

ANNA UNIVERSITY : : CHENNAI 600 025

UNIVERSITY DEPARTMENTS

R – 2008

B.TECH. LEATHER TECHNOLOGY

III TO VIII SEMESTERS CURRICULUM AND SYLLABI

SEMESTER III

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
MA 9211	Mathematics III	3	1	0	4
CY 9211	Organic Chemistry	3	0	0	3
CY 9213	Instrumental Methods of Analysis	3	0	0	3
CE 9215	Mechanics of Solids	3	0	0	3
EE 9213	Electrical Drives and Controls	3	0	0	3
LT 9201	Chemistry and Technology of Leather Manufacture	3	0	0	3
PRACTICALS					
EE 9214	Electrical Engineering Laboratory	0	0	4	2
CY 9214	Instrumental Methods of Analysis Laboratory	0	0	4	2
LT 9207	Tannery Practice – Introduction to Leather Manufacture	0	0	4	2
TOTAL		18	1	12	25

SEMESTER IV

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
MA 9267	Statistics and Linear Programming	3	1	0	4
CH 9204	Basic Mechanical Engineering	3	0	0	3
LT 9251	Leather Biotechnology	3	0	0	3
LT 9252	Inorganic and Physical Chemistry	3	0	0	3
LT 9253	Theory and Practice of Preservation and Pre-tanning Processes	2	1	0	3
LT 9254	Theory and Practice of Vegetable and Organic Tannages	2	1	0	3
LT 9255	Technology of Heavy Leather Manufacture	3	0	0	3
PRACTICALS					
CH 9257	Mechanical Engineering Laboratory	0	0	4	2
LT 9257	Tannery Practice – Heavy Leather Manufacture	0	0	6	3
TOTAL		19	3	10	27

SEMESTER V

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
LT 9301	Principles of Unit Operations & Processes in Leather Manufacture	3	0	0	3
LT 9302	Theory and Practice of Chrome and Inorganic Tannages	2	1	0	3
LT 9303	Theory and Practice of Post Tanning Processes	2	1	0	3
LT 9304	Leather Analytical Chemistry	3	0	0	3
LT 9305	Technology of Light Leather Manufacture	3	0	0	3
LT 9306	Environmental Science and Engineering for Leather Sector	3	0	0	3
PRACTICALS					
LT 9307	Leather Analytical Chemistry Laboratory	0	0	6	3
LT 9308	Technical Seminar	0	0	2	1
LT 9309	Tannery Practice – Light Leather Manufacture	0	0	6	3
TOTAL		16	2	14	25

SEMESTER VI

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
LT 9351	Leather Microbiology & Physical Testing of Leathers	3	0	0	3
LT 9352	Theory and Practice of Leather Finishing	2	1	0	3
LT 9353	Theory and Mechanism of Leather Machinery	3	0	0	3
	Elective I	3	0	0	3
	Elective II	3	0	0	3
PRACTICALS					
LT 9357	Leather Machinery Laboratory	0	0	2	1
LT 9358	Leather Microbiology & Physical Testing Laboratory	0	0	4	2
LT 9359	Tannery Practice - Post tanning and finishing	0	0	2	1
GE 9371	Communication skills and Soft skills Laboratory	0	0	2	1
TOTAL		14	1	10	20

SEMESTER VII

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
LT 9401	Process Economics and Industrial Management for Leather Sector	3	0	0	3
LT 9402	Computer Applications for Leather & Leather Products	3	0	0	3
	Elective III	3	0	0	3
	Elective IV	3	0	0	3
PRACTICALS					
	Laboratory I(Prerequisite: Relevant theory subjects from Elective streams I or II)	0	0	4	2
LT 9406	Industrial Internship / Training *	0	0	4	2
LT 9407	Project Work - Phase I	0	0	12	6
TOTAL		12	0	20	22

* - Will be pursued during summer vacation after VI Semester

SEMESTER VIII

CODE NO	COURSE TITLE	L	T	P	C
THEORY					
	Elective V	3	0	0	3
	Elective VI	3	0	0	3
PRACTICALS					
	Laboratory II (Prerequisite: Relevant theory subjects from Elective streams I or II)	0	0	4	2
LT 9451	Project Work - Phase II	0	0	16	8
	TOTAL	6	0	20	16

TOTAL CREDITS: 191

LIST OF ELECTIVES FOR B.TECH LEATHER TECHNOLOGY

Sixth Semester

CODE NO	COURSE TITLE	L	T	P	C
LT 9021	Safety in Leather Industry	3	0	0	3
LT 9022	Science & Technology of Leather Supplements and Synthetics	3	0	0	3
LT 9023	Value Engineering and Reengineering in Leather Sector	3	0	0	3
LT 9024	Organisation & Management of Leather Manufacture	3	0	0	3
LT 9025	Leather & Product Merchandising	3	0	0	3
LT 9026	Entrepreneurship for Leather Sector	3	0	0	3
GE 9021	Professional Ethics in Engineering	3	0	0	3
GE 9022	Total Quality Management	3	0	0	3
GE 9023	Fundamentals of NanoScience	3	0	0	3
GE 9261	Environmental Science and Engineering	3	0	0	3

Group I Research and Technology Stream – Elective (III to VI) for VII and VIII Semesters

CODE NO	COURSE TITLE	L	T	P	C
LT 9027	Advanced Physics and Chemistry of Leather – I	3	0	0	3
LT 9028	Advanced Physics and Chemistry of Leather II (Prerequisite :APCL I)	3	0	0	3
LT 9029	Eco-benign Options for Leather Processing	3	0	0	3
LT 9030	Science and Technology of Leather Auxiliaries	3	0	0	3
LT 9031	Technology of Animal & Tannery Byproducts Utilization	3	0	0	3
LT 9032	Environmental Impact Assessment for Leather Sector	3	0	0	3
LT 9033	Principles of Plant Design for Leather and Chemicals Processing	3	0	0	3
LT 9034	Advanced Analytical Laboratory	0	0	4	2
LT 9035	Leather Auxiliaries Laboratory	0	0	4	2

Group II Leather Products Stream – Elective (III to VI) for VII and VIII Semesters

CODE NO	COURSE TITLE	L	T	P	C
LT 9036	Leather Goods Design and Manufacture	3	0	0	3
LT 9037	Leather Garments Design and Manufacture	3	0	0	3
LT 9038	Leather Footwear Design and Manufacture	3	0	0	3
LT 9039	Technology of Leather Supplements, Synthetics & Accessories for Leather Products	3	0	0	3
LT 9040	Fashion Forecasting for Leather and Leather Products	3	0	0	3
LT 9041	Leather Products Machinery	3	0	0	3
LT 9042	CAD/CAM for Leather Products Design & Manufacture (Pre-requisite: Leather Goods/Garments/Footwear Design and Manufacture)	2	1	0	3
LT 9043	Leather Goods and Garments – Design & Fabrication Laboratory (Pre-requisite: Leather Goods/Garments Design and Manufacture)	0	0	4	2
LT 9044	Leather Footwear – Design & Fabrication Laboratory (Pre-requisite: Leather Footwear Design and Manufacture)	0	0	4	2

Additional Electives (Common for Group I & II Streams)

CODE NO	COURSE TITLE	L	T	P	C
LT 9045	Principles of Production Management	3	0	0	3
LT 9046	Consumer Behavior and Business Orientation	3	0	0	3
LT 9047	Human Resources Management	3	0	0	3
LT 9048	Engineering Economics and Finance Management	3	0	0	3
LT 9049	International Marketing and Foreign Trade	3	0	0	3
LT 9050	Enterprise Resource Planning for Leather Sector	3	0	0	3
LT 9051	Supply Chain Management for Leather Sector	3	0	0	3
LT 9052	Advanced Soft Skills Laboratory	0	0	4	2

AIM

To facilitate the understanding of the principles and to cultivate the art of formulating physical problems in the language of mathematics.

OBJECTIVES

- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems
- To acquaint the student with Fourier transform techniques used in wide variety of situations in which the functions used are not periodic
- To introduce the effective mathematical tools for the solutions of partial differential equations that model physical processes
- To develop Z- transform techniques which will perform the same task for discrete time systems as Laplace Transform, a valuable aid in analysis of continuous time systems

UNIT I FOURIER SERIES**9+3**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half-range Sine and Cosine series – Complex form of Fourier series – Parseval's identity – Harmonic Analysis.

UNIT II FOURIER TRANSFORM**9+3**

Fourier integral theorem – Fourier transform pair-Sine and Cosine transforms – Properties – Transform of elementary functions – Convolution theorem – Parseval's identity.

UNIT III PARTIAL DIFFERENTIAL EQUATIONS**9+3**

Formation – Solutions of first order equations – Standard types and Equations reducible to standard types – Singular solutions – Lagrange's Linear equation – Integral surface passing through a given curve – Solution of linear equations of higher order with constant coefficients.

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS**9+3**

Method of separation of Variables – Solutions of one dimensional wave equation and one-dimensional heat equation – Steady state solution of two-dimensional heat equation – Fourier series solutions in Cartesian coordinates.

UNIT V Z – TRANSFORM AND DIFFERENCE EQUATIONS**9+3**

Z-transform – Elementary properties – Inverse Z-transform – Convolution theorem – Initial and Final value theorems – Formation of difference equation – Solution of difference equation using Z-transform.

L: 45, T: 15, TOTAL : 60 PERIODS**TEXT BOOK**

1. Grewal, B.S. "Higher Engineering Mathematics", Khanna Publications (2007).

REFERENCES

1. Glyn James, "Advanced Modern Engineering Mathematics, Pearson Education (2007)
2. Ramana, B.V. "Higher Engineering Mathematics" Tata McGraw Hill (2007).
3. Bali, N.P. and Manish Goyal, "A Text Book of Engineering 7th Edition (2007) Lakshmi Publications (P) Limited, New Delhi.

CY9211

ORGANIC CHEMISTRY

(Common to Chemical, Textile, Leather, Petroleum Refining & Petrochemicals and Apparel Technology)

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

AIM

To learn fundamental and applied aspects of organic chemistry towards different applications.

OBJECTIVES

- To acquire knowledge about chemical bonding, hybridization, bond fission, different types of chemical reactions and their mechanism, isomerism in organic molecules, synthesis of organic compounds and various applications of organic products.

UNIT I STRUCTURAL CONCEPT OF ORGANIC MOLECULES 5

Nature of bonding (covalent, hydrogen) – atomic orbitals – hybridization – electronegativity – conjugation – mesomerism and resonance – hyper-conjugation – inductive effect.

UNIT II REACTION AND THEIR MECHANISM 10

Homolytic bond fission – free radicals – heterolytic bond fission – electrophiles, carbonium ion, nucleophiles – acids and bases – Bronsted - Lowry concept, Lewis concept, strength of acids and bases. Substitution reactions – S_N1 , S_N2 , S_{Ni} , Addition reactions – carbon – carbon (double bond), Addition of dienes – carbon – oxygen (double bond), carbon – carbon (triple bond) – poly addition reactions, Elimination reactions – E1, E2, Condensation – simple and polycondensation, Redox reactions.

UNIT III ISOMERISM 6

Structural isomerism – stereoisomerism – optical isomerism – racemic mixture – resolution, racemisation – asymmetric synthesis, Walden Inversion. Geometrical isomerism – cis, trans isomerism, syn, anti isomerism – determination of configuration of geometrical isomers – tautomerism.

UNIT IV HYDROCARBONS AND THEIR CLASSIFICATION 10

Alkanes – alkenes – alkynes – alicyclic compounds – Bayers-strain theory - Hydrocarbons related to petrol, diesel, kerosene, lube oil and waxes. Benzene and its homologues – aromatic substitution, Friedal - Crafts reactions, Kolbe's synthesis – Riemeier – Tiemann reaction, Benzoin condensation, Perkin reaction, Beckmann rearrangement, Claisen condensation, Hoffmann rearrangements.

UNIT V SYNTHETIC ORGANIC CHEMISTRY 7

Synthesis of different types of compounds – alcohol – aldehyde – carboxylic acid – ester – ether – nitrocompounds – amines – amides (industrial methods only). Synthetic reagents – acetoacetic ester – malonic ester and Grignard reagent.

APPLIED ORGANIC CHEMISTRY 7

Polysaccharides – starch and cellulose – Proteins – amino acids and peptides – Dyes and dyeing – colour and constitution – classification of dyes based on chemical constitution and applications.

TOTAL : 45 PERIODS

TEXT BOOKS

- B.S. Bahl and Arun Bahl, "Essentials of Organic Chemistry", S.Chand and Company, New Delhi (2005).
- K.S. Tiwari, N.K. Vishnoi and S.N. Malhotra "A Text Book of Organic Chemistry", Third Edition, Vikas Publishing House Pvt. Ltd., New Delhi (2006).

REFERENCES

- R.T. Morrison and R.N. Boyd "Organic Chemistry" VI Edition, Prentice Hall of India Pvt. Ltd., New Delhi (2000).
- I L Finar "Organic Chemistry", Volume – I, IX Edition, Pearson Education (Singapore) Pte. Ltd., New Delhi (2004).
- I L Finar "Organic Chemistry", Volume – II, VII Edition, Pearson Education (Singapore) Pte. Ltd., New Delhi (2004).

