

ANNA UNIVERSITY, CHENNAI 600 025
UNIVERSITY DEPARTMENTS
R 2017
B. TECH. (PART TIME) LEATHER TECHNOLOGY
I TO VII SEMESTERS CURRICULA AND SYLLABI

SEMESTER I

S. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	PTMA7151	Applied Mathematics	3	0	0	3
2	PTPH7151	Engineering Physics	3	0	0	3
3	PTCY7151	Engineering Chemistry	3	0	0	3
4	PTGE7151	Computing Techniques	3	0	0	3
5	PTGE7154	Engineering Graphics	3	0	0	3
TOTAL CREDITS			15	0	0	15

SEMESTER II

S. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTLT7201	Chemistry for Leather Technologists	3	0	0	3
2.	PTLT7202	Instrumental Methods of Analysis for Leather Technologists	3	0	0	3
3.	PTLT7203	Introduction to Leather Manufacture	3	0	0	3
4.	PTLT7204	Principles of Electrical and Electronics Engineering	3	0	0	3
5.	PTLT7205	Theory of Skin Proteins and Pre-tanning Processes	3	0	0	3
TOTAL CREDITS			15	0	0	15

SEMESTER III

S. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTLT7301	Bovine Leather Manufacturing Technologies	3	0	0	3
2.	PTLT7302	Leather Biotechnology and its Application in Leather	3	0	0	3
3.	PTLT7303	Principles of Unit Operations and Processes in Leather and Leather Chemicals Manufacture	3	0	0	3
4.	PTLT7304	Theory of Material Testing of Leathers	3	0	0	3
5.	PTLT7305	Theory of Organic and Inorganic Tannages	3	0	0	3
TOTAL CREDITS			15	0	0	15

SEMESTER IV

S. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTLT7401	Environmental Science and Engineering for Leather Sector	3	0	0	3
2.	PTLT7402	Leather Machineries	3	0	0	3
3.	PTLT7403	Technology of Light Leather Manufacture from Skins	3	0	0	3
4.	PTLT7404	Theory and Practice of Post Tanning Processes	3	0	0	3
5.		Elective - I	3	0	0	3
TOTAL CREDITS			15	0	0	15

SEMESTER V

S. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	PTLT7501	Eco-benign Options for Leather Processing	3	0	0	3
2.	PTLT7502	Leather Goods and Garments Technology	3	0	0	3
3.	PTLT7503	Theory and Practice of Leather Finishing	3	0	0	3
4.		Elective - II	3	0	0	3
5.		Elective - III	3	0	0	3
TOTAL CREDITS			15	0	0	15

SEMESTER VI

S. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	PTLT7601	Footwear Technology	3	0	0	3
2	PTLT7602	Organisation and Management of Leather Manufacture	3	0	0	3
3	PTLT7603	Science and Technology of Leather Auxiliaries	3	0	0	3
4		Elective - IV	3	0	0	3
5		Elective-V	3	0	0	3
TOTAL CREDITS			15	0	0	15

SEMESTER VII

S. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	PTLT7701	Entrepreneurship for Leather Sector	3	0	0	3
2	PTGE7074	Total Quality Management	3	0	0	3
PRACTICAL						
3	PTLT7711	Project	6	0	0	6
TOTAL CREDITS			12	0	0	12

TOTAL: 102 CREDITS

ELECTIVES

S. No.	COURSE CODE	COURSE TITLE	L	T	P	C
1.	PTGE7071	Disaster Management	3	0	0	3
2.	PTGE7072	Engineering Ethics and Human Values	3	0	0	3
3.	PTGE7073	Human Rights	3	0	0	3
4.	PTGE7075	Intellectual Property Rights	3	0	0	3
5.	PTGE7076	Fundamentals of Nano Science	3	0	0	3
6.	PTLT7001	Advanced Physics and Chemistry of Leather I (APCL I)	3	0	0	3
7.	PTLT7002	Advanced Physics and Chemistry of Leather II(APCL II)	3	0	0	3
8.	PTLT7003	CAD/CAM for Leather Products Design and Manufacture	3	0	0	3
9.	PTLT7004	Computer Applications for Leather and Leather Products	3	0	0	3
10.	PTLT7005	Consumer Behavior and Business Orientation	3	0	0	3
11.	PTLT7006	Engineering Economics and Finance Management	3	0	0	3
12.	PTLT7007	Enterprise Resource Planning for Leather Sector	3	0	0	3
13.	PTLT7008	Fashion Forecasting for Leather and Leather Products	3	0	0	3
14.	PTLT7009	Human Resources Development	3	0	0	3
15.	PTLT7010	International Marketing and Foreign Trade	3	0	0	3
16.	PTLT7011	Leather and Leather Products Costing	3	0	0	3
17.	PTLT7012	Leather and Product Merchandising	3	0	0	3
18.	PTLT7013	Leather Products Machinery	3	0	0	3
19.	PTLT7014	Polymer Science	3	0	0	3
20.	PTLT7015	Safety in Leather Industries	3	0	0	3
21.	PTLT7016	Science and Technology of Leather Supplements and Synthetics	3	0	0	3
22.	PTLT7017	Technology of Animal and Tannery By products Utilisation	3	0	0	3
23.	PTLT7018	Value Engineering in Leather Sector	3	0	0	3

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**9**

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**9**

Partial derivatives – Homogeneous functions and Euler's theorem – Total derivative – Differentiation of implicit functions – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables - Maxima and minima of functions of two variables.

UNIT III ANALYTIC FUNCTION**9**

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**9**

Line Integral – Cauchy's theorem and integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of Residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour with no pole on real axis.

UNIT V LAPLACE TRANSFORMS**9**

Existence conditions – Transforms of elementary functions – Basic properties – Transforms of derivatives and integrals – Inverse transforms – Convolution theorem – Transform of periodic functions – Application to solution of linear ordinary differential equations with constant coefficients.

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:

- Grewal B.S., " Higher Engineering Mathematics ", Khanna Publishers, New Delhi, 43rd Edition, 2014.

REFERENCES:

- Ramana. B.V., " Higher Engineering Mathematics ", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
- Erwin Kreyszig , " Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2016.
- Glyn James, Advanced Modern Engineering Mathematics, Prentice Hall of India, Fourth Edition, 2011.

4. Bali, N.P. and Manish Goyal, A Text Book of Engineering Mathematics, Lakshmi Publications Pvt. Ltd., New Delhi, 2006.
5. Ray Wylie C and Barrett.L.C, " Advanced Engineering Mathematics " Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

PTPH7151

ENGINEERING PHYSICS

(Common to all branches of B.E / B.Tech programmes)

L T P C

3 0 0 3

OBJECTIVE:

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

UNIT I PROPERTIES OF MATTER

9

Elasticity – Poisson’s ratio and relationship between moduli (qualitative) - stress-strain diagram for ductile and brittle materials, uses - factors affecting elastic modulus and tensile strength - bending of beams - cantilever - bending moment - Young’s modulus determination - theory and experiment - uniform and non-uniform bending - I shaped girders - twisting couple - hollow cylinder - shaft - torsion pendulum - determination of rigidity modulus- moment of inertia of a body (regular and irregular).

UNIT II ACOUSTICS AND ULTRASONICS

9

Classification of sound - loudness and intensity - Weber-Fechner Law - standard intensity and intensity level - decibel - reverberation - reverberation time - calculation of reverberation time for different types of buildings – sound absorbing materials - factors affecting acoustics of buildings : focussing, interference, echo, echelon effect, resonance - noise and their remedies. Ultrasonics: production - magnetostriction and piezoelectric methods - detection of ultrasound - acoustic grating – ultrasonic interferometer - industrial applications – Non-destructive testing - ultrasonic method: scan modes and practice.

