulphates by gravimetric method
d) Temporary Hardness by Hehner's method.
e) Permanent and Magnesia hardness by Alkali precipitation method
f) Total hardness by EDTA method.
g) Effect of hardness of water on different stages of leather manufacture.
<b>02. Analysis of lime:</b>
Principles underlying determination of following in lime
a) Available lime
b) Total bases by titration method
c) Iron by colorimetric method
<b>03. Analysis of sodium sulphide:</b>
Principles underlying analysis of sodium sulphide by official International method.
<b>04. Analysis of lime liquor (Fresh &amp; Used ):</b>
Principles followed to determine
i) total alkalinity by boric acid method
ii) total lime by precipitation method
iii) total nitrogen by kjeldahl's method
<b>05. Analysis of delimiting agents:</b>
Principles underlying analysis of
i) Ammonium salts
ii) Organic & inorganic acids
<b>06. Analysis pickle liquor (used &amp; fresh):</b>
Principles followed for determination of acid and salt content in used and fresh pickle liquor.
<b>07. Principles underlying analysis of bates for the following:</b>
1. Enzymatic Activity
2. Ammonium salt content
<b>08. Analysis of Metal Tanning Agents:</b>
a) Analysis of Chrome liquor/ Chrome Tanning Agents:
Principles underlying determination of acidity and basic chromium in single bath chrome liquor, Calculation of Basicity Figures and changes of basicity, Principles followed for the determination of degree ofolation of basic chromium salt.
b) Analysis of Zirconium Tanning Agents:
c) Analysis of Alum Tanning Agents:
d) Analysis of Iron Tanning Agents:
<b>09. Analysis of Vegetable Tannin:</b>
Principles underlying estimation of tannin in vegetable tanstuffs, extracts, liquors etc. by ----
a) lead acetate method
b) Hide powder method
<b>Suggested Books:</b>
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.

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04. Different Standards issued by B.I.S. from time to time.
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<b>LT 404 Leather Footwear Design &amp; Manufacture</b>
<b>1. Introduction: (4 hours)</b>
History of footwear evolution . Nomenclature of different types of footwear. Different parts of footwear.
<b>2. Anatomy of human foot</b>
Bones, joints, muscles, ligaments, arches of skin of human foot. Common foot defects and their remedies. Internal & External changes of human feet from infant to adult stage . Functions of human foot. Analysis of human locomotion. Foot measurement. Foot comfort and Foot-care.
<b>3. Last</b>
Definition, classification of last, different parts of last, methodology of seasoning of wood for wooden last; Last measurement; Comparison of last with human foot.
<b>4. Designing and ‘shoe sizes &amp; fittings’:</b>
Introduction to Designing. Elements of Design. Elements of Fashion. Functions of a Designer. Design procedure related to footwear & other leather products. design documentation. Limitations imposed by purpose, material and technical considerations. Concept of inside form, outside form and mean form. Different techniques to get these three forms. Concept of Bio-mechanical designing of shoe. . Relation between foot ‘sizes & fittings’ and shoe ‘sizes & fittings’. English, American, French, Continental and Mondopoint shoe sizes and fittings system.
<b>5. Pre-closing &amp; closing operation:</b>
Principle of clicking operation, different size & stitch marking system; skiving operation – its objectives & different types ;different types of edge –treatment ; lock-stitch & chain-stitch; different types of seam;
<b>6. Construction :</b>
Material selection, flow chart, methodology, advantages & disadvantages of Cemented construction, Good-year wetted construction, Veldtschoen construction, D.V.P. construction, D.I.P(PVC) construction & D.T.P(PU) construction.
<b>7. Footwear materials:</b>
Upper & Lining Materials : Different natural & synthetic materials; comparison between natural & synthetic materials
Adhesive: Defination; different types of adhesion; different types of adhesive used in footwear industry-and their relative advantages & disadvantages.Sole, Insole, Toe-puff, Shank, Stiffener, Heel, Thread and Needle: Required properties of these materials, different types of these material and their relatives advantages & disadvantages.
<b>Suggested Books :</b>
1. Manual of Shoe Making - Clark.
2. Text book of Footwear Manufacture- J.H.Thronton.
3. Footwear Materials – Harvey.
4. Leather Work - I.P.Roseman ; The Manual Arts Press.

