

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-III

DETAILED CONTENTS:

HU 301 Values and Ethics in Profession
Science, Technology and Engineering as knowledge and as Social and Professional Activities
Effects of Technological Growth:
Rapid Technological growth and depletion of resources, Reports of the Club of Rome. Limits of growth: sustainable development
Energy Crisis: Renewable Energy Resources
Environmental degradation and pollution, Eco-friendly Technologies. Environmental Regulations, Environmental Ethics
Appropriate Technology Movement of Schumacher; later developments
Technology and developing notions. Problems of Technology transfer, Technology assessment impact analysis.
Human Operator in Engineering projects and industries. Problems of man, machine, interaction, Impact of assembly line and automation. Human centered Technology.
Ethics of Profession:
Engineering profession: Ethical issues in Engineering practice, Conflicts between business demands and professional ideals. Social and ethical responsibilities of Technologists. Codes of professional ethics. Whistle blowing and beyond, Case studies.
Profession and Human Values:
Values Crisis in contemporary society
Nature of values: Value Spectrum of a good life
Psychological values: Integrated personality; mental health
Societal values: The modern search for a good society, justice, democracy, secularism, rule of law, values in Indian Constitution.
Aesthetic values: Perception and enjoyment of beauty, simplicity, clarity.
Moral and ethical values: Nature of moral judgments; canons of ethics; ethics of virtue; ethics of duty; ethics of responsibility.
Suggested Books:
1. Premvir Kapoor, Professional Ethics & Human Values, Khanna Publishing House, New Delhi
2. Stephen H Unger, Controlling Technology: Ethics and the Responsible Engineers, John Wiley & Sons, New York 1994 (2nd Ed)
3. Deborah Johnson, Ethical Issues in Engineering, Prentice Hall, Englewood Cliffs, New Jersey 1991.
4. A N Tripathi, Human values in the Engineering Profession, Monograph published by IIM, Calcutta 1996.

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CH(LT) 301 Histology and Microbiology of Leather Manufacture – I
Histology of different hides and skins –
1.Histological structure
Buffalo, Cow, Goat and Sheep.
2. Histology and chemistry of epidermis
Epithelium-classification-Simple epithelia- simple squamous epithelium,simple columnar epithelium,simple cuboidal epithelium, Pseudo stratified epithelium, Stratified epithelia-stratified squamous epithelium,stratified columnar and stratified cuboidal epithelium,Transitional epithelium, Regeneration of epithelium.
3.Epidermis and process of keratinization
4.Histology and chemistry of dermis
Connective tissue fibres – white or collagen fibre, reticular fibres, elastic fibres, Ground substances, Glands, Origin of the connective tissue fibres
5.Histology of hair, hair follicle and wool
6.Histological Techniques
Fixing & hardening, dehydration, clearing, embedding, sectioning, staining, mounting for preparation of hides and Skins for observation under microscope.
7.Significance of histological characteristics on leather making properties
Hair and wool density, percentage of coarse hairs or wools,depth, diameter,angle of inclination of hair or wools, papillation of epidermis, thickness and compactness of grain and corium,tightness, and nature of merging of the grain into corium, uniformity of the fibre texture, angle of weave, fullness of collagen fibres, amount and distribution of natural fat, condition of sweat glands ,amount and condition of elastic and reticular tissues.
8.Assessment of leather
9.Photomicrography
Definition, utility of Photomicrography in leather science.
10.Study of diffects of hides/skin &leather
Suggested books:-
1.The chemistry and Technology of leather- volume-1- O’Flaherty,William T.Roddy and Robert M.Lollar-Kriege r publishing company, Malabar, Florida.
2.Theory & Practice of Leather manufacture- K.T.Sarkar-A.M.Sharif,555,Poonamallee High Road, Madras.
3.Indian hides & skins-Histological characteristics-(part-1)-Central Leather Research Institute,Madras,India.