UNIT III THERMAL AND MODERN PHYSICS

9

Thermal expansion - thermal stress - expansion joints - bimetallic strips - thermal conductivity- heat conductions in solids – flow of heat through compound media - Forbe’s and Lee’s disc method: theory and experiment- Black body radiation – Planck’s theory (derivation) – Compton effect – wave model of radiation and matter – Schrödinger’s wave equation – time dependent and independent equations – Physical significance of wave function – particle in a one dimensional box.

UNIT IV APPLIED OPTICS

9

Interference - Michelson interferometer: construction, working, determination of wave length and thickness - anti-reflection coating - air wedge and its applications - Lasers – principle and applications – Einstein’s coefficients – CO₂ and Nd:YAG laser - semiconductor lasers: homo junction and hetro junction - construction and working – applications. Optical fibres - classification (index & mode based) - principle and propagation of light in optical fibres - acceptance angle and numerical aperture - fibre optic communication system - active and passive sensors.

UNIT V CRYSTAL PHYSICS

9

Single crystalline, polycrystalline and amorphous materials – Single crystals: unit cell, crystal systems, Bravais lattices, directions 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:

1. Gaur R.K. and Gupta S.L., "Engineering Physics", Dhanpat Rai Publications (2013)
2. Palanisamy P.K., "Engineering Physics", Scitech Publications (P) Ltd. (2006).
3. Arumugam M., "Engineering Physics", Anuradha Publications (2000)

REFERENCES:

1. Serway R.A. and Jewett, J.W. "Physics for Scientists and Engineers with Modern Physics". Brooks/cole Publishing Co. (2010).
2. Tipler P.A. and Mosca, G.P., "Physics for Scientists and Engineers with Modern Physics". W.H.Freeman, (2007).
3. Markert J.T., Ohanian, H. and Ohanian, M. "Physics for Engineers and Scientists". W.W.Norton & Co. (2007).

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: T_g, 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**

Adsorption-Types of adsorption-adsorption of gases on solids- adsorption from solutions- Types of isotherms-Freundlich adsorption isotherm, Langmuir adsorption isotherm. Industrial applications of adsorption. Catalysis: Characteristics and types of catalysts-homogeneous and heterogeneous, auto catalysis. Enzyme catalysis -factors affecting enzyme catalysis, Michaelis-Menton equation. Industrial applications of catalysts

UNIT III PHOTOCHEMISTRY AND SPECTROSCOPY**9**

Photochemistry: Laws of photochemistry-Grotthuss-Draper law, Stark-Einstein law and Lambert-Beer Law. Photo processes-internal conversion, inter-system crossing, fluorescence, phosphorescence, chemiluminescence and photo-sensitization. Spectroscopy: Electromagnetic spectrum-absorption of radiation-electronic, vibrational and rotational transitions. Width and intensities of spectral lines. Spectrophotometric estimation of iron. UV-Vis and IR spectroscopy-principles, instrumentation (Block diagram) and applications.

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: Helmholtz and 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 9

Basics-distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Preparation of nanoparticles – sol-gel and solvothermal. Preparation of carbon nanotube by chemical vapour deposition and laser ablation. Preparation of nanowires by VLS growth, electrochemical deposition and electro spinning. Properties and uses of nanoparticles, nanoclusters, nanorods, nanotubes and nanowires.

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:

1. Jain P. C. & Monica Jain., “Engineering Chemistry”, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2014.
2. Kannan P., Ravikrishnan A., “Engineering Chemistry”, Sri Krishna Hitech Publishing Company Pvt. Ltd. Chennai, 2014

REFERENCES:

1. Pahari A., Chauhan B., “Engineering Chemistry”, Firewall Media, New Delhi, 2012.
2. Sivasankar B., “Engineering Chemistry”, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2012.
3. AshimaSrivastava. Janhavi N N, Concepts of Engineering Chemistry”, ACME Learning Private Limited., New Delhi., 2010.
4. Vairam S., Kalyani P., Suba Ramesh., “Engineering Chemistry”, Wiley India Pvt Ltd., New Delhi., 2011.

PTGE7151	COMPUTING TECHNIQUES	L	T	P	C
	(Common to all branches of Engineering and Technology)	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 9

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 9

Introduction to C programming – Fundamentals – Structure of a C program – Compilation and linking processes - Constants, Variables – Data Types – Expressions - Operators –Decision Making and Branching – Looping statements – Solving Simple Scientific and Statistical Problems.

UNIT III ARRAYS AND STRINGS 9

Arrays – Initialization – Declaration – One dimensional and two dimensional arrays - Strings-String operations – String Arrays - simple programs- sorting- searching – matrix operations.

UNIT IV POINTERS 9

Macros - Storage classes –Basic concepts of Pointers– Pointer arithmetic - Example Problems - Basic file operations

UNIT V FUNCTIONS AND USER DEFINED DATA TYPES**9**

Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion –Enumerators – Structures - Unions

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:

1. Pradip Dey, Manas Ghosh, "Computer Fundamentals and Programming in C", Second Edition, Oxford University Press, 2013
2. Ashok N. Kamthane, "Computer programming", Pearson Education, 2007.
3. Yashavant P. Kanetkar. "Let Us C", BPB Publications, 2011.

REFERENCES:

1. Kernighan,B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2006
2. Byron S Gottfried, "Programming with C", Schaums Outlines, Second Edition, Tata McGraw-Hill, 2006.
3. R.G. Dromey, "How to Solve it by Computer", Pearson Education, Fourth Reprint, 2007

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**9**

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves, Scales: Construction of Diagonal and Vernier scales.

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES**9**

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**9**

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 9

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 9

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:

1. N.D.Bhatt and V.M.Panchal, "Engineering Drawing", Charotar Publishing House, 50th Edition, 2010

REFERENCES:

1. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
2. Luzzader, Warren.J. and Duff,John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
3. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson, 2nd Edition, 2009.
4. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.
5. Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009.
6. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

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 electriles. 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**

Introduction to colloids – properties of colloids – coagulation of solutions –Origin of charge on colloidal particles –Determination of size of colloidal particles- Donnan Membrane equilibrium – Emulsions – Gels – Applications of colloids

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:

- J W Huheey, E A Keiter and R L Keiter, 'Inorganic Chemistry' 4th edn, Harper Collins,
- M J Winter, 'Chemical Bonding' Oxford Primer Series, Oxford University Press, 1994
- N C Norman, 'Periodicity and the p-block Elements' Oxford Primer Series, Oxford University Press, 1994
- R.T. Morrison and R.N.Boyd "Organic Chemistry" VI Edition Prentice Hall Inc (1996) USA
- K.S.Tiwari, N.K.Vishnoi and S.N.Malhotra "A text book of Organic Chemistry" Second Edition, Vikas Publishing House Pvt. Ltd. (1998) New Delhi.
- Puri B.H. Sharma L.R and M.S.Prathama, Principles of Physical Chemistry, S. Chand and Company, Delhi (2001).
- Gordon M. Barrow, Physical Chemistry, Sixth edition, Tata McGraw Hill (1998).
- Introduction to Colloid and Surface Chemistry, Duncan J. Shaw, Butterworth, Hewemann, (1992)

OBJECTIVE:

- To introduce various methods of chemical analysis through sophisticated instruments for accuracy

UNIT I	INTRODUCTION TO SPECTROSCOPICAL METHODS OF ANALYSIS	13
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	9
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	6
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	4
Polarimetry and refractometry Principle, instrumentation and Applications		
UNIT V	THERMAL ANALYSIS	7
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	6
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:

1. Willard, H.H., Merritt, L.L., Dean J.A., and Settle, F.A., Instrumental methods of analysis, Sixth edition,
2. CBS publishers, 1986.