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<b>LT 405 Histology and Microbiology of Leather Manufacture – II</b>
<b>1. Mould and Bacterial aspect on leather:</b>
Different types of moulds associated with leather manufacture., Effect of mould/bacterial growth during processing of skins/hides, finished leathers, leather goods and during transportation. Prevention of mould/bacterial growth during processing, storage of finished goods and transportation..Testing of efficacy of fungicide on finished leather.
<b>2. Enzymes:</b>
Definition of enzymes; active site, substrate, coenzyme, cofactor and external factors affecting enzyme performances.Role of enzymes in different stages of leather processing (with a regular provision of upgradation.)
<b>3. Morphology &amp; fine structure of bacteria:</b>
The size, shape & arrangement of bacterial cells, Bacterial structures-structres external to the cell wall- flagella & motility, pili, capsules, sheaths, prosthecae & stalks.
<b>4. The cell wall:</b>
Structure & chemical composition, Structures internal to the cell wall- the cytoplasmic membranes, protoplasts, spheroplasts, membranous intrusions & intracellular membrane system, the cytoplasmic inclusion & vacuoles, nuclear material, spores & cysts.
<b>5. The cultivation, reproduction &amp; growth:</b>
Nutritional requirments, nutritional types of bacteria – Phototrophs, chemotrophs autotrophs & hetrotrophs, obligate parasites.
<b>6. Bacteriological media:</b>
Types of media , preparation of media. Physical conditions required for growth.
<b>7.Reproduction:</b>
Modes of cell division, new cell formation.
<b>8.Growth:</b>
Normal growth cycle ( growth curve) , tansitionsal periods between growth phases, synchronous growth, continuous culture.
<b>9.Quantitative measurement of bacterial growth:</b>
Direct microscopic count, electronic enumeration of cell numbers, the plate count method, membrane filter count, turbidimetric methods, determination of nitrogen content, determination of dry weight of cells, measurements of a specific chemical change produced on a constituent of a medium, Importance of quantitative measurement of growth.
<b>10.Methods of isolating pure cultures:</b>
The streak plate technique, the pour plate and spread techniques, micro manipulator techniques, the maintence & preservation of pure cultures. Culture collections, cultural characteristics, colony characateristics, characteristics of broth culture.
<b>11. Bacterial Genetics:</b>
Bacterial mutation, bacterial recombination- bacterial conjugation,transduction, transformation
<b>Suggested Books:</b>
1) Microbiology- Michel J. Pelczar, JR, E.C.S. Chan, Noel R. Krieg (Fifth Edition)
2) Molecular Biology of the gene-walson, Hopkins, Roberts, Steitz Weiner (Fourth Edition)
3) Standard Methods –Examination of water and wastewater-20th Edition Lenove S. Clesceri, Arnold E. Greenberg,Andrew D. Eaton
4) The Science of Ecologys- Second Edition-Richard Brewe
5) Textbook of microbiology-C.P. Baveja.
6) Microbiology-Prescott,Harley, Klein-McGrawHill
7) Microbiology Principles and Explorations-J.G.Black
8) Textbook of Microbiology- Paniker

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<b>HU 481 Communication skill &amp; Report Writing</b>
Objectives of this Course: This course has been designed: 1. To inculcate a sense of confidence in the students. 2. To help them become good communicators both socially and professionally. 3. To assist them to enhance their power of Technical Communication.
<b>Detailed Course Outlines:</b>
<b>A. Technical Report Writing : 2L+6P</b>
1. Report Types (Organizational / Commercial / Business / Project )
2. Report Format & Organization of Writing Materials
3. Report Writing (Practice Sessions & Workshops)
<b>B. Language Laboratory Practice</b>
I. Introductory Lecture to help the students get a clear idea of Technical Communication & the need of Language Laboratory Practice Sessions 2L
2. Conversation Practice Sessions: (To be done as real life interactions) 2L+4P a) Training the students by using Language Lab Device/Recommended Texts/cassettes /cd's to get their Listening Skill & Speaking Skill honed b) Introducing Role Play & honing over all Communicative Competence
3. Group Discussion Sessions: 2L+6P a) Teaching Strategies of Group Discussion b) Introducing Different Models & Topics of Group Discussion c) Exploring Live /Recorded GD Sessions for mending students' attitude/approach & for taking remedial measure
Interview Sessions; 2L+6P a) Training students to face Job Interviews confidently and successfully b) Arranging Mock Interviews and Practice Sessions for integrating Listening Skill with Speaking Skill in a formal situation for effective communication
4. Presentation: 2L+6P a) Teaching Presentation as a skill b) Strategies and Standard Practices of Individual /Group Presentation c) Media & Means of Presentation: OHP/POWER POINT/ Other Audio-Visual Aids
5. Competitive Examination: 2L+2P a) Making the students aware of Provincial /National/International Competitive Examinations b) Strategies/Tactics for success in Competitive Examinations c) SWOT Analysis and its Application in fixing Target
<b>Books – Recommended:</b>
Kulbushan Kumar: Effective Communication Skills, Khanna Publishing House, New Delhi, 2019
Nira Konar: English Language Laboratory: A Comprehensive Manual PHI Learning, 2011 D.
Sudharani: Advanced Manual for Communication Laboratories & Technical Report Writing Pearson Education (W.B. edition), 2011
<b>References:</b>
Adrian Duff et. al. (ed.): Cambridge Skills for Fluency A) Speaking (Levels 1-4 Audio Cassettes/Handbooks) B) Listening (Levels 1-4 Audio Cassettes/Handbooks) Cambridge University Press 1998 Mark Hancock: English Pronunciation in Use 4 Audio Cassettes/CD'S OUP 2004