(Common to Chemical, Textile, Leather, Ceramic and Petroleum Refining & Petrochemicals)

AIM

To know the principle and importance of various analytical instruments used for the characterization of various materials

OBJECTIVES

- To have thorough understanding of theory, instrumentation and applications of analytical equipments used in industries for testing quality of raw materials, intermediates and finished products To know the importance of analytical instrumentation during the purification, compounding and formulating the finished product

UNIT I INTRODUCTION TO SPECTROSCOPICAL METHODS OF ANALYSIS**12**

Electromagnetic Radiation: various ranges, dual properties, various energy levels, interaction of photons with matter, absorbance & transmittance and their relationship, permitted energy levels for the electrons of an atom and simple molecules, classification of instrumental methods based on physical properties.

Quantitative Spectroscopy: Beer-Lambert's law, limitations, deviations (real, chemical, instrumental), estimation of inorganic ions such as Fe, Ni and estimation of nitrite using Beer-Lambert's law

UNIT II UV AND VISIBLE SPECTROSCOPY**12**

Various electronic transitions in organic and inorganic compounds effected by UV, and Visible radiations, Various energy level diagrams of saturated, unsaturated and carbonyl compounds, excitation by UV and Visible radiations, Choice of solvents, cut off wavelengths for solvents, λ_{max} and ϵ_{max} rules, Woodward-Fieser rules for the calculation of absorption maxima (λ_{max}) for dienes and carbonyl compounds, Effects of auxochromes and effects of conjugation on the absorption maxima, Different shifts of absorption peaks (Bathochromic, hypsochromic, hypochromic), Multicomponent analysis (no overlap, single way overlap and two way overlap), Instrumentation for UV and VISIBLE spectrophotometers (source, optical parts and detectors), Photometric titration (Experimental set-up and various types of titrations and their corresponding curves), Applications of UV and VISIBLE spectroscopies

UNIT III IR, RAMAN AND ATOMIC SPECTROSCOPY**10**

Theory of IR spectroscopy, Various stretching and vibration modes for diatomic and triatomic molecules (both linear and nonlinear), various ranges of IR (Near, Mid, Finger print and Far) and their usefulness, Instrumentation (Only the sources and detectors used in different regions), sample preparation techniques, Applications. Raman spectroscopy: Theory, Differences between IR and Raman. Atomic absorption spectrophotometry: Principle, Instrumentation (Types of burners, Types of fuels, Hollow cathode lamp, Chopper only) and Applications, Various interferences observed in AAS (Chemical, radiation and excitation) Flame photometry: Principle, Instrumentation, quantitative analysis (Standard addition method and internal standard method) and applications Differences between AAS and FES.

UNIT IV THERMAL METHODS**5**

Thermogravimetry: Theory and Instrumentation, factors affecting the shapes of thermograms (Sample Characteristics and instrumental characteristics), thermograms of some important compounds ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$, $\text{CaC}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$, MgC_2O_4 , Ag_2CrO_4 , Hg_2CrO_4 , AgNO_3 etc), applications. Differential thermal analysis: Principle, Instrumentation and applications, differences between DSC and DTA. Applications of DSC (Inorganic and Polymer samples)

UNIT V CHROMATOGRAPHIC METHODS 6

Classification of chromatographic methods, Column, Thin layer, Paper, Gas, High Performance Liquid Chromatographical methods (Principle, mode of separation and Technique). Separation of organic compounds by column and Thin layer, mixture of Cu, Co and Ni by Paper, separation of amino acids by paper, estimation of organic compounds by GC and HPLC.

TOTAL : 45 PERIODS**REFERENCES**

1. Willard, H.H., Merritt.I.I., Dean J.a., and Settle,F.A., Instrumental methods of analysis, Sixth edition, CBS publishers,1986
2. Skoog D.A and West D.M, Fundamentals of Analytical Chemistry, Saunders -college Publishing, 1982.
3. Banwell, G.C., Fundamentals of molecular spectroscopy, TMH,1992.
4. A.I. Vogel's Quantitative Inorganic analysis . V Edition
5. Day R.A Underwood A.L Qualitative Inorganic analysis (A. I. Vogel). V Edition, Prentice-Hall of India (P) Ltd, NewDelhi
6. Sharma, B.K., Instrumental Methods of Analysis, Goel publishing House,1995
7. Kalsi .P.S. Spectroscopy of organic compounds, 6th Edition, New Age International Publishers,2006
8. William Kemp, Organic Spectroscopy, 3rd Edition, Palgrave publishers, 2007
9. Sathya Narayana. D. N. Vibrational Spectroscopy, First Edition 2004 and Reprint 2005, New Age International publishers.

CE 9215**MECHANICS OF SOLIDS****L T P C
3 0 0 3****AIM**

To given them knowledge on structural, Mechanical properties of Beams, columns.

OBJECTIVES

- The students will be able to design the support column, beams, pipelines, storage tanks and reaction columns and tanks after undergoing this course. This is precursor for the study on process equipment design and drawing.

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 9

Rigid bodies and deformable solids – forces on solids and supports – equilibrium and stability – strength and stiffness – tension, compression and shear stresses – Hooke's law and simple problems – compound bars – thermal stresses – elastic constants and poission's ratio – welded joints – design.

UNIT II TRANSVERSE LOADING ON BEAMS 9

Beams – support conditions – types of Beams – transverse loading on beams – shear force and bending moment in beams – analysis of cantilevers, simply – supported beams and over hanging beams – relationships between loading, S.F. and B.M. In beams and their applications – S.F.& B.M. diagrams.

UNIT III DEFLECTIONS OF BEAMS 9

Double integration method – Macaulay's method – Area – moment theorems for computation of slopes and deflections in beams – conjugate beam method

UNIT IV STRESSES IN BEAMS 9

Theory of simple bending – assumptions and derivation of bending equation ($M/I = F/Y = E/R$) – analysis of stresses in beams – loads carrying capacity of beams – proportioning beam sections – leaf springs – flitched beams – shear stress distribution in beams – determination of shear stress in flanged beams.

UNIT V TORSION**9**

Torsion of circular shafts – derivation of torsion equation ($T/J = C/R = G\theta/L$) – stress and deformation in circular and hollow shafts – stresses and deformation in circular and hollow shafts – stepped shafts – shafts fixed at both ends – stresses in helical springs – deflection of springs – spring constant

COLUMNS

Axially loaded short columns – columns of unsymmetrical sections – Euler's theory of long columns – critical loads for prismatic columns with different end conditions – effect of eccentricity.

TOTAL : 45 PERIODS**TEXT BOOKS**

1. Junarkar, S.B., Mechanics of Structure Vol. 1, 21st Edition, Character Publishing House, Anand, Indian, (1995)
2. William A.Nash, Theory and Problems of Strength of Materials, Schaum's Outline Series. McGraw Hill International Editions, Third Edition, 1994.

REFERENCE

1. Elangovan, A., Thinma Visai Iyal (Mechanics of Solids in Tamil), Anna University, Madras, 1995.

EE9213**ELECTRICAL DRIVES AND CONTROLS****L T P C
3 0 0 3****UNIT I INTRODUCTION****9**

Fundamentals of Electrical Drives, advantages of Electrical Drives. Choice of an Electric Drive – characteristics of loads. Components of an Electric Drive: Electrical Motors – power converters (AC to DC, DC to DC, DC to AC, AC to AC) – Control units (Fuses, Switches, Circuit breakers, contactors and relays). Equations governing motor load dynamics – equilibrium operating point and its steady state stability.

UNIT II HEATING AND POWER RATING OF MOTOR DRIVE**9**

Load diagram, heating and cooling of motors – classes of motor duty. Determination of rating for continuous, intermittent and short time duty cycles.

UNIT III POWER CONVERTERS**9**

Control rectifiers – single phase and three phase circuits – choppers – step up and step down choppers – A.C. Voltage controllers. Single phase and three phase A.C. Voltage controllers, Inverters: Voltage source and current source inverters (Elementary Treatment only).

UNIT IV D.C. MOTOR DRIVE**9**

D.C. Motor: Types, speed – torque characteristics. Starting – braking – speed control: Armature voltage – field current control – Ward Leonard methods – Four-quadrant operation. Converter fed separately excited D.C. motor drive – chopper fed D.C. motor drive (Continuous current operation only).

UNIT V A.C. DRIVES**9**

Principle of operation of 3 phase induction motor – equivalent circuit – Slip – torque characteristic – starting methods: star – Delta starter, Auto transformer starter, Rotor resistance starter, Speed control: Stator voltage control, frequency control, rotor resistance control, slip-power recovery scheme. Inverter fed 3-phase induction motor drive: v/f control, Rotor resistance control, slip-power recovery controls.

TOTAL : 45 PERIODS**TEXT BOOKS**

1. G.K. Dubey, Power Semi Conductor Controller Drives. Prentice Hall of India 1989.
2. S.K.Pillai, A First Course on Electrical Drives. Wiley Eastern Ltd., 1993.

REFERENCES

1. P.C. Sen – Principles of Electric Machines and Power Electronics. John – Willey and Sons – 1997.
2. S.K. Bhattacharya and Brijinder Singh, Control of Electrical Machines, New Age International Publishers.

LT9201 CHEMISTRY AND TECHNOLOGY OF LEATHER MANUFACTURE

L T P C
3 0 0 3

AIM

This course aims at introducing the fundamentals of chemistry and technology of leather manufacture.

OBJECTIVES

- Through this course the student gains an appreciation of the underpinning science and technology involved in manufacturing of leathers.

UNIT I RAW MATERIALS AND PRESERVATION 5

Origin and characteristics of hides and skins; Categories of livestock; Grading systems; Defects in hides and skins; Various preservation techniques and their principles.

UNIT II PRETANNING PROCESSES 10

Principles and objectives of beamhouse processes viz., soaking, liming, reliming, deliming, bating, pickling, depickling and degreasing.

UNIT III TANNING PROCESSES 10

Definition and objectives of tanning; Types and basic chemistry of vegetable tannins; Basic chemistry of basic chromium sulfate; Principles involved in vegetable and chrome tanning and their mechanism in brief; Combination tannages.

UNIT IV POST TANNING PROCESSES 10

Types of syntans; Basic chemistry of phenolic and acrylic syntans; Types of fatliquors; Basic chemistry of fatliquors; Types of dyes; Basic chemistry of acid, basic, direct and metal complex dyes; Principles and objectives of post tanning processes viz., neutralisation, retanning, dyeing and fatliquoring; Various unit operations involved.

UNIT V FINISHING TECHNIQUES 10

Types of binders; Basic chemistry of protein, resin and PU binders; Types of pigments; Basic characteristics of pigments; Basic theory of coating; Principles and objectives of finishing; Classification of finishing; Types of auxiliaries and finishes.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Sarkar, K.T., Theory and Practice of Leather Manufacture Ajoy Sorcor, Madras, 1981.
2. Dutta, S.S., Introduction to the Principles of Leather Manufacture, Indian Leather Technologists Association, Calcutta, 1980.
3. Thorstenson, T.C., Practical Leather Technology, Robert E. Krieger Publishing Co., Alabar, Florida, 1985.
4. Fred O Flaherty, Roddy, T.W. and Lollar, R.M. 'The Chemistry and Technology of Leather', Vol.I & II, Type of tannages, Robert E. Krieger Publishing Co., New York, 1977.
5. Beinkiewicz, K. 'Physical Chemistry of Leather Making', Robert E. Krieger Publishing Co., Florida, 1983.

REFERENCE

1. Koteswara Rao, C., and Olivannan, M.S., Lecture Notes on dyeing and finishing of leathers, CLRI, Madras, 1983.

AIM

To experimentally determine the load characteristics on various types of AC/DC Motors and also study on the generator and alternators circuit arrangement.

OBJECTIVES

- After the completion of this course students gain knowledge in fundamentals of Electrical Engineering and the operational and design aspects of DC and AC motors and drivers.

LIST OF EXPERIMENTS

1. Open circuit characteristics of D.C. shunt generator.
2. Load characteristics of D.C. shunt generator
3. Load characteristics of D.C. compound generator
4. Load test on D.C. shunt motor
5. Study of D.C. motor starters
6. O.C. and S.C. tests on single phase transformer
7. Load test on single phase transformer
8. Load test on 3 - phase squirrel cage induction motor
9. Study of 3 - phase induction motor starters
10. Load test on 3 - phase slip ring induction motor
11. O.C. and S.C. tests on 3 - phase alternator
12. Synchronization and V-curves of alternator

TOTAL : 60 PERIODS

1. Precision and validity in an experiment using absorption spectroscopy .
2. Validating Lambert-Beer's law using KMnO_4
3. Finding the molar absorptivity and stoichiometry of the Fe (1,10 phenanthroline)₃ using absorption spectrometry.
4. Finding the pKa of 4-nitrophenol using absorption spectroscopy.
5. UV spectra of nucleic acids.
6. Chemical actinometry using potassium ferrioxalate.
7. Estimation of SO_4^- by nephelometry.
8. Estimation of Al^{3+} by fluorimetry.
9. Limits of detection using aluminium alizarin complex.
10. Chromatography analysis using TLC.
11. Chromatography analysis using column chromatography.