REFERENCES:

1. Parikh V.M. Absorption spectroscopy of organic molecules Addison –Wesley Publishing company, 1994.
2. Skoog D.A. and West D.MM., Fundamentals of Analytical Chemistry, Saunders –college Publishing, 1982.
3. Banwell, G.C., Fundamentals of molecular spectroscopy TMH, 1992.

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:

1. Sarkar, K.T., Theory and Practice of Leather Manufacture, Ajoy Sorcor, Madras, 4th Rev.Ed 1995.
2. Dutta, S.S., An Introduction to the Principles of Leather Manufacture, 4th Edition, Indian Leather Technologists Association, Calcutta, 4th Edition 1999.
3. Sharpouse, J.H., "Leather Technicians Handbook", Leather Producers Association, Northampton NN3 1JD, Reprinted 1995.
4. Fred O Flaherty, Roddy, T.W. and Lollar, R.M. 'The Chemistry and Technology of Leather', Vol.I & II, Type of tannages, Rober E. Krieger Publishing Co., New York, 1978.
5. Thorstensen, T.C., Practical Leather Technology, Krieger Publications, 1993

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

Types of Materials –Silicon & Germanium- N type and P type materials – PN Junction –Forward and Reverse Bias –Semiconductor Diodes –Bipolar Junction Transistor – Characteristics – transistor as an Amplifier –Introduction to operational Amplifier –Inverting Amplifier –Non Inverting Amplifier –DAC – ADC .

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:

1. Del Toro, "Electrical Engineering Fundamentals", Pearson Education, New Delhi, 2007
2. John Bird, "Electrical Circuit Theory and Technology", Elsevier, First Indian Edition, 2006
3. Allan S Moris, "Measurement and Instrumentation Principles", Elseveir, First Indian Edition, 2006
4. Rajendra Prasad, "Fundamentals of Electrical Engineering", Prentice Hall of India, 2006
5. Thereja .B.L., "Fundamentals of Electrical Engineering and Electronics", S. Chand & Co. Ltd., 2008
6. V.K Mehta and Rohit Mehta, "Principle of Electrical Engineering", S. Chand & Company, 2008

**PTLT7205 THEORY OF SKIN PROTEINS AND PRE-TANNING PROCESSES LT 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; erectorpilli 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 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:

1. Choichi Ogiwara, 'A practical guide to heavy leather processing', Fuel and Leather Research Centre, Karachi, 1980.
2. Tuck, D.H. 'The manufacture of upper leathers', Tropical Products Institute, London, 1981.
3. Jyotirmay Dey, 'Practical aspects of the manufacture of upper leather', Indian Leather Technologists Association, Calcutta, 1989.

**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 & ENZYMOLOGY 10

Chemistry of DNA and RNA: Structure, Conformation and function Proteins - Chemistry, structure and Function, Separation Principles in proteins. Classification, assay, characterization, mechanism of action, enzyme kinetics, immobilized enzymes.

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

Applications in Animal nutrition and animal production: embryo transfer, gene transfer, transgenic animals. Cleaner Leather Processing: Use of enzyme options in beam house operations - Soaking, unhairing, bating, degreasing, offal treatment: Types of enzymes - proteases, lipases - properties, assay systems and production. Types of fermentation, Preparation of media, preparation of inoculum, separation and purification of products.

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:

1. Rohm, H.J. and Reed, G. "A Comprehensive treatise on Biotechnology", Verlag Chemie, Weinheim, 1983.
2. Pelczar, J., Reid, R.D. and Chan, F.C.S., "Microbiology", Tata McGraw Hill, 1977.
3. Old, R.W., and Primrose, S.B., "Principles of Genemanipulation" 3/e Cambridge, 1985. Stryer, L. "Biochemistry" 3/e W.H. Freeman and Co. 1989.
4. Lehninger, A.L., Nelson, D.L., Gx M.M "Principles of Biochemistry", CBS Publications, 1993
5. Puvanakrishnan, R and Dhar, S.C. "Enzyme Technology in Beamhouse practices" CLRI Publication.
6. Wrinter, N.A., "Biological treatment of waste water", 1982.
7. Schroeder, E.D., "Waste and Waste water treatment", McGraw - Hill Inc. 1983

PTLT7303

**PRINCIPLES OF UNIT OPERATIONS AND PROCESSES
IN LEATHER AND LEATHER CHEMICALS MANUFACTURE**

**L T P C
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**

Concepts of Unit operations and Processes, Fundamentals: Unit and Dimensions, Material and Energy Balances. Fluid statics and dynamics, Compressible and incompressible fluids, Newtonian and Non-Newtonian fluids, Measurement of pressure drop and fluid velocity. Pumps, Compressor, Blowers.

UNIT II HEAT TRANSFER AND MASS TRANSFER**16**

Fundamentals of Heat Transfer, Heat transfer equipment, Heat exchangers, Evaporators and Condensers and Simple Design Calculations.

Diffusion: Binary diffusion, concept of mass transfer coefficients and interface mass transfer and stage wise contact.

Distillation: Principle of distillation, Application of distillation in leather chemicals and auxiliaries processing.

Extraction: Extraction principles, Leaching and Extraction equipment and their application in manufacture of leather chemicals

Drying: Drying characteristics, Theory and mechanism of drying, estimation of drying rate, design and performance of industrial dryers for leather.

Humidification: Humidity charts, methods of humidification and dehumidification; Equipments and their design aspects; Humidity control in leather processing.

UNIT III MECHANICAL SEPARATIONS**3**

Size reduction : Theory and equipment ; application in leather chemical processing

Clarification : Principles of clarification, Liquid-Liquid, Liquid-solid and Liquid-gas separations, Application in leather processing and effluent treatment Mixing : Basic theory and application in leather and leather chemical processing.

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 fatliquors.

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 5

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:

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. Shreve, R.N., Austin, G.T., Shreve's Chemical Process Industries, McGraw-Hill Book company, 1984.
7. Groggins, P.H., Unit Processes in Organic synthesis, McGraw-Hill Book company, 5th Edition, 2004.
8. Dutta, S.S., An introduction to the principles of leather manufacture, ILTA.