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CH (LT) 302	Biology for Engineers
Introduction	
Purpose: To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry.	
Classification	
Purpose: To convey that classification per se is not what biology is all about. The underlying criterion, such as morphological, biochemical or ecological be highlighted. Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c) energy and Carbon utilization -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricotelic, ureotelic (e) Habitataaquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus	
Genetics	
Purpose: To convey that “Genetics is to biology what Newton’s laws are to Physical Sciences” Mendel’s laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics.	
Biomolecules	
Purpose: To convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids.	
Enzymes	
Purpose: To convey that without catalysis life would not have existed on earth Enzymology: How to monitor enzyme catalyzed reactions. How does an enzyme catalyzereactions. Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis.	
Information Transfer	
Purpose: The molecular basis of coding and decoding genetic information is universal Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structurefrom single stranded to double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination.	
Macromolecular analysis	
Purpose: How to analyses biological processes at the reductionistic level Proteins- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.	
Metabolism	
Purpose: The fundamental principles of energy transactions are the same in physical and biological world. Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergoinc reactions. Concept of Keq and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to CO ₂ + H ₂ O (Glycolysis and Krebs cycle) and synthesis of glucose from CO ₂ and H ₂ O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge	
Microbiology Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics.	
References:	
1) Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd 2) Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi,	

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R.H., John Wiley and Sons 3) Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company 4) Molecular Genetics (Second edition), Stent, G. S.; and Calender, R.W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher 5) Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers

LT 301 Fluid Mechanics
Introduction:
The basics of Chemical Engineering Operations and Chemical Engineering Processes. Fundamentals of Momentum, Heat and Mass Transfer. The two basic approaches to the study of Momentum, Heat and Mass Transport - The Unit Operation Approach and the Transport Phenomena Approach. The physical and transport properties. Units and dimensions. Dimensional Analysis.
Section 1: Flow and Fluid Properties
Ideal & Real fluids, Viscosity, relationship between stress and strain-rate for Newtonian fluids, incompressible and compressible flows, differences between laminar and turbulent flows.
Section 2: Hydrostatics
Buoyancy, metacentre, manometry, forces on submerged bodies. Pressure at a point, gauge pressure, surface tension.
Section 3: Kinematics
Stream line, Eulerian and Lagrangian description of fluids motion, concept of local and convective accelerations, steady and unsteady flows.
Section 4: Integral analysis
Control volume analysis for mass, momentum and energy.
Section 5: Differential Analysis
Differential equations of mass and momentum for incompressible flows: inviscid - Euler equation and viscous flows - Navier-Stokes equations, concept of fluid rotation, vorticity, stream function, Exact solutions of Navier-Stokes equation for Couette Flow and Poiseuille flow, potential flow.
Section 6: Dynamics of ideal fluids
Inviscid flows, Bernoulli's equation - assumptions and applications, Total head; Velocity head; Pressure head, potential function, Elementary plane flows - uniform flow, source, sink and doublet and their superposition for potential flow past simple geometries.
Section 7: Dimensional analysis
Concept of geometric, kinematic and dynamic similarity, some common non-dimensional parameters and their physical significance: Reynolds number, Froude number and Mach number.
Section 8: Internal flows
Fully developed pipe flow, velocity profile, empirical relations for laminar and turbulent flows: friction factor and Darcy-Weisbach relation, pressure drop, friction loss, pipe fittings.
Section 9: Prandtl boundary layer equations
Concept and assumptions, qualitative idea of boundary layer and separation, streamlined and bluff bodies, drag and lift forces.
Section 10: Flow measurements
Basic ideas of flow measurement using venturimeter, pitot-static tube and orifice plate, etc.
REFERENCES
1. McCabe .W.L and Smith, J.C., Unit Operations in Chemical Engineering, McGraw Hill, Fourth Ed., 1993.
2. Treybal, R.E., Mass Transfer Operations, McGraw Hill Book Company, Third Ed. 1981.
3. Coulson, J.M., and Richardson, J.F., Chemical Engineering, Vol.I and II Third Ed. Pergamon press, 1978.
4. Welty, J.R., Wilson, R.E., and Wicks, C.E. Fundamentals of momentum, Heat and Mass Transfer, Third Ed., John Wiley, 1984.
5. Perry, J.H., Chemical Engineers Handbook, McGraw Hill, New York, Sixth Ed., 1984.
6. Geankoplis, C.J., Transport Processes and Separation Process Principles (Includes Unit Operations), 4th Edition.
7. Dr. Sadhu Singh, Fluid Mechanics, Khanna Book Publishing House (AICTE Recommended Textbook 2018)