TOTAL : 60 PERIODS**TEXTBOOKS**

1. Skoog, D.A. et al. "Principles of Instrumental Analysis", 5th Edition, Thomson / Brooks – Cole, 1998.
2. Braun, R.D. "Introduction to Instrumental Analysis", Pharma Book Syndicate, 1987.
3. Willard, H.H. et al. "Instrumental Methods of Analysis", 6th Edition, CBS, 1986.
4. Ewing, G.W. "Instrumental Methods of Chemical Analysis", 5th Edition, McGraw- Hill, 1985.

AIM

To provide practical training in making chrome and vegetable tanned leathers from raw hides and skins.

OBJECTIVES

To train the students gain practical experience in

- Various unit processes and operations in leather making from raw to finish
 - Brief functions of various machineries used in leather manufacture
1. Assortment of hides and skins
 2. Various methods of Curing
 3. Manufacture of wet-blue from hides and skins
 4. Manufacture of E.I and vegetable tanned leathers
 5. Quality control and Process control aspects of each unit process involved in wet blue and E.I. manufacturing
 6. Introduction to various post tanning and finishing processes for the manufacture of upper and garment leathers
 7. Introduction to various mechanical operations.

TOTAL : 60 PERIODS

AIM

This course aims at providing the required skill to apply the statistical and Linear Programming tools for engineering problems.

OBJECTIVES

- The students will have a fundamental knowledge of the concepts of statistical inference
- Have the knowledge of applying Linear programming tools in management problems.

UNIT I TESTING OF HYPOTHESIS

9 + 3

Sampling distributions - Tests for single mean , proportion and difference of means (large and small samples) – Tests for single variance and equality of variances – χ^2 -test for goodness of fit – Independence of attributes – Non-parametric tests: Test for Randomness and Rank-sum test (Wilcoxon test).

UNIT II DESIGN OF EXPERIMENTS

9 + 3

Completely randomized design – Randomized block design – Latin square design - 2^2 - factorial design.

UNIT III STATISTICAL QUALITY CONTROL

9 + 3

Control charts for measurements (\bar{X} and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling

UNIT IV LINEAR PROGRAMMING

9 + 3

Formulation – Graphical solution – Simplex method – Big-M method - Transportation and Assignment models

UNIT V ADVANCED LINEAR PROGRAMMING

9 + 3

Duality – Dual simplex method – Integer programming – Cutting-plane method.

L: 45, T: 15, TOTAL : 60 PERIODS

TEXT BOOKS

1. Johnson, R.A. and Gupta, C.B., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 7th edition, (2007).
2. Taha, H.A., "Operations Research", Pearson Education, Asia, 8th edition, (2007).

REFERENCES

1. Walpole, R.E., Myers, R.H., Myers, S.L. and Ye, K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 8th edition, (2007).
2. Devore, J.L., "Probability and Statistics for Engineering and the Sciences", Thomson Brooks/Cole, International Student Edition, 7th edition, (2008).
3. Winston, W.L., "Operations Research – Applications and Algorithms", Thomson, 1st Indian Reprint, 4th edition, (2007).

CH9204

BASIC MECHANICAL ENGINEERING

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

AIM

To impart knowledge on thermodynamics and thermal engineering power generating units such as engines and theory of machines

OBJECTIVE

- Students should learn thermodynamics and thermal engineering to understand the principles behind the operation of thermal equipments like IC engines and turbines etc., Students should be able to appreciate the theory behind operation of machinery and be able to design simple mechanisms

UNIT I LAWS OF THERMODYNAMICS

10

Basic concepts and hints; Zeroth law; First Law of Thermodynamics - Statement and application; Steady flow energy equation-problems- Second law of Thermodynamics – Kelvin - Plank statement and Clausius statement- problems; Limitations; Heat Engine, Refrigerator and Heat Pump, Available energy, Equivalence entropy; Reversibility: Entropy charts; Third law of Thermodynamics - Statement.

UNIT II HEATING AND EXPANSION OF GASES

6

Expressions for work done, Internal energy and heat transfer for Constant Pressure, Constant Volume, Isothermal, Adiabatic and Polytropic processes-Derivations and problems; Free expansion and Throttling process.

UNIT III AIR STANDARD CYCLES

6

Carnot cycle; Stirlings cycle; Joule cycle; Otto cycle; Diesel cycle; Dual combustion Cycle- Derivations and problems.

UNIT IV I.C. ENGINES, STEAM AND ITS PROPERTIES AND STEAM TURBINES

12

Engine nomenclature and classification; SI Engine; CI Engine; Four Stroke cycle, Two stroke cycle; Performance of I.C.Engine; Brake thermal efficiency; Indicated Thermal Efficiency, Specific fuel consumption. Steam - Properties of steam; Dryness fraction; latent heat; Total heat of wet steam; Dry steam; Superheated steam. Use of steam tables; volume of wet steam, volume of superheated steam; External work of evaporation; Internal energy; Entropy of vapour, Expansion of vapour, Rankine cycle. Steam turbines – Impulse and Reaction types - Principles of operation.

UNIT V SIMPLE MECHANISM, FLY WHEEL, DRIVES AND BALANCING

11

Definition of Kinematic Links, Pairs and Kinematic Chains; Working principle of Slider Crank mechanism and inversions; Double slider crank mechanism and inversions.

Flywheel-Turning moment Diagram; Fluctuation of Energy. Belt and rope drives; Velocity ratio; slip; Creep; Ratio of tensions; Length of belt; Power Transmitted; gear trains-types. Balancing of rotating masses in same plane; Balancing of masses rotating in different planes.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Nag, P.K., " Engineering Thermodynamics ", II Edition, Tata McGraw Hill Publishing Co., Ltd., 1995.
2. Rajput, R .K, "Thermal Engineering", Laxmi publications (P) Ltd, 2001.
3. Khurmi R.S., and Gupta J.K, "Theory of Machines", Eurasia Publishing House (P) Ltd., 2004.

REFERENCES

1. Smith, " Chemical Thermodynamics ", Reinhold Publishing Co., 1977.
2. Bhaskaran, K.A., and Venkatesh, A., " Engineering Thermodynamics ", Tata McGraw Hill, 1973.
3. Pandya A. and Shah, " Theory of Machines ", Charatakar Publishers, 1975.
4. Khurmi R.S., and Gupta J.K, "Thermal Engineering", S.Chand & Company (P) Ltd.,2001.
5. Kothandaraman and Dhomkundwar,": A course in Thermal Engineering (SI Units)", Dhanpat Rai and Sons, Delhi (2001).

LT9251

LEATHER BIOTECHNOLOGY

L T P C
3 0 0 3

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, assaay systems and production. Types of fermentation, Preparation of media, preparation of inoculum, separation and purification of products.

UNIT IV WASTE MANAGEMENT 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 DIFFERENT APPLICATIONS 4

Collagen and its application in food, cosmetic and medical fields.

TOTAL: 45 PERIODS

RERERENCES

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

AIM

To know the basic concepts of inorganic and physical chemistry aspects of chemical compounds and their behavior at different processing conditions.

OBJECTIVES

- At the end of this course students would have gained knowledge on the structure and symmetry of inorganic compounds and theories of coordination compounds. Students will also be in a position to appreciate the concepts of phase rule and their applications in separation of liquids, behavior of ions and colloids in different processing conditions.

UNIT I INTRODUCTION TO INORGANIC COMPOUNDS 9

A brief survey of the s block - binary compounds, complexes, alkalides and electrides. Features in the chemistry of the p block- expansion of the octet, Lewis structures; d orbitals – transition metals; coordination compounds – basic terms, nomenclature, Coordination theory, Werner's theory, Stereo chemistry

UNIT II MOLECULAR BONDING AND THEORIES OF INORGANIC COMPOUNDS 9

Shapes of molecules by application of the Valence Shell Electron Pair Repulsion method. Valence bond approach and atomic orbital hybridizations. CF theory, LCAO-MO theory, pictorial derivation of bonding and antibonding molecular orbitals. MO energy level diagrams for homonuclear diatomics. Redox reactions

UNIT III PHASE RULE 9

Definition – Application of phase rule to water system – Thermal Analysis – Cooling curves – Two component system – Eutectic and compound formation-Liquid –liquid equilibria-Distillation of binary liquid mixture- Azeotropic distillation-Fractional distillation-partially miscible liquid-CST-Immiscible liquid-Steam distillation

UNIT IV IONIC EQUILIBRIA 9

Acids and bases; Arrhenius concept, Lewis concept; Dissociation of weak acid, weak base; Ionic product of water; Buffer solutions, calculation of pH; Henderson's equation; Hydrolysis of salts; Degree of hydrolysis; Acid-base indicators-their applications; solubility product; Ionic equilibria involving complex ions

UNIT V COLLOIDS 9

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.

TOTAL : 45 PERIODS**TEXT BOOKS**

1. T L Brown, H E LeMay Jr., B E Bursten, 'Chemistry: The Central Science' 8th edn., Prentice-Hall, 2000.
2. M J Winter, 'Chemical Bonding' Oxford Primer Series, Oxford University Press, 1994
3. N C Norman, 'Periodicity and the p-block Elements' Oxford Primer Series, Oxford University Press, 1994
4. J W Huheey, E A Keiter and R L Keiter, 'Inorganic Chemistry' 4th edn, Harper Collins, 1993
5. Puri B.H. Sharma L.R and M.S.Prathama, Principles of Physical Chemistry, S. Chand and Company, Delhi (2001).
6. Gordon M. Barrow, Physical Chemistry, Sixth edition, Tata McGraw Hill (1998).

REFERENCES

1. Website – [http:// www.prenhall.com/brown](http://www.prenhall.com/brown)
2. Kund and Jain, Physical Chemistry, S.Chand and Company, Delhi (1996).
3. Negi and Anand "Physical Chemistry" Wiley eastern (1992).

AIM

This course will be dealing with basic principles and technology of various pretanning processes and operations.

OBJECTIVES

- To impart knowledge on principles and practices of long and short term preservation
- To make the students appreciate the principles involved in various pretanning processes and operations
- To impart knowledge on various technologies involved in pretanning.

UNIT I PRESERVATION OF HIDES AND SKINS 6

Principles and practice involved in long and short term preservation techniques for hides and skins; Preservation defects

UNIT II PRETANNING PROCESSES 12

Objectives, Principles and practice of different pretanning processes - Soaking, liming, deliming, bating, pickling, depickling and degreasing.

UNIT III CLEANER PROCESSING PRACTICES IN BEAMHOUSE 12

Salt-free curing options, sulphide free unhairing systems, ammonia-free deliming, salt free pickling systems, eco friendly degreasing systems. Strategies to bring down BOD, COD and TDS of tannery effluents. Recycling and reuse of waste streams.

UNIT IV PRACTICE OF PRETANNING PROCESSES 10

Different methods of pretanning processes as applied to light, heavy and industrial leathers.

UNIT V QUALITY CONTROL IN PRETANNING PROCESSES 5

Process and quality control in pretanning operations.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Flaherty, O., William Roddy, T. Robert, M. Lollar, 'The Chemistry and Technology of Leather', Vol.1 Preparation for Tannage, E Robert Krieger Publishing Company, New York, 1978.
2. Bienkiewicz, 'Physical Chemistry of Leather Manufacture', Krieger, Florida, 1982.

AIM

To make the students understand the chemistry of different organic tanning agents and systems.

OBJECTIVES

- At the end of this course, the students will have knowledge of chemistry of various organic tanning agents and the mechanism of their interaction with the skin protein-collagen.

**UNIT I CLASSIFICATION, OCCURANCE, BIOSYNTHESIS AND
CHEMISTRY OF VEGETABLE TANNINS 14**

Vegetable tannins - definition and classification, Occurrence, Biosynthesis; Chemistry of hydrolysable tannins - gallotannins, ellagi tannins - their structural aspects including ellagi tannin dimers, trimers, etc., Chemistry of condensed (flavanoid) tannins proanthocyanidins, dimers, trimers and other oligomers.