**PTLT7304 THEORY OF MATERIAL TESTING OF LEATHERS L T P C
3 0 0 3**

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 12

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:

1. Sarkar, P.K., 'Analytical Chemistry of Leather Manufacture', Indian Leather Technologists Association, Calcutta, 1982.
2. 'Official methods of Analysis', Society of Leather Technologists and Chemists, U.K., 1981.
3. Fred O Flaherty, Roddy, T.W. and Lollar, R.M. 'The Chemistry and Technology of Leather', Vol.IV, Evaluation of leather, Rober E. Krieger Publishing Co., New York, 1978.
4. Dutta, S.S. "An introduction to the principles of physical testing of leather", Indian Leather Technologist's Association, Calcutta, 1991.
5. 'Methods of chemical testing of leathers', IS: 582 - 1970, Bureau of Indian Standards, New Delhi, 1977.
6. "Methods of Physical testing of leathers, IS: 5914-1970, Bureau of Indian Standards, New Delhi, 1971

**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, McCandish precipitation point.

UNIT II FACTORS CONTROLLING CHROME TANNING 7

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 10

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 7

Vegetable tannins - definition and classification, Occurrence; Chemistry of hydrolysable tannins - gallotannins, ellagi tannins
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 11

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:

1. Fred O Flaherty, Roddy, T.W. and Lollar, R.M. 'The Chemistry and Technology of Leather', Vol.III, Type of tannages, RoberE.Krieger Publishing Co.,New York, 1978.
2. Gustavson, K.H. 'Chemistry of Tanning Processes' Academic Press, New York, 1958.
3. Bienkiewicz, K., 'Physical Chemistry of Leather Manufacture', Krieger, Florida 1982.
4. Covington A D, 'Tanning Chemistry' RSC Publishing, Cambridge, UK, 2009.
5. Howes, F.N. "Vegetable tanning materials", Butterworth. London, 1953.
6. Haslam, E. "The biochemistry of Plants", Vol.7. Academic Press, 1981, Chapter 18, "Vegetable tannins". "A survey of modern vegetable tannages". Tanning extracts Producers Federation, Switzerland, 1975.
7. Humphreys, G.H.W. and Jones, C.R. "The manufacture of sole and other heavy leathers". Pergamon Press, 1966. Chapter 5, "Vegetable tannin materials and syntans".
8. Vegetable and Synthetic Tanning agents, Sundara Rao, V.S., et al – The Leather Industry, (ed. by Sadulla, S) Kothari Desk book series, H.C. Kothari Group (Publications Division), Madras, p.71, 1995.

PTLT7401 ENVIRONMENTAL SCIENCE AND ENGINEERING FOR LEATHER SECTOR

**L T P C
3 0 0 3**

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
<p>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.</p>		
UNIT II	ENVIRONMENTAL POLLUTION AND CHEMISTRY	14
<p>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.</p> <p>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.</p> <p>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.</p>		
UNIT III	TREATMENT OF TANNERY WASTEWATER	10
<p>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.</p>		
UNIT IV	ENVIRONMENTAL IMPACT & RISK ASSESSMENT	9
<p>Definition and over view of Environmental Impact Assessment (EIA), key issues in EIA, legal and regulatory aspects in India – types and limitations of EIA –public participation in EIA- EIA process: screening, scope, setting, analysis – risk analysis - sources of environmental risks – risk management - risk communication and risk perception- emergency preparedness.</p>		
UNIT V	ENVIRONMENTAL POLICIES AND LEGISLATION	4
<p>Environmental legislations in India- environment protection act – air (prevention and control of pollution) act – water (prevention and control of pollution) act – wildlife protection act – forest conservation act – solid and hazardous waste management rules - biomedical waste rules – responsibilities of generators- role and responsibility of pollution control boards.</p>		
		TOTAL : 45 PERIODS
OUTCOME:		
<ul style="list-style-type: none"> • At the end of this course, the students will be able to appreciate the importance of environmental science and technology in leather manufacture. 		
REFERENCES:		
<ol style="list-style-type: none"> 1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education (2004). 2. Sawyer,C.N., MacCarty, P.L. and Parkin, G.F., Chemistry for Environmental Engineering and Science, Tata McGraw – Hill, Fifth edition, New Delhi 2003. 3. Metcalf and Eddy, Wastewater Engineering, Treatment and Reuse, Tata McGraw Hill, New Delhi, 2003. 4. Peavy HS, Rowe DR, Tchobanoglous G (1985) Environmental Engineering. (Eds: McGraw-Hill International Editions), Civil Engineering Series, 577. 5. Petts, J., Handbook of Environmental Impact Assessment, Vol., I and II, Blackwell Science, London, 1999. 		

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:

1. Walter Landmann, The Machines in the Tannery – A Review of Leather Producing Machinery and Equipment in current use, World Trades Publishing, UK, 2003
2. T.C.Thorstensen, Practical Leather Technology- Robert E.krieger Publishing Company, Huntington, New york, 1976.

**PTLT7403 TECHNOLOGY OF LIGHT LEATHER MANUFACTURE FROM SKINS L T P C
3 0 0 3****OBJECTIVE:**

- This course aims at imparting knowledge in the technology of making different types of light leathers from skins.

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:

1. Briggs, P.S. 'Gloving, clothing and special leathers', Tropical Products Institute, London, 1981.
2. Kartheiz, Fuchs, H.P. 'The Chemistry and technology of Novelty Leathers' FAO, United Nations, Rome.
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
Fatliquors – chemical classification, natural and synthetic oils. Unit operations: Sulphation, sulphonation, sulphitation reactions of oils, role of double bonds and iodine value in oils. Stability of emulsions, grain and particle sizes of emulsions, factors controlling grain sizes of emulsions. Mechanism of fatliquoring process and softening of leathers.		
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;

TOTAL: 45 PERIODS

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:

1. Venkataraman, K. 'Chemistry of Synthetic Dyes', Academic Press, New York and Lond, 1971.
2. Fred O Flaherty, Roddy, T.W. and Lollar, R.M. 'The Chemistry and Technology of Leather', Vol.III, , Rober E. Krieger Publishing Co., New York, 1978.
3. Billmeyer and Saltzman's, 'Principles of Color Technology', Wiley-Inter Sciences Publication.
4. Dutta, S.S., Introduction to the Principles of Leather Manufacture, Indian Leather Technologists Association, Calcutta, 1980.
5. Gustavson, K.H., 'Chemistry of Tanning Processes' Academic Press, New York, 1958.

**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 7

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:

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.

PTLT7502 LEATHER GOODS AND GARMENTS TECHNOLOGY L T P C
3 0 0 3

OBJECTIVE:

- To impart knowledge on making leather goods and garments

UNIT I OVERVIEW 8

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 12

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.

ii) Cutting and clicking - Hand & machine cutting, Knives & tools – Preparation and handling. Pattern interlocking/nesting for material optimization. Factors influencing cutting value. Dieless cutting.

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 9

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 9

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 7

Project Feasibility reports, plant lay out, costing and pricing for leather goods and garments. Analysis of International market trends for goods and garments – EU, USA & other markets.

Social auditing of leather goods & garment units - occupational Health & Safety, ISO 9000 & 14000.

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 goods 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:

1. Pattern Making Manual - Womens Garments, ESMOD, Paris, 1991.
2. Fashion Drawing Method, ESMOD, Paris, 1992.
3. Metric Pattern cutting for Menswear, Winifred Aldrich, BSP Professional Books, London, 1990.
4. Grading Manual, ESMOD, Paris, 1994.
5. Skiving Manual, First Edition, 1994 CLRI, Madras.
6. A course manual on leather garment pattern designing.
7. Leather garments making, NIMI publication, 2012.
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 9

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 9

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 9

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 9

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 9

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:

1. Pattern. T.E., Pigment Hand Book, vol.3 ed. W.J., New York, 1973.
2. Patterson, P., Pigments - An Introduction to Theory of Physical Chemistry, Elsevier Publishing Co. Ltd., Amsterdam, 1967.
3. Treatise on coating, Misers and Long Ed., Marcel Dekker, New York (5 Vol.)
4. Sharpouse, J.H., "Leather Technicians Handbook", Leather Producers Association, Northampton NN3 1JD, Reprinted 1995.

PTLT7601**FOOTWEAR TECHNOLOGY****LT P C
3 0 0 3****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**9**

Different types of upper and lining leathers; Different types of soling materials; Different types of adhesives used in footwear industry; Kinds of insole boards, Grinderies; Fasteners; Shoe dressing materials etc.