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<b>M(CS)491 Numerical Methods with C Programming</b>
1. Assignments on Newton forward /backward, Lagrange's interpolation.
2. Assignments on numerical integration using Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule.
3. Assignments on numerical solution of a system of linear equations using Gauss elimination and Gauss-Seidel iterations.
4. Assignments on numerical solution of Algebraic Equation by Regular-falsi and Newton Raphson methods.
5. Assignments on ordinary differential equation: Euler's and Runge-Kutta methods.
6. Introduction to Software Packages: Matlab / Scilab / Labview / Mathematica.

<b>LT 491 Tannery Practice II</b>
At the end of the course students will gain confidence in processing of
chrome tanning for various types of leathers
Manufacture of chrome tanned leather by normal tannage
Manufacture of leathers by masked chrome tannage

<b>LT 492 Analytical Chemistry of Leather Auxiliaries Lab-I</b>
<b>01. Analysis of Water:</b>
a) Determination of hardness
i) Conventional method
ii) E.D.T.A. method
b) Determination of Iron content
c) Determination of Chloride content
<b>02. Analysis of lime:</b>
i) Determination of Available lime
ii) Determination of Total base
iii) Determination of Iron Content
<b>03. Analysis of Sodium Sulphide:</b> Determination of Available sulphide by official method
<b>04. Analysis of Pickle Liquor (used &amp; fresh):</b> Determination of acid and salt content
<b>05. Analysis Chrome tanning agents and liquors:</b>
i) Determination of Moisture
ii) Determination of Chromic oxide content
iii) Determination of Acid combined with chromium
iv) Determination of Percentage basicity
v) Determination of Change of basicity
vi) Determination of Degree of olation
<b>06. Analysis of Tannin:</b> Determination of
i) Moisture
ii) Tannins
iii) Non-tannins
iv) Colour by Lovibond tintometer
v) pH of extract
vi) Total solubles & solids
<b>07. Analysis of Synthetic Tanning agents:</b> Determination of
i) Moisture

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ii) Total soluble & solids
iii) Non-tannins
iv) Tannins
v) Colour by Lovibond Tintometer &
vi) pH of extract
<b>Suggested Books :</b>
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.

<b>LT 493 Footwear Design Lab</b>
Different techniques of clicking. Tools and machinery for clicking. Nesting of diferent components.
Different steps of Pre-closing and Closing operations.
Different types of light footwear and slipper making.
Designing and pattern cutting of various leather goods. Making of Gents’ & Ladies’ money purses.
<b>Suggested Books :</b>
5. Manual of Shoe Making - Clark.
6. Text book of Footwear Manufacture- J.H.Thronton.
7. Footwear Materials – Harvey.
8. Leather Work - I.P.Roseman ; The Manual Arts Press.

<b>LT 494 Histology and Microbiology of Leather Manufacture Lab – II</b>
1. Preparation of various culture media
2. Staining of bacteria
3. Enumeration of bacteria in hides and skins and in tan liquors
4. Isolation of bacteria from tan liquors
5. Biochemical test of isolated pure bacterial culture
6. Isolation and identification of fungi in leathers
7. Mildew resistance test for leathers
8. Identification of insect and parasitic damages
<b>Suggested Books:</b>
1) Microbiologys- Michel J. Pelczar, JR, E.C.S. Chan, Noel R. Krieg (Fifth Edition)
2) Molecular Biology of the gene-walson, Hopkins, Roberts, Steitz Weiner (Fourth Edition)
3) Standard Methods –Examination of water and wastewater-20th Edition Lenove S. Clesceri, Arnold E. Greenberg,Andrew D. Eaton
4) The Science of Ecologys- Second Edition-Richard Brewe
5) Textbook of microbiology-C.P. Baveja.
6) Microbiology-Prescott,Harley, Klein-McGrawHill
7) Microbiology Principles and Explorations-J.G.Black
8) Textbook of Microbiology- Paniker