- UNIT II POLYPHENOLIC CONSTITUENTS OF VEGETABLE TANNINS 9**
Tannins as well as non-tannins, polyphenolic constituents present in popular indigenous tanning materials like avaram, konnam, wattle, cutch, babul, myrobalan, etc and their Physico-chemical properties and effect on the physical properties of leathers.
- UNIT III MECHANISM AND PRACTICE OF VEGETABLE TANNING 8**
Mechanism of reaction of vegetable tannins with collagen. Electrolytic equilibria, diffusion equilibria, fixation and absorption equilibria. General practices in vegetable tanning. Pit tanning and drum tanning. Manufacture of E.I. skins and kips - Modern practices in E.I. tanning.
- UNIT IV ORGANIC TANNAGES 7**
Mechanism of tanning with Aldehyde, Dialdehydes, oil, Sulphonyl chloride, Quinone,, oxazolidine and other organic tanning agents. Synthetic tannins - Classification - properties, uses in leather industry. Mechanism of reaction with collagen.
- UNIT V PREPARATION OF TANNINS AND TANNIN EXTRACTS 7**
Methods of preparation of vegetable tannin extracts, spray dried vegetable tannins, synthetic and other organic tannages.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Howes, F.N. "Vegetable tanning materials", Butterworth. London, 1953.
2. Rodd, "Chemistry of carbon compounds", Vol. III-D, Chapter on "Hydrolysable tannins".
3. 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.
4. Humphreyes, 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".
5. O'Flaherty and Roddy, T.W. , Lollar, R.M. "The Chemistry and Technology of Leather", Vol. II. Krieger Publishing Corpn., New York, 1977.
6. Gustavson, K.H. "Chemistry of Tanning Processes" Academic Press, New York, 1950.
7. Vegetable and Synthetic Tanning agents, Sundara Rao, V.S., et al – The Leather Industry, (ed. Bu Sadulla, S) Kothari Desk book series, H.C. Kothari Group (Publications Division), Madras, p.71, 1995.

**LT9255 TECHNOLOGY OF HEAVY LEATHER MANUFACTURE L T P C
3 0 0 3**

AIM

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

OBJECTIVES

- 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

UNIT I SOLE, HARNESS AND SADDLERY LEATHERS 9
Property requirement of sole leathers; Process design considerations; Manufacture of vegetable tanned and chrome tanned sole leathers; Water proofing of sole leathers; Manufacture of harness and saddlery leathers.

UNIT II INDUSTRIAL LEATHERS 9

Different types of raw materials used, properties required: physical and chemical, standards required and process details to achieve the specifications for the following industrial leathers: Belting leathers, honing leathers, picking band leathers, picker as apron leathers. Hydraulic and pneumatic leathers such as hand pump and deep bore well leathers.

UNIT III SPORTS GOODS LEATHERS 9

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, rugby ball, volley ball, hockey ball and cricket ball. Glove leathers for wicket keepers and boxing. Different types of sports goods leathers made from bag tanned leathers.

UNIT IV FINISHED LEATHERS FROM HIDES 9

Different types of raw materials used, physical and chemical properties required and process details to achieve the specifications for the following leathers: Full chrome, Semi chrome and Chrome retan - uppers, suedes, nubuck, lining, nappa, shrunken grain, dressing of E.I. kips into upper, lining and leathers for leathergoods application, upholstery, burnishable, printed leathers, Kattai, Bunwar, Case hides.

UNIT V UPGRADATION AND QUALITY CONTROL 9

Upgradation technologies; Rectification of defects in hides; Control of area, yield, color and finish of leathers; Quality control in heavy leather manufacture.

TOTAL : 45 PERIODS

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.

CH9257 MECHANICAL ENGINEERING LABORATORY

**L T P C
0 0 4 2**

AIM

To impart practical knowledge in operating IC engines and conduct experiments. To understand test procedures in testing material for engineering applications

OBJECTIVES

- Students will be able to understand Power-generating units such as engines and operate IC engines and conduct tests. They will be able to appreciate the theory behind the functioning of engines. Material properties, their behavior under different kinds of loading and testing can be visualized.

LIST OF EXPERIMENTS

1. Port timing diagram
2. Valve timing diagram
3. Study of 2,4 stroke I C Engines
4. Load test on 4-stroke petrol engine
5. Performance test on 4-stroke single cylinder diesel engine
6. Performance test on 4-stroke twin cylinder diesel engine
7. Heat balance test on diesel engines
8. Tension test

9. Compression test
 10. Deflection test
 11. Hardness test (Rockwell and Brinell)
 12. Spring test
 13. Torsion test
 14. Impact test
- * Minimum 10 experiments shall be offered

TOTAL : 60 PERIODS

LT9257 TANNERY PRACTICE - HEAVY LEATHER MANUFACTURE L T P C
0 0 6 3

AIM

To carry out the practical leather processing of heavy and finished leathers from raw hides.

OBJECTIVES

At the end of the course students will gain confidence in manufacturing

- Heavy leathers like sole, saddle, belting etc., from hides
 - Finished leathers from different hides
- i. Manufacture of vegetable tanned and chrome sole leathers - Waterproofing of sole leathers.
 - ii. Processing of Industrial leathers like belting, harness and saddler, belting, honing, picking band, hydraulic and pneumatic leathers.
 - iii. Manufacture of following leathers from different raw materials and tannages:
 1. Picking band leathers
 2. Sports goods leathers
 3. Upholstery leathers
 4. Upper leathers
 5. Zug grain upper leathers
 6. Nappa leathers
 7. Patent leathers
 8. Shrunken grain leathers
 9. Suede upper leathers
 10. Burnishable upper leathers
 11. Kattai and Bunwar leathers

TOTAL : 90 PERIODS

LT9301 PRINCIPLES OF UNIT OPERATIONS AND PROCESSES IN L T P C
LEATHER MANUFACTURE 3 0 0 3

AIM

To impart knowledge on basic concepts of chemical engineering unit operations and processes

OBJECTIVES

- 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 chemicals

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 stagewise 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 concepts for unit processes; 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 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		
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

REFERENCES

- McCabe .W.L and Smith, J.C., Unit Operations in Chemical Engineering, McGraw Hill, Fourth Ed., 1993.
- Treybal, R.E., Mass Transfer Operations, McGraw Hill Book Company, Third Ed. 1981.
- Coulson, J.M., and Richardson, J.F., Chemical Engineering, Vol.I and II Third Ed. Pergamon press, 1978.
- Welty, J.R., Wilson, R.E., and Wicks, C.E. Fundamentals of momentum, Heat and Mass Transfer, Third Ed., John Wiley, 1984.
- Perry, J.H., Chemical Engineers Handbook, McGraw Hill, New York, Sixth Ed., 1984.

AIM

To impart knowledge on the chemistry of various inorganic tanning materials and systems

OBJECTIVES

- Chemistry of inorganic tanning materials giving more thrust to chrome tanning material and system and a glimpse of other inorganic tanning systems based on Al, Zr, Ti, Fe, Si and P.

**UNIT I INTRODUCTION TO COORDINATION CHEMISTRY; METAL IONS
IN TANNING 10**

Werner's theory of coordination, origins of coordinative interactions, role of d and f orbitals, definition of ligands, nucleophilicity of ligands and electronegativity of donor atoms, chelation and masking, ligand field stabilisation energy and introduction of factors controlling molecular stability of transition metal complexes. Historical overview of mineral tanning.

UNIT II AQUEOUS CHEMISTRY OF CHROMIUM 8

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, olation, oxolation and polymerisation, Stiasny's series, Mc Clandish precipitation point.

UNIT III FACTORS CONTROLLING CHROME TANNING 8

Single and double bath chrome tannages and their relative merits and demerits, preparation of Basic chromium sulphate salt, reaction parameters influencing composition of BCS, kinetics of chrome tanning, diffusion and complexation, effects of float volume, pH, basicity, masking, temperature, drum speed, ageing chrome tanned substrates.

UNIT IV MECHANISM OF CHROME TANNAGE 9

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, chromium induced structural changes in collagen.

UNIT V OTHER INORGANIC TANNAGES 10

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, mechanistic classification of inorganic tannages and their relevance to combination tanning.

TOTAL: 45 PERIODS**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, 1977.
2. Gustavson, K.H. 'Chemistry of Tanning Processes' Academic Press, New York, 1956.
3. Bienkiewicz 'Physical Chemistry of Leather Manufacture' Krieger, Florida 1982.

AIM

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

OBJECTIVES

- Post tanning processes like neutralization and its importance to the manufacture of various types of leathers.
- Chemistry of post tanning auxiliaries.
- Mechanism of dyeing, fatliquoring and retanning

UNIT I DYES AND DYEING OF LEATHER 10

Theory of colours, chromphoric groups and their optical absorption, structural features of dyes, factors affecting hue and colour, intensity; 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, formaldehyde-free, acrylic and PU syntans. Chemistry and mechanism of retanning.

UNIT IV PRACTICE OF POST TANNING PROCESSES AND OPERATIONS 10

Practice, Mechanism and Formulation of post tanning processes viz., neutralization, retanning, dyeing, fatliquoring and various post tanning operations involved in processing of different types of leathers.

UNIT V POST TANNING PROCESSES OF SPECIALITY LEATHERS 5

Chemistry and mechanism of retanning, dyeing and fat liquoring processes for the manufacture of all speciality leathers like burnish, oil pull ups and upgradation techniques.

TOTAL : 45 PERIODS

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, 1977.
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, 1956.
6. Sarkar. K.T, 'Theory and practice of leather manufacture', The author, Kolkata, India, 2005.

AIM

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

OBJECTIVES

At the end of the course, the student would understand

- The analytical chemistry in testing of leather chemicals and leathers
- The principle used in instrumental techniques
- Various methods of analysis of leather chemicals, spent process liquors and pelts/leathers
- Standard and quality control measures of leather chemicals

UNIT I ANALYSIS OF PRETANNING LEATHER CHEMICALS 7

Principles of analytical methods employed in analysis of pretanning chemicals - lime, unhairing, deliming and bating agents; Specifications recommended by standards organizations.

UNIT II ANALYSIS OF TANNING AGENTS 8

Principles of analytical and instrumental methods employed in analysis of vegetable tanning materials and extracts; Aldehydes; chrome extracts and liquors; zirconium, titanium, aluminium and Iron tanning agents; Specifications recommended by standards organizations.

UNIT III ANALYSIS OF POST TANNING AND FINISHING CHEMICALS 8

Principles of analytical and instrumental methods employed in analysis of neutralising agents, syntans, dyes, oils and fats, fatliquors, post tanning auxiliaries, pigments, resin binders, wax emulsions, fillers, lacquer and lacquer emulsions and finishing auxiliaries; Specifications recommended by standards organizations.

UNIT IV 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 V ANALYSIS OF TANNED LEATHERS 8

Principles of analytical and instrumental methods employed in analysis of various chrome leathers, vegetable tanned leathers; Specifications recommended by standards organizations.

UNIT VI ANALYSIS OF ECO-SENSITIVE LEATHER CHEMICALS IN LEATHER 6

Principles of analytical and instrumental methods employed in analysis of eco-sensitive chemicals present in leather chemicals and finished leathers; Specifications recommended by standards organizations.

TOTAL : 45 PERIODS

REFERENCES

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. 'Methods of chemical testing of leathers', IS: 582 – 1970 (Reaffirmed 2003) Bureau of Indian Standards, New Delhi.
4. 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, 1977.

AIM

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

OBJECTIVES

- 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 the manufacture of the same.

UNIT I PROPERTIES OF LEATHER 9

Definition and understanding of various physical, chemical and organo-lectic properties of leather.

UNIT II PROPERTY – PROCESS RELATIONSHIP 8

Understanding of the relationship between each leather property and the process parameter of each unit operation/process.

UNIT III PRODUCT BRIEF OF LIGHT LEATHERS 8

Product brief i.e, property requirements w.r.t. product manufacture and use of different light leathers

UNIT IV PROCESS DESIGN 8

Concept of designing the process of manufacture of light leathers of different product briefs.

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**TEXT BOOKS**

- Briggs, P.S. 'Gloving, clothing and special leathers', Tropical Products Institute, London, 1981.
- Kartheiz, Fuchs, H.P. 'The Chemistry and technology of Novelty Leathers' FAO, United Nations, Rome.
- CLRI Process Bulletins.

LT9306 ENVIRONMENTAL SCIENCE AND ENGINEERING FOR LEATHER SECTORL T P C
3 0 0 3**AIM**

The aim of this course is to create awareness in every engineering graduate about the importance of environment, the effect of technology on the environment and ecological balance and make them sensitive to the environment problems in every professional endeavour that they participates.

OBJECTIVE

- At the end of this course the student is expected to understand what constitutes the environment, what are precious resources in the environment, how to conserve these resources, what is the role of a human being in maintaining a clean environment and useful environment for the future generations and how to maintain ecological balance and preserve bio-diversity. The role of government and non-government organization in environment managements.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 14

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

Field study of common plants, insects, birds

Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION 8

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – soil waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.

Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES 10

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Gilbert M. Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education (2004).
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, (2006).

REFERENCES

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press (2005)

LT9307

LEATHER ANALYTICAL CHEMISTRY LABORATORY

L T P C
0 0 6 3

AIM

To provide practical knowledge and the skill on chemical analysis of various leather chemicals, process liquors, effluent and pelts/ leathers at various stages of processing and eco-sensitive chemicals present in leather.