UNIT II DESIGN AND PATTERN DEVELOPMENT**9**

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**13**

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 scrim, trimming linings, finishing off closed seams. Top line and other edge treatments, local reinforcements, attaching fasteners and trims.

UNIT IV PRELASTING AND LASTING**10**

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**4**

Various methods of shoe construction; shoe room techniques.

TOTAL: 45 PERIODS**OUTCOME:**

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

REFERENCES:

1. Cott, N.F., "American Shoe Making", Shoe Trades Publishing Co., Cambridge.1993.
2. "Shoes and Leather News", Published by bureau of foreign and domestic commerce, Dept of commerce, US, 1940.

3. B.Venkatappaiah, (1997), "Introduction to modern footwear technology" Chennai. -GOTETI GRAPHICS

**PTLT7602 ORGANISATION AND MANAGEMENT OF LEATHER MANUFACTURE L T P C
3 0 0 3**

UNIT I TRENDS IN LIVESTOCK POPULATION 5

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 10

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 10

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 5

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 15

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
4. Report of the Nation wide Survey on Leather Product Units in India, CLRI, 1997.
5. Thyagarajan, G, Srinivasan, A.V. and Amudeswari, A., "Indian Leather 2010, A technology, Industry and Trade Forecast', CLRI, Madras 1994.
6. Bulletins of India's Foreign Trade in Leather and Leather Products , CLRI
7. Sadulla, S. The Leather Industry Kothari's Desk book Series, H.C. Kothari Group (Publications Division), Madras 1995.

AIM:

- This course aims to impart knowledge on the chemistry and properties of various auxiliaries used in leather processing

UNIT I**9**

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**9**

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

UNIT III**13**

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, chromophoric groups, structural features of dyes; acid, basic and reactive dye classification. Chemistry and technology of dye manufacture.

UNIT IV**9**

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**5**

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.

TOTAL: 45 PERIODS**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:

1. Fred O Flaherty, Roddy, T.W. and Lollar, R.M. 'The Chemistry and Technology of Leather', Vol.II, Type of tannages, Rober E. Krieger Publishing Co., New York, 1978.
2. Gustavson, K.H. 'Chemistry of Tanning Processes' Academic Press, New York, 1958.
3. Venkataraman, K. 'Chemistry of Synthetic Dyes', Academic Press, New York and Lond, 1971.
4. Myers, R.R., and Lond, J.S. 'Treatise on Coatings', Marcel Dekker, New York, 1975.

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**8**

Entrepreneurs – Mindset, character, motivation. Competencies - creativity, innovation, risk taking, leadership, communication. Negotiation and networking skill. Myths about entrepreneurs; benefits and drawbacks of entrepreneurship. Reasons for a venture failure. Successful first generation entrepreneurs in leather sectors – case study.

UNIT II**8**

Business Plan - Generating idea; converting an idea into business venture. Conducting feasibility analysis – Financial, Commercial, Technical, Environmental and Legal. Developing a business plan for leather and leathers products. Presenting a business plan to investors to pitch for funds.

UNIT III**10**

Business Finance – Forms of ownership, Financial projections and pro- forma of profit and loss account, cash flow statements; production and marketing budgets. Capital budgeting and investment analysis, breakeven point and sensitivity analysis to decide on a tannery proposal. Source of funds – own funds, banks , long term development financial institutions, Angel investors, Venture Capitalist, Public issue (IPO). Taxes - VAT, Service Taxes, Excise and Customs duties, CST, GST (proposed), tax exemptions for exports and SEZ. Controlling business - working capital control and cost control; inventory, procurement and receivables control. Quality control. Sales and marketing expenses control. SCM for leather sector.

UNIT IV**9**

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**10**

Building Business – Market plan, market research, competitive analysis, formulating competitive marketing strategy – Segmenting, Targeting and Positioning of the brand.. Formulating marketing mix – 4 P. Personal selling, managing a sales team. Distribution and CRM Strategy. New Product development. E-commerce fundamentals; strategy for expansion. Franchising - benefits and drawbacks of franchising. Global marketing – overseas marketing strategies; export documentation. Mergers and Acquisitions – synergy and valuation. Intellectual Property - patterns, trademarks, copy rights and trade secrets to grow the business in leather sector.

TOTAL: 45 PERIODS**REFERENCES:**

1. Entrepreneurship - D.F. Kuratko and T.V.Rao – Cengage Learning -2012 ; ISBN – 978-81-315-1716-1
2. Entrepreneurial Development – Dr. S.S. Khanna - S. Chand -2012 ISBN – 81- 219-1801-4
3. Handbook for New Entrepreneurs – P.C. Jain – Entrepreneurship Development Institute of India – 2010; ISBN:13 : 978-0-19-565224-6
4. Essentials of Entrepreneurship and Small Business Management – Thomas W. Zimmerer, Norman M. Scarborough – PHI Learning Ltd New Delhi. ISBN : 978 – 81- 203-3911-8
5. <http://smallb.in/entrepreneurship> - A SIDBI initiative

6. <http://business.gov.in/> - Business Knowledge Resources for SMEs
7. <http://www.dcmsme.gov.in/> - Development Commissionaire (MSME) Ministry of Small Micro Medium Industries

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

9

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

9

Leadership--The Deming Philosophy, Quality council, Quality statements and Strategic planning-- Customer Satisfaction –Customer Perception of Quality, Feedback, Customer complaints, Service Quality, Kano Model and Customer retention – Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition & Reward and Performance Appraisal-- Continuous process improvement –Juran Trilogy, PDSA cycle, 5s and Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating and Relationship development.

UNIT III TQM TOOLS & TECHNIQUES I

9

The seven traditional tools of quality – New management tools – Six-sigma Process Capability-- Bench marking – Reasons to bench mark, Bench marking process, What to Bench Mark, Understanding Current Performance, Planning, Studying Others, Learning from the data, Using the findings, Pitfalls and Criticisms of Bench Marking – FMEA – Intent of FMEA, FMEA Documentation, Stages, Design FMEA and Process FMEA.

UNIT IV TQM TOOLS & TECHNIQUES II

9

Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Performance measures-- Cost of Quality - BPR.

UNIT V QUALITY MANAGEMENT SYSTEM

9

Introduction—Benefits of ISO Registration—ISO 9000 Series of Standards—Sector-Specific Standards—AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements—Implementation— Documentation—Internal Audits—Registration--**ENVIRONMENTAL MANAGEMENT SYSTEM:** Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001—Benefits of EMS.

TOTAL: 45 PERIODS

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:

1. Dale H. Besterfield, Carol B. Michna, Glen H. Besterfield, Mary B. Sacre, Hemant Urdhwareche and Rashmi Urdhwareche, "Total Quality Management", Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression, 2013.

REFERENCES:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", (6th Edition), South-Western (Thomson Learning), 2005.
2. Oakland, J.S. "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, Third Edition, 2003.
3. Suganthi, L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
4. Janakiraman, B and Gopal, R.K, "Total Quality Management – Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.

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 9

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) 9

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 stakeholders- Institutional Processes 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 9

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 9

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 9

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, Scenarios in the Indian context, Disaster damage assessment and management.

TEXTBOOKS:

1. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-13: 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IAS and Sage Publishers, New Delhi, 2010.

REFERENCES:

1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy, 2009.

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 3

Morals, Values and Ethics – Integrity – Work Ethic – Honesty – Courage –Empathy – Self-Confidence – Discrimination- Character.