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LT 302 Bio Chemistry of Protein & Fundamentals of Pre-tannage
Curing agents: Name of different Curing agents, their Manufacturing Methods and use in curing,
Curing:- Definition; necessity; principles and different state of cured hides and skins.
Soaking agents:- Theory of wetting and its application to soaking agents chemistry. Nature and classification of soaking agents ---action of different types of soaking agents on a polar substrate like collagen- HLB value as a determinant of surface active Phenomenon - Method of preparation of different soaking agents and uses. Function and uses of preservatives in soaking.
Soaking:- Physico-Chemical explanation of wetting; objectives and different controls in soaking operation .
Lime:- Classification and manufacture of lime—Chemical composition of Indian limes and their suitability.
Liming:- Chemistry of unhairing; unhairing by different methods; objectives of liming; effects of liming on collagen; controls in liming operation to achieve different physical properties of leather.
Depilants:- Manufacture and properties of sodium sulphide, unhairing mechanism of sodium sulphide. Other unhairing agents—sodium sulfydrate, Arsenic sulphides, Cyanides. etc.
Organic Depilating Agents:- Their unhairing chemistry. Enzyme depilants, Oxidative depilants.
Chemistry of Deliming Agents:- Boric acid, Ammonium salts, Sodium bisulfite. Organic deliming agents. Proprietary deliming agents.Merits of proprietary deliming agents over conventional deliming chemicals.
Deliming:- Objectives, principles and controls of deliming.
Bating Agents:- Manufacture , properties and uses of Bating agents. Functions of different components in synthetic bates in bating operation. Acid bates vs alkaline bates.
Bating:- Chemistry of Proteolytic enzymes used for bating; necessity of bating ; its preparation and controls for desired properties of leather.
Pickling Agents:- Pickle liquor materials and composition—effect of different pickle acids and salts on leather quality. Use of acidic syntans in pickling.Their difference with inorganic acid as pickling agent. Pickling without salt.
Pickling:- Acid binding capacity of collagen; use of organic acids or salts in pickling; its necessity and controls; concept of Depickling.
01. Fundamentals of Biochemistry:
The molecular logic of life, strong and weak interactions, introductory concept of cell, bio-molecules and water.
02. Chemistry of Bio-molecules:
Chemical composition and bonding, 3-D structure – configuration and conformation, chemical reactivity, macromolecules and their monomeric subunits, prebiotic evaluation.
03. Water:
Electronic structure, weak interactions in aqueous system, ionisation of water – weak acid – weak bases, Buffering against pH changes.
04. Amino acids, peptides and proteins:
Chemistry, classification, determination of amino acids, qualitative test and quantitative determination, structure of various amino acids, formation of polypeptides, purification and separation of proteins, covalent structure of proteins.
05. Three dimensional structure of proteins:
Fundamentals of protein structure, amino acid sequencing of protein, hierarchy in protein structure, primary, secondary, super-secondary,tertiary, quaternary and domain structure of protein, protein folding and denaturation.
06. Types of proteins:
Functional role of various proteins, structure of fibrous and globular proteins of connective tissues like keratin, reticulin and elastin; albumin, globulin, mucine etc.
07. Biosynthesis of protein:
Central dogma, structure of DNA, RNA, DNA replication, transcription and translation (elementary introduction only).
08. Molecular Biology of Collagen:
Introduction of collagen, proteoglycan network, level of orders in collagen, primary, secondary, tertiary and quaternary structure of collagen, genes of collagen, collagen biosynthesis, physiological disorders for inappropriate biosynthesis, reactivity of collagen,cursory look on the interaction of collagen network with leather auxiliary.
09. Origin of cutaneous structure:
Origin of epidermal cells, cutaneous appendages, epithelial – mesenchymal interaction.