OBJECTIVES

- At the end of the course, the students will have practical experience and understanding on the analysis of various leather chemicals, pelts/leathers and eco-sensitive by means of qualitative and quantitative methods of analysis

Analysis of Lime

- a. Purity of lime
- b. Total bases

Analysis of Sodium Sulphide

Analysis of Deliming Agents

- a. Analysis of ammonium salts
- b. Analysis of boric acid

Analysis of Bate

Analysis of Vegetable Tanning Materials

- a. Qualitative analysis
- b. Quantitative analysis
- c. Acids and Salts in Vegetable Tannin Extracts by Different Methods

Analysis of Chrome tanning agents

- a. Moisture
- b. Cr₂O₃ content
- c. Acid combined with chromium
- d. Basicity: Proctor and Lehigh basicities
- e. Distribution of acid groups combined with chromium
- f. Degree ofolation

Analysis of Syntans

Quantification of phenolic content & free formaldehyde

Analysis of fatliquors

- a. Moisture
- b. Acid value
- c. Saponification value
- d. Iodine value
- e. Free fatty acids
- f. Unsaponifiables
- g. Total alkalinity

Analysis of pretanned pelts and tanned leathers

Analysis of process liquors

Soak, Lime, Pickle Liquor, Chrome and Vegetable tan liquors;
BOD, COD, TOC, TDS, TS in composite liquors/waste waters.

TOTAL : 90 PERIODS

LT9308

TECHNICAL SEMINAR

L T P C
0 0 2 1

The object of the technical seminar is to assess the technical communication proficiency and the scholastic attainment of the student in the technical subjects related to leather science and technology studied during the degree programme.

TOTAL : 30 PERIODS

LT9309

TANNERY PRACTICE – LIGHT LEATHER MANUFACTURE

L T P C
0 0 6 3

AIM

To carry out the practicals of leather manufacture of light leathers from raw goat, sheep and calf skins.

OBJECTIVES

At the end of the course students will gain confidence in processing

- Upper, Lining, Nappa, Suede, Nubuck, Glove leathers from different skins
- Specialty leathers from different skins
- Upgradation techniques employed for skins

I. Practical training on the manufacture of

Resin and protein upper leathers

Nappa leathers

Glazed kid leathers

Nubuck leathers

Dress glove

Utility glove leathers

Crushed kid leathers

Suede upper leathers

Suede garment leathers

Mesh leathers

Hair-on/Fur-on leathers

Chamois leathers

II. Novel Finishing Techniques and Upgradation

TOTAL : 90 PERIODS

AIM

To impart knowledge on analytical methods for physical testing of leathers and related microscopical and bacteriological tests of leather and leather chemicals

OBJECTIVES

At the end of the course, the student would understand the

- Principle in microscopical and bacteriological testing related to leather processes
- Mould and pest growth and control in leather
- The analytical methods/principles and instrumental techniques used in physical testing leathers
- Standard and quality control measures of physical testing of leathers

UNIT I MICROSCOPY 10

Mechanical and optical parts of compound microscope, images formed, defects in eye pieces -and their rectification etc. Preparation of microscopical slides, fixing, embedding, sectioning, staining and mounting etc. Fibre structure and assessment - Orientation of fibre structure in curing, soaking, liming, pickling, tanning , post tanning and finishing. Optimal condition of fibre structures in various types of leathers. Assessment of finished leather, heavy leathers and light leathers.

UNIT II BACTERIOLOGY 8

Structure of bacterial cell, nutritional requirements, culture media, sterilization, staining of bacterial cells. Effect of environmental factors on bacterial growth, enzymes of bacteria, biochemical properties of bacteria, control of bacterial growth. Testing of bacterial action on raw hides and skins and in the different stages of Leather Manufacture.

UNIT III MOULD & PEST CONTROL 10

Structure of moulds associated during different stages of leather manufacture. Effect of environmental factors on mould growth. 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. Parasitic diseases of livestock that affect the leather quality - Demodectic - Sarcoptic and Psoroptic mange mites, warble flies, ticks and lice.

UNIT IV PHYSICAL TESTING OF LEATHERS 14

Sampling position for physical testing of leathers. Different physical testing methods - principles involved. Static and Dynamic methods, Non-destructive testing of leathers.

UNIT V STANDARDS AND QUALITY CONTROL 3

Physical characteristics and specifications of various types of leathers

TOTAL : 45 PERIODS

TEXT BOOKS

1. Dutta, S.S. "An introduction to the principles of physical testing of leather", Indian Leather Technologist's Association, Calcutta, 1991.
2. Sale, A.J., 'Fundamental principles of Bacteriology', McGraw Hill Book Company Inc., New York, Toronto, London.
3. Mackie and McCartneys, 'Handbook of Bacteriology', Edited by Robert Crucikshank, E & S Livingstone Ltd, Edinburgh and London.
4. Tanner., F.W, 'Practical Bacteriology', John Wiley & Sons Inc., Chapman & Hall Ltd., Newyork, London.

AIM

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

OBJECTIVES

At the end of this course, the students would be in a position to

- Appreciate the role of various finishing agents and auxiliaries used in leather finishing
- Formulate strategies for finishing different types of leathers
- Study various upgradation techniques
- Methods of drying – Toggle drying, paste drying, vacuum drying etc. and preparing the crust

UNIT I COATING SCIENCE**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. Eco- friendly finishing - volatile organic compounds (VOC) reductions. Finish formulation for various types of leathers.

UNIT V COATING METHODS AND NOVEL FINISHING SYSTEMS**9**

Role of newer equipments like autospray, roller coats, continuous embossing machines, dorn busch, 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**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.

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 GENERAL PRINCIPLES AND MECHANISM OF LEATHER MACHINERY 9

involved in various tannery machines. Mechanism of cutting and shearing action of helical blade systems. Bush, ball, roller and ring oil bearing, cam springs and their application and function in tannery machinery.

UNIT II DESIGN, MATERIAL SELECTION AND CONSTRUCTION OF EQUIPMENT 9

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 9

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, autospry, driers and measuring machine etc.

UNIT IV TANNERY LAYOUT, PREVENTIVE MAINTENANCE AND SAFETY 9

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. Preventive maintenance and safety in the use of leather machinery

UNIT V PRACTICAL WORKING ON MACHINERY USED IN LEATHER PROCESSING 9

Adjusting the position of rollers for proper fleshing of skins and hides in a fleshing machine
 Adjusting the position of rollers to achieve proper grain setting in a mechanical setting machine
 Adjusting the position of different rollers in a splitting machine to get the required thickness while splitting
 Adjusting the grinding stones to achieve the required level profile in a splitting band knife.
 Adjusting the position of rollers in a shaving machine to achieve proper thickness
 Replacing the worn-out helical blades in a shaving machine
 Procedure to be followed in removing the worn-out knife
 Replacing the rubber beading in a drum door.
 Changing the main ball bearing in a drum
 Tightening the V-belts in a drum
 Adjusting the worn-out staking blades in a slocomb staking machine for proper staking
 Increasing the staking pressure
 Selection and fixing of the emery paper in a buffing machine
 Adjusting the lateral oscillation of a buffing cylinder
 Adjusting the feed roll position for proper buffing

Fixing the felt in a buffing machine
 Fixing the glass roll in a glazing machine
 Fixing the leather strap to the cast iron bed of a glazing machine
 Increasing the glazing bed
 Adjusting the various knobs in a spray gun to achieve proper spraying over leather
 Adjusting the air compressor pressure for proper spraying
 Changing embossing plates in hydraulic press

TOTAL : 45 PERIODS

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. Thomas C.Thorstensen, Practical Leather Technology- Robert E.krieger Publishing Company, Huntington, New york, 1976.

LT9357

LEATHER MACHINERY LABORATORY

**L T P C
0 0 2 1**

AIM

To impart practical knowledge on the working principles and maintenance of machineries used in leather manufacture.

OBJECTIVES

1. At the end of the course the student would understand the
2. Adjustment of machinery parts for proper functioning of different machines used in leather processing
3. Adjusting the position of rollers for proper fleshing of skins and hides in a fleshing machine
4. Adjusting the position of rollers to achieve proper grain setting in a mechanical setting machine
5. Adjusting the position of different rollers in a splitting machine to get the required thickness while splitting.
6. Adjusting the grinding stones to achieve the required level profile in a splitting band knife.
7. Adjusting the position of rollers in a shaving machine to achieve proper thickness
8.
 - a) Replacing the worn-out helical blades in a shaving machine
 - b) Procedure to be followed in removing the worn-out knife
9.
 - a) Replacing the rubber beading in a drum door.
 - b) Changing the main ball bearing in a drum
 - c) Tightening the V-belts in a drum
10.
 - a) Adjusting the worn-out staking blades in a slocomb staking machine for proper staking
 - b) Increasing the staking pressure
11.
 - a) Selection and fixing of the emery paper in a buffing machine
 - b) Adjusting the lateral oscillation of a buffing cylinder
 - c) Adjusting the feed roll position for proper buffing
 - d) Fixing the felt in a buffing machine
12.
 - a) a. Fixing the glass roll in a glazing machine
 - b) Fixing the leather strap to the cast iron bed of a glazing machine
 - c) Increasing the glazing bed
13.
 - a) Adjusting the various knobs in a spray gun to achieve proper spraying over leather
 - b) Adjusting the air compressor pressure for proper spraying

TOTAL : 30 PERIODS

AIM

To provide practical knowledge on physical testing of leathers and microscopical and bacteriological testing of leathers and leather chemicals

OBJECTIVES

At the end of the course the students would have practical experience and understanding on

- Physical testing of leathers
- Microscopical analysis/identification of leathers
- Bacteriological testing of leathers and leather chemicals

PHYSICAL TESTING LAB**Strength Properties**

- a. Tensile Strength and Elongation at break
- b. Tongue tear strength
- c. Stitch tear and slit tear strengths
- d. Grain crack and bursting strengths

Wear and Comfort Properties

- a. Static/dynamic water absorption
- b. Water vapour permeability
- c. Abrasion resistance
- d. Perspiration resistance

Fastness Properties

- a. Rub fastness
- b. Water fastness
- c. Heat fastness
- d. Light fastness
- e. Gloss

MICROSCOPY LAB

- a. Setting up of a compound microscope
- b. Preparation of microscopical slides by paraffin embedding method and By freezing method
- c. Identification of hides and skins from their histological structures and from their grain pattern-Buffalo, Cow, Sheep and Goat
- e. Microscopical assessment of fibre structure during the process - Soaking, liming, pickling and tanning of finished leather - sole leather.

BACTERIOLOGY LAB

- a. Preparation of various culture media
- b. Staining of bacteria
- c. Enumeration of bacteria in hides and skins and in tan liquors
- d. Isolation and identification of fungi in raw hides/skins, leathers and tan liquors
- e. Isolation and identification of fungi in leathers
- f. Mildew resistance test for leathers
- g. Identification of insect and parasitic damages

TOTAL : 60 PERIODS

AIM

To carry out the practical leather processing of various types of leathers from semi-processed/crust leathers.

OBJECTIVES

At the end of the course, the students will gain confidence in

- Post tanning and finishing different types of leathers

Post tanning operations for at least three different types of leathers

Various finishing techniques for grain/split leathers

Machinery interventions for different leathers

TOTAL : 30 PERIODS

GE9371 COMMUNICATION SKILLS AND SOFT SKILLS LAB

L T P C
0 0 2 1

AIM

To enhance the overall capability of students and to equip them with the necessary Communication Skills and Soft Skills that would help them excel in their profession.

OBJECTIVES

- To equip students of engineering and technology with effective speaking and listening skills in English.
- To help them develop their soft skills and interpersonal skills, which will make the transition from college to workplace smoother and help them excel in their job.
- To enhance the performance of students at Placement Interviews, Group Discussions and other recruitment exercises.

1. PC based session

A. Career Lab (15 periods) Viewing and discussing audio-visual materials

1. Resume / Report Preparation / Letter Writing: (3) Letter writing – Job application with Resume - Project report - Email etiquette.

2. Presentation skills: (3) Elements of effective presentation – Structure of presentation - Presentation tools – Body language.

3. Soft Skills: (3) Time management – Stress management – Assertiveness – Negotiation strategies, Psychometrics - Analytical and logical reasoning.

4. Group Discussion: (3) Group discussion as part of selection process, Structure of group discussion – Strategies in group discussion – Mock group discussions.

5. Interview Skills: (3) Kinds of interviews – Interview techniques – Corporate culture – Mock interviews.

TOTAL : 45 PERIODS

II. Class Room Session

1. **Resume / Report Preparation / Letter writing:** (9)
Students prepare their own resume and report.
 2. **Presentation Skills:** (12)
Students make presentations on given topics.
 3. **Group Discussion:** (12)
Students participate in group discussions.
 4. **Interview Skills:** (12)
Students participate in Mock Interviews
- Note:** Classroom sessions are practice sessions.

REFERENCES

1. Prakash P, Verbal and Non-Verbal Reasoning, Macmillan India Ltd., 2nd Edition, New Delhi, 2004.
2. John Seely, The Oxford Guide to Writing and Speaking, Oxford University Press, New Delhi 2004.
3. Paul V Anderson, Technical Communication, Thomson Wadsworth , 6th Edition, New Delhi, 2007.
4. Edgar Thorpe and Showick Thorpe, Objective English, Pearson Education, 2nd Edition, New Delhi 2007.
5. David Evans, Decision maker, CUP, 1997

Lab Requirement:

1. Teacher console and systems for students.
2. English Language Lab Software
3. Tape recorders

LT9401 PROCESS ECONOMICS AND INDUSTRIAL MANAGEMENT FOR LEATHER SECTOR

L T P C
3 0 0 3

AIM

To introduce process economics and industrial management principles to leather technologists

OBJECTIVES

- The objective of this course is to teach principles of cost estimation, feasibility analysis, management, organization and quality control that will enable the students to perform as efficient managers.