UNIT II ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' - variety of moral issues - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles - theories about right action - Self-interest –Professional Ideals and Virtues - uses of ethical theories. Valuing Time – Co-operation – Commitment.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

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 12

Collegiality and loyalty – Respect for authority – Collective Bargaining – Confidentiality- Conflict of

interest – Occupational Crime – Professional Rights – IPR- Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the Three Mile Island, Bhopal Gas plant and Chernobyl as case studies.

UNIT V GLOBAL ISSUES

12

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

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw-Hill, New York 2005.
2. Charles E Harris, Michael S. Pritchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Wadsworth Thomson Learning, United States, 2000 (Indian
3. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

REFERENCES

1. Charles D. Fleddermann, "Engineering Ethics", Pearson Education / Prentice Hall, New Jersey, 2004
2. Charles E Harris, Michael S. Pritchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Wadsworth Thomson Learning, United States, 2000
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003.
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford Press , 2000
5. R. Subramanian , "Professional Ethics ",Oxford University Press ,Reprint ,2015.

PTGE7073

HUMAN RIGHTS

**L T P C
3 0 0 3**

OBJECTIVES :

- To sensitize the Engineering students to various aspects of Human Rights.

UNIT I

9

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

UNIT II

9

Evolution of the concept of Human Rights Magna carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

UNIT III

9

Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV

9

Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V

9

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabled persons, including Aged and HIV Infected People. Implementation of Human Rights – National

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:

1. Kapoor S.K., "Human Rights under International law and Indian Laws", Central Law Agency, Allahabad, 2014.
2. Chandra U., "Human Rights", Allahabad Law Agency, Allahabad, 2014.
3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi

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

9

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

10

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

10

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT IV DIGITAL PRODUCTS AND LAW

9

Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

UNIT V ENFORCEMENT OF IPRs

7

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

1. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012
2. Intellectual Property Rights and Copy Rights, Ess Ess Publications.

REFERENCES

1. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets", Cengage Learning, Third Edition, 2012.
2. Prabuddha Ganguli,"Intellectual Property Rights: Unleashing the Knowledge Economy", McGraw Hill Education, 2011.
3. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.

OBJECTIVES:

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

UNIT I INTRODUCTION**8**

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**9**

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**12**

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, TiO₂,MgO, ZrO₂, NiO, nanoalumina, CaO, AgTiO₂, Ferrites, Nanoclays-functionalization and applications-Quantum wires, Quantum dotspreparation, properties and applications

UNIT IV CHARACTERIZATION TECHNIQUES**9**

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**7**

NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip, nanocrystal, Nanobiotechlogy: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sunbarrier products - In Photostat, printing, solar cell, battery

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

- A.S. Edelstein and R.C. Cammearata, eds., "Nanomaterials: Synthesis, Properties and Applications", Institute of Physics Publishing, Bristol and Philadelphia, 1996.
- N John Dinardo, "Nanoscale charecterisation of surfaces & Interfaces", 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000

REFERENCES

- G Timp (Editor), "Nanotechnology", AIP press/Springer, 1999.
- Akhlesh Lakhtakia (Editor),"The Hand Book of Nano Technology,Nanometer Structure, Theory, Modeling and Simulations". Prentice-Hall of India (P) Ltd, New Delhi, 2007.

**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:

1. Flaherty, O. Roddy, T.W., Lollar, R.M., 'The Chemistry & Technology of Leather', Vol.1, E. Robert Krieger Publishing Co., New York 1978.
2. Gustavson, K.H., 'The Chemistry & Reactivity of Collagen', Academic Press, New York, 1958.
3. Ramachandran, G.N., 'Treatise on the Biology of Collagen', Academic Press, New York, 1967.
4. Krishnan, V, Ed. 'Trends in Collagen', Proceedings of the Indian Academy of Sciences (Chemical Sciences), Vol. 111, No. 1, Indian Academy of Sciences, Bangalore, 1999.

**PTLT7002 ADVANCED PHYSICS AND CHEMISTRY OF LEATHER - II L T P C
(APCL-II) 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	6
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	9
Types of transport of fluids into solid matrices. Diffusion and transport phenomena in collagenous matrices. Kinetics and diffusion of tannery materials, dyes; forced diffusion into collagenous matrices.	
UNIT III	15
Molecular level processes and changes in soaking, liming/dehairing, deliming/bating, pickling, tanning, dyeing and fatliquoring.	
UNIT IV	6
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	9
Surface science application to leather. Surface charge and energy of full chrome and chrome retanned leather. 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:

1. Fred O, Flaherty, Roddy, T.W Roddy and Robert M. Lollar Ed., 'The Chemistry of Technology of Leather', Robert E. Krieger Publishing Co., New York 1978.
2. Bienkiewicz, 'Physical Chemistry of Leather Manufacture' Krieger, Floridaa, 1982.
3. Gustavson, K.H., 'Chemistry of Tanning Processes', Academic Press, New York, 1958.
4. Krishnan, V, Ed. 'Trends in Collagen', Proceedings of the Indian Academy of Sciences (Chemical Sciences), Vol. 111, No. 1, Indian Academy of Sciences, Bangalore, 1999.

PTLT7003 CAD/CAM FOR LEATHER PRODUCTS DESIGN AND MANUFACTURE L T P C
3 0 0 3

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 12

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 12

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:**

1. MP Groover and EW Zinimers, "CAD/CAM, Computer Aided Design and Manufacturing", Prentice Hall of India, 1984.
2. Newman & S P Sul., "Introduction to Computer Graphics", Published by Morgan Kaufmann, 1995
3. S.Harrington, "Computer Graphics : A programming approach", Edition 2, Published by Elsevier, 1997.
4. Zandi, "Computer Aided Design and drafting", Published by Delmer, 1985.
5. William Pratt., "Digital Image Processing", 1978.
5. Desai and Abel, "Introduction to FEM". "Step by Step guide to CAD for footwear": CAD Centre, SDDC, CLRI.
6. Rapid prototyping ; AU – FRG publications, 1984.
7. Jorg Buchner, Simulation: "QUEST" manual: EDS Technologies, Published by Springer, 2003.

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	7
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	12
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	11
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:

1. Alex Leon & Mathews Leon, “Fundamentals of Information Technology”, Leon Techworld, 1999.

REFERENCES:

1. Efraim Turban, R. Kelly Rainer and Richard E. Potter, “Introduction to Information Technology”, John Wiley & Sons; 3rd Edition edition (24 May 2004)
2. Dorian Cougias, E. L. Heiberger, Karsten Koop, The Backup Book: Disaster Recovery from Desktop to Data Center.
3. Date C. J., “An Introduction to Database Systems”, 7th Ed., Narosa Publishing, 2004
4. Kendall & Kendall, Systems Analysis and Design (Prentice Hall India)
5. Achyut S. Gobbole, Data Communication and Networks (Tata McGraw Hill Publishing Company)
6. Understanding SQL (BPB Publications)
7. Hands-on HTML(BPB Publications)
8. Ann Navarro, Effective Web Designing (BPB Publications)
9. E-commerce Developer’s Guide to Building Community & using Promotional Tools (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	6
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	7
Psychological influence - symbolic consumption, self image, personality, personal values, life style, psychographics, groups. Memory and learning, perception and cognition, motivation, emotion, mood, self image, belief, attitude, intention, gender, age.	

UNIT III **10**
Sociological influence – cultural, sub cultural, cross cultural, social class, ethnic, religion, club, group, family.