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Suggested Books:
1) Introduction to the principles of Leather Manufacture by Prof. S . S. Dutta 4th Edition, I.L.T.A. Publication.
2) Theory and Practice of Leather Manufacture by K.T. Sarkar, Latest Edition Published by Ajoy Sorcar, Chennai-41.
3) The Chemistry and Technology of Leather (Vol-1,2) by Fred O'Flaherty William T. Roddy and Robert M. Lollar. Published by Robert E. Krieger Publishing Company Huntington, New York (1978)
4) Fundamentals of Leather Manufacture – Eckhart Hidemann.
5) Theory and Practice of Leather Manufacture –K. T. Sarkar, Macmillan India Press, Madras.
6) Leather Technician's Handbook –J. H. Sharphouse, Vernon Lock Ltd., 125 High Holborn, London W-C1.
7) Nelson, D.L. and Cox, M.M. (2000), <i>Lehninger principles of biochemistry</i> , 3rd Edn. Worth Publishers, N.Y.
8) Gilbert, F.G. (1997) <i>Development Biology</i> , 5th Edn. Sinauer Associates, Massachusetts.
9) Kleinsmith, L.J. and Kish, V.M. (1998), <i>Principles of cell biology</i> , Harpar & Row publishers, N.Y.
10) Gustavson, K.H. (1956), <i>The chemistry and reactivity of collagen</i> , Academic press, N.Y.
11) Hames, B.D., Hooper, N.M. and Houghton, J.D. (1999), <i>Instant notes on Biochemistry</i> , Viva Books Pvt. Ltd. N.D.
12) Turner, P.C., McLennan, A.G., Bates, A.D. and White, M.R.H. (1999), <i>Instant notes on Molecular Biology</i> , Viva Books Pvt. Ltd. N.D.
13) Elden, H.R. <i>Biophysical properties of skins</i> , vol.1 of treatise of skin, Wiley Interscience a divn. of John Wiley & sons. N.Y.
14) Dutta, S.S. (2000), <i>An introduction to the principles of leather manufacture</i> , 4th Edn. Indian Leather Technologists Association, Calcutta

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LT 303 Fundamentals of Digital Computer
1.Introduction:
Historical background- Computer generations, idea of operating systems their developments, concept of machine, assembly and high level languages and assemblers and compilers – the basic functions and objectives
2. Number systems: Idea of positional number systems, decimal, binary, octal and hexadecimal numbers and inter conversion amongst them. Arithmetic with binary numbers. Representation of numbers in digital computers – concept of radix mantissa form.
3. Digital logic:
AND, OR, NOT and EXOR gates with truth tables. Universal gates. Introductory idea of Boolean algebra, De Morgan’s Theorem without proof. Simplification of Boolean functions with up to four variables using K-maps. Half and full adders. Introduction to Latches and flip-flops, concept of clock – S-R, J-K, D, T truth tables only. Use of F-F for construction of various registers memories circuits and simple explanations only; no analysis and timing diagrams needed.
4. Introduction to Digital computers:
CPU – ALU and Control units and their functions, Memory unit – brief description and use of magnetic memories, RAM, ROM and Cache, idea of virtual memory. Input and output units – description of Display and keyboard, mouse, printers- interfacing concept of serial and parallel ports taking printer port, RS232 and USB port.
5. Introduction to Operating systems:
Idea of hardware and software as scarce resources. Functions of OS, Processor management – processes creation and termination, processor environment, idea of threads; memory management – paging and segmentation basic concepts use of page and segment tables, scheduling methods- FIFO, LIFO, LRU algorithms. Deadlocks - conditions for deadlocks, Concurrency control - idea of critical section semaphores and locks.
6. Problem Solving Techniques:
Concept of program as data structure plus algorithm. Data types and data structures – arrays, trees, linked list, stacks and queues. Inorder, preorder and postorder traversal of trees with examples. Concept of algorithms., termination condition. Concepts of iteration and recursion with simple examples; sorting and searching techniques without proof and analysis – bubble sort, insertion sort and binary sort, linear search. Idea of complexity of computation – Big Oh notation with simple examples.
Suggested Books:
1. Hayes-- Computer Architecture & Organization,3/e ,MH
2. Carter—Computer Architecture (Schaum Series), TMH
3. Chaudhury P. Pal—“ Computer Organization & Design” , PHI
4. Tanenbaum A.S., “Operating System Design & Implementation”, Practice Hall NJ.
5. Silberschatz A. and Peterson J. L., “Operating System Concepts”, Wiley.
6. Dhamdhere: Operating System TMH
7. Horowitz Ellis & Sartaj Sahni, “Fundamentals of Data Structures”, Galgotria Pub.
8. R.S. Salaria, Data Structures, Khanna Publishing House (AICTE Recommended Textbook 2018)
9. Ekta Walia, Operating System Concepts, Khanna Publishing House (AICTE Recommended Textbook 2018)