UNIT I PRINCIPLES OF PRODUCTION MANAGEMENT AND ORGANISATION

15

Planning, organization, staffing, coordination, directing, controlling, communicating, organization as a process and a structure; types of organizations
Method study; work measurement techniques; basic procedure; motion study; motion economy; principles of time study; elements of production control; forecasting; planning; routing; scheduling; dispatching; costs and costs control, inventory and inventory control.

UNIT II ENGINEERING ECONOMICS FOR TECHNOLOGISTS - INTEREST, INVESTMENT COSTS AND COST ESTIMATION

10

Time Value of money; capital costs and depreciation, estimation of capital cost, manufacturing costs and working capital, invested capital and profitability.

UNIT III PROFITABILITY, INVESTMENT ALTERNATIVE AND REPLACEMENT

8

Estimation of project profitability, sensitivity analysis; investment alternatives; replacement policy; forecasting sales; inflation and its impact.

UNIT IV ANNUAL REPORTS AND ANALYSIS OF PERFORMANCE 4
Principles of accounting; balance sheet; income statement; financial ratios; analysis of performance and growth.

UNIT V ECONOMIC BALANCE AND QUALITY CONTROL 8
Essentials of economic balance – Economic balance approach, economic balance for leather and product industries. Elements of quality control, role of control charts in production and quality control.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Peters, M. S. and Timmerhaus, C. D., " Plant Design and Economics for Chemical Engineers ", 5th Edn., McGraw Hill, 2002.
2. Holand, F.A., Watson, F.A. and Wilkinson, J.K., " Introduction to process Economics ", 2nd Edn., John Wiley, 1983.
3. Narang, G.B.S. and Kumar, V., " Production and Costing ", Khanna Publishers, New Delhi, 1988.

REFERENCE

1. Allen, L.A., " Management and Organization", McGraw Hill.

**LT 9402 COMPUTER APPLICATIONS FOR LEATHER AND LEATHER PRODUCTS LT 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

OBJECTIVES

To expose the students to Systems analysis concepts, application aspects of Operating systems & DBMS, Data communication principles, web designing, E-Commerce and CAD applications in leather/leather products manufacture

UNIT I SYSTEMS ANALYSIS & DESIGN AND IT INFRASTRUCTURE 8
Definition of a System; System development life cycle- System study; System analysis; System Design (Input, output, files, procedure); Implementation and maintenance; Need for the IT Infrastructure; Form factor; Data Center & Disaster Recovery; Security & Threads.

UNIT II OPERATING SYSTEMS AND DBMS 7
Different types of operating systems and their applications – in LINUX, Macintosh and Windows Platforms; Different types of Database Management Systems and SQL; DDL, DML - Retrieving, Manipulating, Updating tables;

UNIT III DATA COMMUNICATIONS 7
Concept of Data Communication, Modes of Transmission -Digital Vs Analog, SerialVs Parallel, Synchronous Vs Asynchronous; Types of Communication - Simplex, Half Duplex, Full Duplex; Communication channels - Twisted pair cables, Coaxial cables, Optical Fiber, Radio Waves, Satellites; Communication Protocols - FTP, HTTP, TCP/IP, WAP; Data Communication Devices; Network topologies; Network Types (LAN, WAN and MAN), Data Communication Terminologies in Internet – WWW-Website-Webpage-HTML-URL.

UNIT IV ADVANCED TOOLS FOR WEB DESIGNING 12
HTML, DHTML, XML, Scripting Languages - Java script, VB script; Perl & CGI; ASP; JSP; Java; C#, .NET

UNIT V**11****E-COMMERCE**

E-Commerce-Definition; Traditional Commerce V/s E-Commerce; Benefits of e-commerce; Various e-commerce models-B2B, B2C;

CAD SYSTEMS

CAD Systems for Leather & Leather Products- Pattern grading & cutting for footwear, leather goods and garments; Design and development of Leather products; 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. Dorian Cougias, E. L. Heiberger, Karsten Koop, The Backup Book: Disaster Recovery from Desktop to Data Center.
2. Tannenbaum, "Operating Systems", PHI, 4th Edition, 2000
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

LT9406**INDUSTRIAL INTERNSHIP / TRAINING****L T P C****0 0 4 2**

Each student is required to undergo a practical training in leather processing unit/ leather chemical manufacturing unit and submit an industrial training report on practical internship undertaken by/assigned to him/her by the Department. The report should be based on the practical experience gained at the industry duly certified by the issuing authority at the training centre of leather industry. The objective of the training is to make use of the practical knowledge gained by the student at various stages of the leather processing. This helps to judge the level of proficiency, originality of the student in understanding and applying the practical aspects of leather technology.

Student should undertake this industrial internship/training during the summer vacation after the sixth semester. However evaluation for this course will be done in seventh semester.

TOTAL DURATION: 4 WEEKS**LT9407****PROJECT WORK PHASE I****L T P C****0 0 12 6**

Each student is required to submit a report on the project undertaken by and assigned to him by the Department. The report should be based on the information available in the literature or data determined in the laboratory/industry. The objective of the project is to make use of the knowledge gained by the student at various stages of the degree programme. This helps to judge the level of proficiency, originality and capacity for application of the knowledge attained by the student at the end of the programme.

VIVA VOCE

The object of the viva-voce examination is to determine whether the objectives of the Project work have been met by the student as well as to assess the originality and initiative of the student as demonstrated in the Project Work.

TOTAL : 180 PERIODS

LT9451

PROJECT WORK PHASE II

**L T P C
0 0 16 8**

Each student is required to submit a report on the project undertaken by and assigned to him by the Department. The report should be based on the information available in the literature or data determined in the laboratory/industry. The objective of the project is to make use of the knowledge gained by the student at various stages of the degree programme. This helps to judge the level of proficiency, originality and capacity for application of the knowledge attained by the student at the end of the programme.

VIVA VOCE

The object of the viva-voce examination is to determine whether the objectives of the Project work have been met by the student as well as to assess the originality and initiative of the student as demonstrated in the Project Work.

TOTAL : 240 PERIODS

LT9021

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.

LT9022 SCIENCE & TECHNOLOGY OF LEATHER SUPPLEMENTS & 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, cellulosics.

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.

LT9023 VALUE ENGINEERING AND REENGINEERING 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.

OBJECTIVE

- 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 8

Value- Types –How to add value-Job plan – techniques employed- Who will do value engineering- Organizing the value engineering study-Benefits.

UNIT II STEP BY STEP APPLICATION OF JOB PLAN 10

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

UNIT III WORK SHEETS AND GUIDE LINES 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 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.

UNIT V IMPLEMENTATION OF REENGINEERING 8

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

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.

UNIT I	TRENDS IN LIVESTOCK POPULATION	5
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	5
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	5
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	5
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 Deskbook Series, H.C. Kothari Group (Publications Division), Madras 1995.

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

This course aims at providing necessary skills for the students in becoming a technocrat.

OBJECTIVE

- To understand the entrepreneurship in leather sector related to industrial enterprise, venture planning and development, techno economic feasible reports, resource management and production. To gain knowledge on market management.

UNIT I INDUSTRIAL ENTERPRISE 6

Concepts and Fundamental Principles - Factors influencing business environment, Opportunity assessment, Business forecasting and prospective - Leather as an economic and export opportunity sector - Influence of socio-economic environment on the sustainability of the leather sector.

UNIT II VENTURE PLANNING AND DEVELOPMENT 12

Resource planning, Product and process selection criteria - Market segmentation and selection - Investment strategies, Business financing systems, Financial analysis for investment decision - Policy issues and legal clearances - Venture planning in tanneries, shoe units, chemical units and leather garments and goods units - Return on investments in leather sector - Financial sensitivity analysis for investments in the leather sector.

UNIT III TECHNO - ECONOMIC FEASIBILITY REPORTS (TEFR) 5

Components of TEFR - size of projects, Project costing - Selection and means of finance - cash-flow projections - Costing and pricing - Implementation schedules - PERT and related project scheduling charts - TEFR for tannery, shoe plants, leather chemical, leather garments and leather goods units.

UNIT IV RESOURCE MANAGEMENT AND PRODUCTION PLANNING 10

Material and money flow - Labour management - Principles of production management - TQM concepts - ISO and related certification methods - Purchase management in leather sector - Credit financing and labour issues in leather sector - Productivity bottlenecks in tanneries and shoe plants and debottlenecking strategies - Inventory control measures for leather sector.

Operations research - time-motion studies - Principles of time management - Management information system - Intranet and Internet communication and its relevance in managing enterprises - Factors concerning system productivity in leather sector.

UNIT V MANAGING MARKETS 12

Market demand assessment techniques - Taxation and internal revenue issues - Market forecasting tools and techniques - Brand building - Export - import guidelines and trade issues - Market sensitivity analysis - Global trade in leather - inter-country comparison of strengths and weaknesses at market place - WTO and related issues influencing leather - Eco-criteria and its influence in leather market - Forecasting domestic market for leather products and market driven planning of an enterprise in leather sector.

TOTAL : 45 PERIODS**REFERENCES**

- Brandt, Steven C., The 10 Commandments for Building a Growth Company, Third Edition, Macmillan Business Books, Delhi, 1977
- Bhide, Amar V., The Origin and Evolution of New Businesses, Oxford University Press, New York, 2000.
- Desai, Vasant, Small Scale Enterprises Vols. 1-12, Mumbai, Himalaya Publishing House. (Latest edition).
- Dollinger, Mare J., Entrepreneurship: Strategies and Resources, Illinois, Irwin, 1955.
- Holt, David H., Entrepreneurship: New Venture Creation, Prentice-Hall of India, New Delhi, latest Edition.

6. Panda, Shiba Charan, Entrepreneurship Development, New Delhi, Anmol Publications. (Latest Editions)
7. Patel, V. G., The Seven Business Crises and How to Beat Them, Tata-McGraw, New Delhi, 1995.
8. SIDBI Report on Small Scale Industries Sector (Latest Editions)
9. Taneja, Satish and Gupta, S.L. Entrepreneurship Development-New Venture Creating, Galgotia Publishing House, New Delhi, Latest Edition
10. Verma, J.C., and Gural Singh, Small Business and Industry-A Handbook for Entrepreneurs, New Delhi, Sage, 2002
11. Vesper, Karlsh, New Venture Strategies, (Revised Edition), New Jersey, Prentice- Hall, 1990.

GE9021

PROFESSIONAL ETHICS IN ENGINEERING

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

AIM

To sensitize the engineering students on blending both technical and ethical responsibilities.

OBJECTIVES

- Identify the core values that shape the ethical behavior of an engineer.
- Utilize opportunities to explore one's own values in ethical issues.
- Become aware of ethical concerns and conflicts.
- Enhance familiarity with codes of conduct.
- Increase the ability to recognize and resolve ethical dilemmas.

UNIT I 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 – Professions and Professionalism – Professional Ideals and Virtues – Uses of Ethical Theories.

UNIT II ENGINEERING AS SOCIAL EXPERIMENTATION

9

Engineering as Experimentation – Engineers as responsible Experimenters – Research Ethics - Codes of Ethics – Industrial Standards - A Balanced Outlook on Law – The Challenger Case Study

UNIT III ENGINEER'S RESPONSIBILITY FOR SAFETY

9

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis – Reducing Risk – The Government Regulator's Approach to Risk - Chernobyl Case Studies and Bhopal

UNIT IV RESPONSIBILITIES AND RIGHTS

9

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) - Discrimination

UNIT V GLOBAL ISSUES

9

Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics - Role in Technological Development – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct

TOTAL: 45 PERIODS

TEXT BOOKS

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", Thompson Learning, (2000).

REFERENCES

1. Charles D Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, (1999).
2. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, (2003)
3. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, (2001)
4. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, "Business Ethics – An Indian Perspective", Biztantra, New Delhi, (2004)
5. David Ermann and Michele S Shauf, "Computers, Ethics and Society", Oxford University Press, (2003)

GE9022

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 under the various principles, practices of TQM to achieve quality
- To learn the various statistical approaches for quality control.
- To understand the TQM tools for continuous process improvement.
- To learn the importance of ISO and Quality systems.

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of manufacturing and service quality - Basic concepts of TQM - Definition of TQM – TQM Framework - Contributions of Deming, Juran and Crosby – Barriers to TQM.

UNIT II TQM PRINCIPLES 9

Leadership – Strategic quality planning, Quality statements - Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement – PDSA cycle, 5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS & TECHNIQUES I 9

The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA – Stages, Types.

UNIT IV TQM TOOLS & TECHNIQUES II 9

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

UNIT V QUALITY SYSTEMS 9

Need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing- QS 9000 – ISO 14000 – Concepts, Requirements and Benefits – Case studies of TQM implementation in manufacturing and service sectors including IT.

TOTAL: 45 PERIODS

TEXT BOOK

1. Dale H.Besterfiled, et at., "Total Quality Management", Pearson Education Asia,Third Edition, Indian Reprint (2006).

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, 3rd 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.