UNIT IV **8**
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 **14**
Advertising Promotion – Consumer impact on marketing, marketing impact on consumer, impact of communication on changing consumer attitude. Shopping environment – social, physical and environ. Fashion – behavioural perspective, cycles of fashion adoption,. Segmentation, Target and positioning (STP). Consumer behaviour and Marketing Mix – 4 P. Creating and sustaining brand personality. Subliminal messaging and persuasion of consumers. Creating “Buzz” to influence consumer behaviour.

TOTAL : 45 PERIODS

REFERENCES:

1. Consumer Behavior 9th Edition Leon and Schiffman and Leslie Lazar Knuk, Pearson Education Blackwell: Consumer Behaviour, 10e, Thomson 2007
2. Consumer Behaviour- Suja Nair - Himalaya Publishers. Assael: Consumer Behaviour, 6e Thomson 2006
3. Research for Marketing decisions- Paul, Donald, Herald- Prentice Hall (India) Zikmund: Exploring Marketing Research, 8e, Thomson 2006
4. Naresh K.Malhotra, Marketing Research, An applied Orientation, Pearson Education Asia. Panda, Shiba Charan, Entrepreneurship Development, New Delhi, Anmol Publications.
5. Patel, V.G., The Seven Business Crises and How to Beat Them, Tata-Mcgraw,New Delhi, 1995.
6. Verma, J.C., and Gurpal Singh, Small Business and Industry-A Handbook for Entrepreneurs, Sage, New Delhi, 2002

PTLT7006 **ENGINEERING ECONOMICS AND FINANCE MANAGEMENT** **L T P C**
3 0 0 3

AIM:

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

UNIT I **FINANCIAL ACCOUNTING** **13**
Accounting principles – basic records depreciation – depreciation methods – preparation and interpretation of profit and loss statement – balance sheet – fixed assets – current assets.

UNIT II **PROFIT VALUE ANALYSIS** **10**
Cost volume profit relationship – relevant costs in decision making profit management analysis – break even analysis – margin of safety Angle of incident & multi product break even analysis – Effect of changes in volume selling price fixed cost and variable cost on profit.

UNIT III **WORKING CAPITAL MANAGEMENT** **8**
Current assets and liability decisions – estimation of working capital requirements – Management of accounts receivable – Inventory – cash – inventory valuation methods.

UNIT IV **CAPITAL BUDGETING** **8**
Significance of capital budgeting – payback period – present value method – Accounting rate of return method.

UNIT V ENGINEERING ECONOMICS**7**

Economics – Engineering economics – Demand analysis Laws of demand – Production and cost – Pricing methods

TOTAL : 45 PERIODS**TEXT BOOKS:**

- R. Kesavan, C.Elanchezhian and T.Sundar Selwyn – Engineering Economics and Financial Accounting, Laxmi Publications 2005

REFERENCES:

1. C.James, Vanhorn, Fundamentals of Financial management PHI 1996
2. Charles T.Homgren, Cost Accounting, PHI 1985
3. S.N.Maheswaran, Management Accounting and Financial Control, Sultan Chand, 1992.

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,s that will enable the students to perform as an efficient entrepreneur.

UNIT I INTRODUCTION**6**

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

UNIT II ERP AND RELATED TECHNOLOGIES**13**

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**10**

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**10**

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

6

Post implementation review of ERP Packages in Manufacturing, Services, and other Organizations

TOTAL : 45 PERIODS

REFERENCES:

1. Leon, A. Enterprise Resource Planning, Tata Mcgraw-hill, 1999.
2. Garg, V.K. and Venkitakrishnan, N.K. ERP Ware: ERP Implementation Framework, Prentice Hall, 1999
3. Garg, V.K. and Venkitakrishnan, N.K. Enterprise Resource Planning Concepts and Practice, PHI Learning Pvt. Ltd., 2004

PTLT7008 FASHION FORECASTING FOR LEATHER AND LEATHER PRODUCTS

**L T P C
3 0 0 3**

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

10

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

9

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

UNIT III PRODUCT DEVELOPMENT

9

Market Strategy - Prototype Development - Field test and evaluation - Standard preparation - Second prototype - Final run. Costing

UNIT IV PRESENTATION TECHNIQUES

9

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

UNIT V FASHION FORECAST

8

Direction of fashion trends in leather and leather products production and marketing.

TOTAL: 45 PERIODS

REFERENCES:

1. Cott, N.F., "American Shoe Making", Shoe Trades Publishing Co., Cambridge.1993.
2. "Apparel International" Published by P.F collier and sons, U.K, 1961.
3. "Shoes and Leather News", Published by bureau of foreign and domestic commerce, Dept of commerce, US, 1940.

PTLT7009 HUMAN RESOURCES DEVELOPMENT

**L T P C
3 0 0 3**

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:**

1. Mathis, R. L. & Jackson, J. H. (2003). Human Resource Management, (10th ed.), Mason, Ohio: Thomson-Southwestern.
2. Rao, T.V., (1996) "Human Resources Development: Experiences. Interventions. Strategies", Sage Publications, New Delhi.

PTLT7010 INTERNATIONAL MARKETING AND FOREIGN TRADE L T P C
3 0 0 3

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 9

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.

UNIT II 11

Introduction-Import to India-An over view, Import and the Customs in India-Importation of Goods, Customs Duty and Exemptions-Valuation of Goods under Customs, Clearance of Imported Goods and Goods in Transit-Warehousing of Goods, Import into India.

India's new foreign trade Policy -Legal frame work 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 11

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 5

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 9

Marketing Management in the Indian context Introduction-concept-process functions-Role of Marketing in modern Organization- Marketing environment-Socio economic forces- Marketing Planning-Understanding Buyer and Organizational behavior- Product Management -Pricing decisions-Promotion Decisions.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Wagdre, H. International Marketing Management, Adhyayan Publisher, 2007
2. Datey, V. S. Foreign Trade Policy, Taxmann Publishers, 2008.
3. Bhat, M. K. international marketing management with special reference to India, king publishers, 2001

**PTLT7011 LEATHER AND LEATHER PRODUCTS COSTING L T P C
3 0 0 3**

UNIT I 9

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

UNIT II 5

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

UNIT III 17

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

UNIT IV 9

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

UNIT V 5

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

TOTAL: 45 PERIODS

REFERENCES:

1. "Cost accounting for textile mills", ATIRA, Ahmadabad, 1974
2. Kantwala, D.N., "Costing and Cost Control – A Marginal Approach for Textile Industry", Texcons, Bombay, 1974
3. James C., Van Home., "Financial Management and Policy", Prentice Hall of India Pvt. Ltd, New Delhi, 1980
4. Bhave P.V. and Srinivasan V., "Costing Accounting to Textile Mills", ATIRA, Ahmadabad, 1976
5. Thukaram Rao M.E., "Cost and Management Accounting" New Age International, Bangalore, 2004
6. Thukaram Rao M.E., "Cost Accounting and Financial Management" New Age International, Bangalore, 2004.

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 9

Introduction, Definition, Importance and Scope of Marketing, Philosophies of Marketing Management, Elements of Marketing - Needs, Wants, Demands, Customer, Consumer, Markets and Marketers; Marketing Vs Selling, Consumer Markets and Industrial Markets. Concept of Marketing Management, Marketing – Mix, Functions of Marketing Management, Marketing Organisations, Qualities of Marketing Manager.

Marketing Environment, Factors Affecting Marketing Environment, Marketing Information System and Marketing Research, Strategic Marketing Planning.