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CH(LT) 391 Histology and Microbiology of Leather Manufacture Lab – I
Histology of hides/ skins
Setting up of a compound microscope
Preparation of microscopic slides by paraffin embedding method and By freezing method
Identification of hides and skins from their histological structures and from their grain pattern-Buffalo, Cow, Sheep and Goat
Microscopic assessment of fibre structure during the process - Soaking, liming, pickling and tanning of finished leather - sole leather.
Suggested books:-
1.The chemistry and Technology of leather- volume-1- O’Flaherty,William T.Roddy and Robert M.Lollar-Kriege r publishing company, Malabar, Florida.
2.Theory & Practice of Leather manufacture- K.T.Sarkar-A.M.Sharif,555,Poonamallee High Road, Madras.
3.Indian hides & skins-Histological characteristics-(part-1)-Central Leather Research Institute, Madras, India.

LT 391 Fluid Mechanics Lab
Mechanical features of different types of pumps & valves, pipe fittings – Characteristics of pumps – Resistances across fittings, valves etc. Calibration of different flow meters for gases & liquids – Pressure drop for flow through packed & fluidized bed – Viscosity – Gas Analysis – Application of Bernoulli’s equation.
REFERENCES
1. Unit Operations – McCabe & Smith – McGraw Hill in Chemical Engineering.
2. Chemical Engineering – Coulson & Richardson – Pergamon Press.
3. Transport Processes and Separation Process Principles - Geankoplis, C.J.

LT 392 Tannery Practice I
Brief functions of various machineries used in leather manufacture
1. Assortment of hides and skins
2. Processing of wet-blue from hides and skins
3. Introduction to various post tanning and finishing processes for the manufacture of upper and garment leathers
4. Introduction to various mechanical operations.

LT 393 Applied Information Technology Lab
1) Overview of Computer Parts and its Application.
<i>Introduction to JAVA as OOPS</i>
<i>An overview of Java</i>
<i>Data Types – variables and arrays</i>
<i>Operators, Control statements</i>
<i>Classes and objects, Inheritance, String and string buffer, Packages, Interfaces, Exception handling, Multithreaded Programming, Applets,</i>
<i>Event handling</i>
<i>Abstract Window Toolkit</i>
2) Project (mini) software on process cost. E.g. finishing chemicals- stock inventory, identification of the course while admission to an institution-three/four disciplines.
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Operating systems – William Stallings (TMH)
DOS guide – Peter Norton (PHI)
Windows Operating System – Teach yourself Windows 98 (Techmedia)
UNIX concepts & applications – S.DAS (TMH)