GE9023

FUNDAMENTALS OF NANOSCIENCE

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

AIM

To make the students understand the importance, relevance and potentialities of this emerging field of study.

OBJECTIVES

- Study the basic nano technology and nano science.
- Understand interdisciplinary nature of this field.
- Understand the importance role of physics, chemistry, biology.
- Recognize that the rules of nano science are fundamentally different than those we experience.
- Study the basic fabrication strategies of nano science.

UNIT I INTRODUCTION 10

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 PREPARATION METHODS 10

Bottom-up Synthesis-Top-down Approach: Precipitation, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBÉ.

UNIT III PATTERNING AND LITHOGRAPHY FOR NANOSCALE DEVICES 5

Introduction to optical/UV electron beam and X-ray Lithography systems and processes, Wet etching, dry (Plasma /reactive ion) etching, Etch resists-dip pen lithography

UNIT IV PREPARATION ENVIRONMENTS 10

Clean rooms: specifications and design, air and water purity, requirements for particular processes, Vibration free environments: Services and facilities required. Working practices, sample cleaning, Chemical purification, chemical and biological contamination, Safety issues, flammable and toxic hazards, biohazards.

UNIT V CHARACTERISATION TECHNIQUES 10

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

TOTAL : 45 PERIODS

TEXT BOOKS

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

REFERENCES

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

GE9261

ENVIRONMENTAL SCIENCE AND ENGINEERING (Common to all branches)

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

AIM

The aim of this course is to create awareness in every engineering graduate about the importance of environment, the effect of technology on the environment and ecological balance and make them sensitive to the environment problems in every professional endeavour that they participates.

OBJECTIVE

- At the end of this course the student is expected to understand what constitutes the environment, what are precious resources in the environment, how to conserve these resources, what is the role of a human being in maintaining a clean environment and useful environment for the future generations and how to maintain ecological balance and preserve bio-diversity. The role of government and non-government organization in environment managements.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY

14

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

Field study of common plants, insects, birds

Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION

8

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – soil waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.

Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES**10**

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT**7**

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT**6**

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

TOTAL : 45 PERIODS**TEXT BOOKS**

1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education (2004).
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, (2006).

REFERENCES

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press (2005)

AIM

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

OBJECTIVES

- 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-chain 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.
3. Ramachandran, G.N., 'Treatise on the Biology of Collagen', Academic Press, New York.
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.

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 pretanning 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, delimiting/bating, pickling, tanning, dyeing and Fatliquoring.

UNIT IV**6**

Dimensional changes and Ultra and micro structural variations of skins during soaking, liming, delimiting/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 1977.
2. Bienkiewicz, 'Physical Chemistry of Leather Manufacture' Krieger, Floridaa, 1982.
3. Gustavson, K.H., 'Chemistry of Tanning Processes', Academic Press, New York, 1956.
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.

AIM

To impart knowledge on eco friendly 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 9

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

UNIT II CLEANER PROCESSING: TANNING 9

Less chrome and chrome-free tanning systems. Latest concepts and trends in leather processing. Eco-labelling. Integrated strategies to achieve permissible BOD, COD and TDS standards of tannery effluents.

UNIT III CLEANER PROCESSING: POST TANNING 9

Formaldehyde, Phenol, VOX, AOX free post tanning systems; Latest concepts and trends in leather processing. Eco-labelling. Integrated strategies to achieve permissible BOD, COD and TDS standards of tannery effluents.

UNIT IV CLEANER PROCESSING: FINISHING 9

Cleaner processing and solvent free finishing systems; Eco-labelling. integrated strategies to achieve permissible BOD, COD and TDS standards of tannery effluents.

UNIT V ADVANCED FINISHING, SPLIT PROCESSING AND UPGRADATION TECHNIQUES – CLEANER TECHNOLOGIES 9

Role of following finishing equipment like autospray, roller coats, embossing machines, finiflex, auto togglers, stacking machines etc. Techniques such as oil pull-up, waxy, burnishable, crazy horse, antique finish, screen printing, roller printing, tie and dye finishing. metallic effects, patent finishing, cationic finishing, other novel finishing techniques like electrostatic finishing.

Shoe suede, garment suede, grain finished effect and speciality finishes at split leather - processing technologies and finishing techniques specially suited for the purpose. Upgradation of lower ends for better utilisation. Transfer foil, lamination techniques, etc in split finishing. Latest trends.

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.

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**

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**

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 fatliqor preparation. Stability of emulsions, grain and particle sizes of emulsions, factors controlling grain sizes of emulsions. Fatliqor manufacturing technology. Theory of colors, chromphoric groups, structural features of dyes; acid, basic and reactive dye classification. Chemistry and technology of dye manufacture.

UNIT IV**9**

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. Functional definition of binders, chemical classification of binders, acrylic, protein, polyurethane, introduction to 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.

TOTAL : 45 PERIODS**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, 1977.
2. Gustavson, K.H. 'Chemistry of Tanning Processes' Academic Press, New York, 1956.
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

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 animals 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 COLLECTION AND CONSERVATION OF ORGANS AND GLANDS FROM SLAUGHTERED ANIMALS : POSSIBLE SCOPE OF THEIR UTILISATION 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 INDUSTRIAL STATUS OF VARIOUS BY-PRODUCTS IN THE COUNTRY 9

Process studies on

- a. Glue making from tannery wastes
- b. Bone glue and deproteinisation of bone
- c. Horn and hoof meal
- d. 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.

AIM

To impart knowledge on the environmental impact assessment for leather sector.

OBJECTIVE

- At the end of the course the students would have gained knowledge on the legislations on environmental pollution control and management, obligations of industries to control environmental pollution, occupational health hazards and industries, environmental impact assessment, audit and management plan

UNIT I LEGISLATIONS ON ENVIRONMENTAL POLLUTION CONTROL AND MANAGEMENT 8

Environmental Legislations in India, Europe, USA and Canada. Development of Legislations, Standards and guidelines.

UNIT II OBLIGATIONS OF INDUSTRIES TO CONTROL ENVIRONMENTAL POLLUTION 5

Water (Prevention and Control of Pollution) Act 1974, Air (Prevention and Control of Pollution) Act 1981, Environmental Protection Act 1986, Hazardous Waste Management Rules and Guidelines for siting of industries. Standards for discharge of treated liquid effluent into water bodies, including inland water bodies and sea, standards for disposal of air emissions (SO₂, SPM, NH₃, H₂S and HC) into atmosphere.

UNIT III OCCUPATIONAL HEALTH HAZARDS AND INDUSTRIES 8

Factory Act 1987 of India, Occupational health and safety requirements and standards of ILO, compliance of rules and guidelines of Factory Act applicable to industries.

UNIT IV ENVIRONMENTAL IMPACT ASSESSMENT (EIA) AND AUDIT (EA) 10

Principles of environmental impact assessment and audit guidelines and legislature requirements for siting of industrial units in estates/complex. Preparatory procedures for EIA study, evaluation of impact on air, water and land environment.

UNIT V ENVIRONMENTAL AUDIT (EA AND MANAGEMENT PLAN 14

Principles of environmental auditing, cleaner technologies in industrial processes and evaluation of processes. Auditing techniques in preparation of EA. Monitoring of ambient environment, including air, water and land, noise liquid and solid waste management.

TOTAL : 45 PERIODS

REFERENCES

1. Canter, W.L. Environmental Impact Assessment, McGraw Hill Inc., 1992.
2. Rau, J.G. and Wooten, D.C., Environmental Impact Analysis Handbook, McGraw-Hill 1980.
3. Woolsten, H., Environmental Auditing. An Introduction and Practical Guide.

AIM

This course aims at imparting knowledge on the principles of designing a leather and chemical processing industry.

UNIT I PRINCIPLES, ILLUSTRATIONS AND METHODOLOGY OF THE FOLLOWING WITH REFERENCE TO THEIR APPLICATION IN LEATHER AND CHEMICAL PROCESSING 9

Process Design
Process flowsheeting
Material and energy flows and networks
Process engineering flow schemes
Codes, Standards and Fabrication processes
Utilities/Offsite facilities
Inplant safety
Selection of Materials of construction

UNIT II BASIC DESIGN OF PROCESS EQUIPMENTS & LAYOUT PRINCIPLES 12

Basic Design of process Equipments :
Stirred reactors (gas liquid and liquid - solid systems)
Tanning drums and supporting units
Forced circulation leather dryer
Distillation units
Principles of layout for Tanneries and Chemical Process Units
Factors to be considered for layout selection
Types of layouts and their design basis

UNIT III PROCESS CONTROL FOR TANNERIES AND CHEMICAL PROCESS UNITS 9

Principles and types
Typical control strategies
Piping and Instrumentation diagrams

UNIT IV UTILITIES AND OFFSITE FACILITIES FOR TANNERIES AND CHEMICAL PROCESS UNITS 7

Estimation of loads
Nature and type of facilities

UNIT V PRE CONSTRUCTION COST ESTIMATION 8

Fixed and working capital requirements
Manufacturing costs
Break-even and profitability analysis
Cash flow analysis

TOTAL : 45 PERIODS

TEXT BOOKS AND REFERENCES

1. Max,S. Peters and Timmerhaus, K.D. `Plant Design and Economics for Chemical Engineering', McGraw-Hill - International Book Company, New York, 1989.
2. Vibrandit, C. and Dryden, C.E. `Chemical Engineering Plant Design', McGraw-Hill book Company Inc., New York.
3. Lloyd, E. Brownell and Young, E.H.`Process Equipment Design', Wiley Eastern Limited, New Delhi.
4. Walas, `Chemical Process Equipment Selection and Design', McGraw-Hill Book Company Inc., New York.
5. `Tannery design' - CLRI Publication.
6. Walter Landman, "The Machines in the Tannery", World leather publication, 2003.

LT9034 ADVANCED ANALYTICAL LABORATORY L T P C

0 0 4 2

Ion exchange and gel filtration chromatographic techniques for the separation of mineral tanning species and determination of charge - UV and visible spectrophotometric techniques and their applications in the determination of chromium, iron, formaldehyde, dyes, NMR methods for fatliquors - Functional group identification in polymers using IR and NMR techniques. ¹³ C spectra of polymeric syntans. GPC for molecular weight determination of polymeric syntans - Leather surface examination by electron microscope.

TOTAL : 60 PERIODS

LT9035 LEATHER AUXILIARIES LABORATORY L T P C

0 0 4 2

Preparation and characterization of Phenol, Naphthalene condensation products; Mineral syntans; Vegetable tannin extracts; Various types of Fatliquors; Pigment formulations.

TOTAL : 60 PERIODS

LT9036 LEATHER GOODS DESIGN AND MANUFACTURE L T P C

3 0 0 3

AIM

To impart knowledge on design and construction of leather goods

OBJECTIVES

Through this course students will be able know

- Various components used for the manufacture of leather goods
- Processing steps involved in the making of leather good
- Techniques to design and develop leather goods
- Organization and management of a leather goods manufacturing unit

UNIT I OVERVIEW AND FABRICATION OF LEATHER GOODS- PRODUCTION & PLANNING 14

Classification of Leather Goods; Grading and assorting of leathers for leather goods; Property requirements for leather and lining materials; Accessories for Leather goods; Various types of fasteners, fittings and other accessories. Alternative materials and their adaptability for goods

Nomenclature used for component identification in various leather goods – Wallet, hand bags, Executive bags etc. operational sequences in Leather goods production

UNIT II FABRICATION OF LEATHER GOODS -CUTTING, CLICKING AND ASSEMBLING 6

Hand & machine cutting, Knives & tools – Preparation and handling. Pattern interlocking/nesting for material optimization. Factors influencing cutting value.

Various types of assembly techniques for leather goods. Pre assembly and assembly techniques – skiving, splitting, folding, sewing etc.

UNIT III FABRICATION OF LEATHER GOODS -PROCESS SCHEDULING AND LINE BALANCING. 3

Quality control measures in leather goods manufacture.

UNIT IV DESIGN & DEVELOPMENT 12

Basic design development – measurement/ sizing for various types of leather goods – pattern grading for leather garments. CAD applications for leather goods design & production; Analysis of fashion and material trends

UNIT V ORGANISATION & MANAGEMENT 10

Project Feasibility reports for leather; Plant lay out, Costing and pricing for leather goods and garments. Analysis of international market trends for goods – Europe, USA & other markets. Social auditing of leather goods, occupational Health & Safety, ISO 9000 & 14000.

TOTAL : 45 PERIODS

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. Training in Tanning Techniques and Leather Goods Manufacture - Course material, CLRI, Madras, 1990.
6. Skiving Manual, First Edition, 1994 CLRI, Madras.