UNIT II PURCHASING PRINCIPLES AND MANAGEMENT 9

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 9

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 9

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 9

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

TOTAL: 45 PERIODS

REFERENCES:

1. Apparel Product Design and Merchandising Strategies by Cynthia L. Regan. Publisher: Prentice Hall
2. Integrated Retail Management by James R. Ogden & Denise T. Ogden, 2007, Biztantra Retail Management – Levy & Weitz-TMH 5th Edition 2002
3. Charles W L Hill. And Arun Kumar Jain. International Business: competing in the global market place, Mc Graw-Hill, 2007.
4. John D. Daniels Lee H Radebaugh, International Business: Environments and Operations Addison Wesley, 2007.
5. Justin Paul – International Business – Prentice Hall of India, 2007 Oded Shenkar Yadong Luo : International Business – John Wiley & Co., 2006

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:**

- Thornton, J.H, "Text Book of Footwear Manufacture", National Trade Press Ltd., London, 1970.
- Blakeman, J., "An Introduction to applied Science for Boot and Shoe Manufacture", The Anglo American Technical Co.Ltd., London,1924.

UNIT I 9

Introduction to natural and synthetic polymers; Terms and fundamental concepts; Step-growth polymerization, Carother's equation, Functionality, Crosslinking; PET manufacturing; Chain growth polymerization, Free radical polymerization, Kinetics of free-radical initiation, termination, chain transfer, Mayo's equation, cage effect, autoacceleration, inhibition and retardation;

UNIT II 9

Polypropylene manufacturing; Acrylic manufacturing; Atom transfer radical polymerization, ionic polymerization, ring opening polymerization; Nylon-6 manufacturing; Co-polymerization and its importance. Copolymer equation, reactivity ratio, tailor making of copolymer properties;

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

UNIT III

9

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

9

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

UNIT V

9

Recycling, remoulding, depolymerisation, incineration, biodegradable polymers.

TOTAL: 45 PERIODS

REFERENCES:

1. Joel R., "Fried Polymer Science and Technology", *Journal of Chemical Association*, ACS Publications, 2004
2. Fred W Billmeyer, "Textbook Of Polymer Science", John Wiley & Sons, 1984-03
3. Hearle, J.W.S, "Polymers and their Properties", E. Horwood, New York, 1982
4. Lenz RW, "Organic Chemistry of Synthetic High Polymers", Interscience Publishers, New York, 1967
5. Anil Kumar; Rakesh K Gupta, "Fundamentals of Polymers", McGraw-Hill, New York, 1998
6. Stephen Z. D. Cheng and Bernhard Wunderlich, "Polymer Science", Polymer Physics Ed., 1986
7. Mishra G. S., "Introductory Polymer Chemistry", John Wiley & Sons, Dhanpat Rai & Co. Pvt. Ltd., 2003
8. Gowariker V.R., Viswanathan N. V., and Jayadev Sreedhar, "Polymer Science", New Age International (P) Limited publishers, Bangalore, 2001
9. William D. Callister, Jr, "Materials Science and Engineering – An Introduction", Sixth Edition, John Wiley & Sons, Inc., 2004.

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:

1. Jeannie Mager Stellmann, Encyclopaedia of Occupational Safety & Health, 4th edition, International Labour Office, Geneva 1999.
2. J. Buljan, A Sahasranaman, J Hannak, Occupational Safety and Health Aspects of Leather Manufacture, 1st edition, United Nations Industrial Development Organization, Chennai, 1998.
3. CLRI, Safety Manual on Leather Processing, 1st edition, Central Leather Research Institute, Chennai, 1999.

PTLT7016	SCIENCE AND TECHNOLOGY OF LEATHER SUPPLEMENTS AND SYNTHETICS	L T P C
		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, polypylene, polyvinyl chloride, polyvinyl alcohol, polyacrylonitrile, polystyrene, polyurethane, fluoro-carbon polymers, epoxy resins, polyamides, polyesters, alkyd resins, silicone polymers, cellulose.	

UNIT III	6
Fabrication of polymeric materials, compounding and mixing, casting, extrusion, fibre spinning, molding, coating, foam fabrication.	

UNIT IV **8**
Testing of polymers. Mechanical and Thermal testing.

UNIT V **10**
Manufacture of rubber and elastomers. Natural rubber, processing, vulcanizing synthetic elastomers, butadiene copolymer, natural rubber, polyisoprene polybutadiene. Polymer and rubber industries in India.

TOTAL: 45 PERIODS

REFERENCES:

1. Williams, D.J., 'Polymer Science & Engineering', Prentice Hall, New York, 1971.
2. Austin, G.T., Shreer's 'Chemical Process Industries', 5th ed., McGraw Hill International Book Co., Singapore, 1984.
3. Elrich. F.R., 'Science & Technology of Rubber;', Academic Press, New York, 1978.
4. Lubin, 'Handbook of composites', Van Nostrand Reinhold Co., New York.

PTLT7017 TECHNOLOGY OF ANIMAL AND TANNERY BY PRODUCTS UTILISATION

L T P C
3 0 0 3

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 **9**

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 **9**

Bone products and their utilisation. Keratinous proteins - various sources keratinous based products and their uses.

UNIT III ANIMAL BLOOD, ITS PRODUCTS AND THEIR UTILISATION **9**

Alimentary tract and its processing into various products. Present status of the industry in the country. Pet foods methods of preparation in brief.

UNIT IV UTILISATION OF ORGANS AND GLANDS FROM SLAUGHTERED ANIMALS **9**

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 **9**

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

1. Burnham, F. 'Rendering - the invisible industry", Aero Publishers, inc., Fallbrook, CA 92028, 1978.
2. Mann, I. 'Processing and Utilisation of animal by-products', Food and Agriculture organisation, Rome, 1962.
3. Scaria, K.J., Mahendrakumar and Divakaran, S. 'Animal by-Products - processing and utilisation', Central Leather Research Institute, Madras, 1981.
4. Taiganides, E.P. 'Animal Wastes', Applied Science, Publishers Ltd., Essex, 1977.

5. Mahendrakumar, 'Hand Book of rural technology for the processing of animal by-products'.
FAO Agricultural Services Bulletin 79, Food and Agriculture Organisation.
6. Divakaran, S. Animal Blood - Processing and utilisation, Food and Agriculture Organisation, Rome, 1978.

PTLT7018 VALUE ENGINEERING IN LEATHER SECTOR L T P C
3 0 0 3

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

Selection of project and team members – general phase – information phase – function phase – creative phase – evaluation phase – Investigation phase – implementation phase – Audit-in leather and allied industries

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

Preparation of worksheets – general and information phase – Function Classification, relationship and summary- Meaningful costs- Cost analysis- Idea listing and Comparison – Feasibility ranking – Investigator phase, study summary – guidelines for writing value engineering proposal – Financial aspects – Life cycle cost analysis – Oral presentation – Audit – Case studies and Discussion.

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

The 6 R's of organizational transformation and reengineering – process reengineering - preparing the workforce – Methodology – PMI leadership expectation – Production and service improvement model – Process improvement in leather and allied industries.

UNIT V IMPLEMENTATION OF REENGINEERING IN LEATHER SECTOR 8

Process analysis techniques – Work flow analysis – Value analysis approach – Nominal group technique – Fish bone diagram – Pareto analysis – team building – Force fields analysis – Implementation in leather and allied industries.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. S.S.Iyer, "Value Engineering", New Age Information, 1996.
2. Del L. Younker, "Value Engineering" Marcel Dekker, Inc. 2003
3. M.S.Jayaraman and Ganesh Natarajan, "Business Process Reengineering", Tata McGraw Hill, 1994.

REFERENCE:

1. Dr.Johnson, A.Edosomwan, "Organizational Transformation and Process reengineering", British Library Cataloguing in publication data, 1996.