**LT9037 LEATHER GARMENTS DESIGN AND MANUFACTURE L T P C
3 0 0 3**

AIM

To impart knowledge on design and construction of leather Garments

OBJECTIVES

Through this course students will be able know

- various components used for the manufacture of leather garments
- processing steps involved in the making of leather good
- techniques to design and develop leather garments
- organization and management of a leather garments manufacturing unit

**UNIT I OVERVIEW AND FABRICATION OF LEATHER GARMENTS-
PRODUCTION & PLANNING 14**

Classification of Leather Garments; Grading and assorting of leathers for leather garments; Property requirements for leather and lining materials; Accessories for Leather garments; Various types of fasteners, fittings and other accessories. Alternative materials and their adaptability for garments

Nomenclature used for component identification in various leather garments – Wallet, hand bags, Executive bags etc. operational sequences in Leather garments production

**UNIT II FABRICATION OF LEATHER GARMENTS- CUTTING, CLICKING AND
ASSEMBLING 5**

Hand & machine cutting, Knives & tools – Preparation and handling. Pattern interlocking/nesting for material optimization. Factors influencing cutting value.

Various types of assembly techniques for leather garments. Pre-assembly and assembly techniques – skiving, splitting, folding, sewing etc.

UNIT III PROCESS SCHEDULING AND LINE BALANCING 4

Quality control measures in leather garments manufacture.

UNIT IV DESIGN & DEVELOPMENT 12
Basic design development – measurement/ sizing for various types of leather garments – pattern grading for leather garments. CAD applications for leather garments design & production; Analysis of fashion and material trends

UNIT V ORGANISATION & MANAGEMENT 10
Project Feasibility reports for leather; Plant lay out, Costing and pricing for leather garments and garments. Analysis of international market trends for garments – Europe, USA & other markets.
Social auditing of leather garments, occupational Health & Safety, ISO 9000 & 14000.

TOTAL : 45 PERIODS

RERERENCES

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. Training in Tanning Techniques and Leather Garments Manufacture - Course material, CLRI, Madras, 1990.
6. Skiving Manual, First Edition, 1994 CLRI, Madras.

**LT9038 LEATHER FOOTWEAR DESIGN AND MANUFACTURE L T P C
3 0 0 3**

AIM

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

OBJECTIVES

- 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, Grinders; 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 fastners 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

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.

LT9039 TECHNOLOGY OF LEATHER SUPPLEMENTS, SYNTHETICS & ACCESSORIES FOR LEATHER PRODUCTS

L T P C
3 0 0 3

AIM

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

OBJECTIVES

- 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. Analytical skills on testing of polymers will be emphasized that will enable them to understand various polymer properties and manufacturing methods.

UNIT I POLYMERS USED FOR LEATHER AND LEATHER PRODUCTS MANUFACTURE 9

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

UNIT II MODIFICATIONS OF POLYMERIC MATERIALS FOR DIFFERENT COMPONENTS 10

i. Polymer Blending : High polymer blends - Plasticization – Other additives, fillers, Antioxidants, flame retardants, stabilizers, colorants and pigments - Post reactions of polymers

ii. Moulding techniques and equipment used in fabrication of polymer products such as : Injection moulding, calendaring, Reaction Injection moulding (RIM), Blow moulding etc.

UNIT III PROPERTIES, SPECIFIC USES AND TESTING OF DIFFERENT POLYMER MATERIALS 9

Properties and test procedures for polymer materials such as rheological, mechanical, electrical, thermal, chemical and comfort -suitability of polymer materials for different components of leather products.

UNIT IV MANUFACTURE OF DIFFERENT POLYMERS 12

Manufacture of industrially important polymers for plastics, fibres and elastomer - Polyethylene, polypropylene, polyvinyl chloride, polyvinyl alcohol, polyacrylonitrile, polystyrene, polyurethane, fluoro-carbon polymers, epoxy resins, polyamides, polyesters, alkyd resins, silicone polymers, cellulose.

UNIT V GRINDERIES AND CHEMICALS 9

Last: Raw material - Manufacture of wooden last, Plastic last and metal last.

Constituents and Manufacture of fibreboards. Plastic back part insole and stiffener board.

Shank, Raw Material - Wood, Fibre board Steel, combined wooden board or steel and board, manufacture technique.

Adhesive: Types of adhesives used in shoe making, raw materials - formulation and manufacture.

Grinderies: Metallic grinderies - tack, rivet and nails, wires - raw materials - sorting and polishing.

TOTAL : 45 PERIODS

TEXT BOOKS AND 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.
5. A.C. Miler & J.H. Bristan, Polymer Tech., Temple Press, London.
6. P.R. Flory, Principles of Polymer Chemistry, Cornell Univ. Press, Ithaca, New York, 1953.

LT9040 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.

AIM

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

OBJECTIVES

- 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**

Definition, historical development, scope of applications and advantage. CNC devices for computer aided cutting including laser and water jet, computer aided manufacturing.

UNIT II HARDWARE IN CAD**12**

Introduction, Principles, Capabilities and operation of graphical workstations, central processing units, graphic terminals, input/output devices, interface and storage devices, networking concepts of LAN and WAN.

Digitization: 2D & 3D Coordinate extracting, principles of digital and analog conversion, digital input/output processing systems.

Output devices: Prints, plotter and cutter. Various types, their working principles and applications.

UNIT III PATTERN ENGINEERING**8**

Computerized techniques for pattern generation, grading and assessment of leather products patterns, consumption calculations, pattern nesting and costing, stitching etc. through computerized techniques.

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.
6. Desai and Abel, "Introduction to FEM". "Step by Step guide to CAD for footwear": CAD Centre, SDDC, CLRI.
7. Rapid prototyping ; AU – FRG publications, 1984.
8. Jorg Buchner Simulation : "QUEST" manual : EDS Technologies, Published by Springer, 2003.

UNIT III PRODUCTION, INVENTORY CONTROL AND MAINTAINANCE 7

Basic types of production, Intermittent, Batch, Continuous – Routing, Scheduling, Activating and Monitoring – Basic Inventory Models – Economic order quantity, Economic batch quantity – Reorder point – Safety stock – Classification and codification of stock – classification – Procedure for stock control, Materials Requirement Planning (MRP), JIT, Implications for Supply chain management.

Maintenance : Preventive Vs. Breakdown maintenance – Break-down time distribution – Maintenance cost balance – Procedure for maintenance.

UNIT IV METHODS ANALYSIS, WORK MEASUREMENT AND QUALITY CONTROL 10

Purposes of inspection and quality control – Acceptance sampling by variables and attributes – Control charts for variables, fraction defectives and defects. Total Quality management. Methods Analysis and Work Measurement: Methods study procedures – The purpose of time study – Stop watch time study – Performance rating – Allowance factors – Standard time – Work sampling technique.

UNIT V PURCHASE AND WARE HOUSE MANAGEMENT 8

Dynamic Purchasing : Purchasing function – Selection of materials and vendors - Purchasing Organization – Concept of value analysis. Store – Keeping and Warehousing Management.

TOTAL : 45 PERIODS

REFERENCES

1. Alan Mulemann, John Oakland , Keith Locker , ‘ Production and Operations Management’ Macmillan India Ltd.
2. Datta A.K., Materials Management : Procedures, Text and Cases, Prentice Hall of India.
3. Gaither, Operations Management , Thomas Learning

**LT9046 CONSUMER BEHAVIOUR AND BUSINESS ORIENTATION L T P C
3 0 0 3**

AIM

To impart consumer behaviour and business orientation skills to students.

OBJECTIVE

- The purpose of this course is to provide an overview of consumer decision making, marketing implications, consumer behaviour, business orientation and issues in business marketing catering to leather sector.

UNIT I CONSUMER DECISION-MAKING AND MARKETING IMPLICATIONS 6

Introduction to the study of consumer behaviour- Stages in Consumer Decision Making- Types of Consumer decision-making -Consumers shopping styles and Trends-Information search and consumers decision-making-Information search and marketing strategies- Dimensions of information search - Impulse Buying of Consumer- an emerging trend.

UNIT II CONSUMER DECISION-MAKING AND BEYOND 7

Models of consumers- Four views of consumer decision-making - Economic, Passive, Cognitive, Emotional-A simple view of consumer decision-making Howard sheth Model- Engel, Kollat and B1ackWell Model- Case studies with reference to India.

UNIT III DETERMINANTS OF CONSUMER BEHAVIOUR 10

- a) Motivation-Abraham Maslow's need Herz-berg's two factor theory, Sigmund Freud's Psycho-analytical model of Motivation.
- b) Perception - Selective attention, Exposure and Subliminal perception Perception Process-Factors for perceptual distortion.
- c) Learning -Pavlovian & Skinner's approaches in Stimulus Response Theories- Leon Festinger's Cognitive Dissonance Theory.
- d) Beliefs and Attitudes- Cognitive , Affective and Action oriented Attitude.

UNIT IV BUSINESS ORIENTATION 8

Management roles and functions in a business. Designing and re-designing business process, location, layout, operations planning and control. Basic awareness on the issues impinging on quality, productivity and environment. Principles of double-entry book-keeping: journal entries, cash-book, pass book, and Bank Reconciliation Statement, ledger accounts, trail balance and preparation of final accounts: Trading and Profit and Loss Account; Balance-sheet. Brief introduction to Single-Entry system of record keeping. Sources of risk/venture capital, fixed capital, working capital and a basic awareness of financial services such as leasing and factoring. Managing business growth. The pros and cons of alternative growth options, internal expansion, acquisitions and mergers, integration and diversification. Crisis in business growth.

UNIT V ISSUES IN BUSINESS MARKETING 14

The concept and application of product life cycle [plc], advertising and publicity, sales and distribution management. The idea of consortium marketing, competitive bidding/tender marketing, negotiating with principal customers. The contemporary perspectives on Infrastructure Development, Product and Procurement Reservation, Marketing Assistance, Subsidies and other Fiscal and Monetary Incentives. National state level and grass-root level financial and non-financial institutions in support of small business development. Credit risk management, contract management, interest risk management, foreign risk management, leadership strategic planning.

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

AIM

To impart human resource management skills to the students.

OBJECTIVES

- The purpose of this course is to provide an overview of human resource management, with particular emphasis in human resource planning and strategy, personnel selection, equal employment opportunity, training, performance appraisal, compensation, and contemporary issues.

UNIT I MANAGEMENT AND GENERAL EMPLOYMENT PRACTICES 15

Human resource planning, organizational design, budgeting, motivation, leadership, quality, research, employee involvement, ethics, international issues
Laws, job analysis, job description, performance appraisals, workplace behaviour problems

UNIT II STAFFING 6

Equal employment opportunity, recruitment, selection, career planning, organizational exit

UNIT III HUMAN RESOURCE DEVELOPMENT 7

Needs analysis, training programs, evaluation

UNIT IV COMPENSATION AND BENEFITS 5

Philosophy, job evaluation, pay structures, benefit programs, strategy

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.

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 BOOK

1. 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.

**LT9049 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 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-Marketing Management- 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 - Retail Management -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-Organizational Buyer 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

LT9050 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 cases studies in the pre and post implementation of ERP, 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

LT9051 SUPPLY CHAIN MANAGEMENT FOR LEATHER SECTOR**L T P C
3 0 0 3****AIM**

To impart knowledge on Supply chain management principles and their application in leather industry.

OBJECTIVE

- To cover the basics of supply chain concepts, associated networks, tools and techniques required for evaluating various supply chain processes.

UNIT I STRATEGIC FRAMEWORK**5**

Objective, decision phases, process views, examples, strategic fit, supply chain drivers and metrics

UNIT II SUPPLY CHAIN NETWORKS**10**

Distribution networks, Facility networks and design options, Factors influencing, Models for facility location and capacity allocation, Transportation networks and design options, Evaluating network design decisions

UNIT III MANAGING DEMAND AND SUPPLY IN A SUPPLY CHAIN**10**

Predictable variability in a supply chain, Economies of scale and uncertainty in a supply chain – Cycle and safety Inventory, Optimum level of product availability, Forward Buying, Multi-echelon cycle inventory

UNIT IV SOURCING AND PRICING IN A SUPPLY CHAIN**10**

Cross-Functional drivers, Role of sourcing in a supply chain, Logistics providers, Procurement process, Supplier selection, Design collaboration, Role of Pricing and Revenue Management in a supply chain

UNIT V INFORMATION TECHNOLOGY AND COORDINATION IN A SUPPLY CHAIN**10**

The role of IT in supply chain, The supply chain IT frame work, Customer Relationship Management, Supplier relationship management, Future of IT in supply chain, E-Business in supply chain, Bullwhip effect – Effect of lack of co-ordination in supply chain, Building strategic partnerships, CPFR

TOTAL : 45 PERIODS**TEXT BOOK**

1. Sunil Chopra and Peter meindl, "Supply Chain Management , Strategy, Planning, and operation", PHI, Third edition,2007

REFERENCES

1. Jeremy F.Shapiro, "Modeling the supply chain", Thomson Duxbury ,2002
2. James B.Ayers, "Handbook of Supply chain management", St.Lucle press, 2000.

The objective of this lab is to develop the student's management skills, that include time management, conflict management and project management. The students are imparted training in these skills. The common training inputs are leadership skills, coaching skills, negotiation skills, meeting skills and team dynamics. After identification of his/her training needs, the students are required to attend the following training modules mentioned below:

1. Presentation Skills
2. Time management
3. Conflict management
4. Individual action plan
5. Project management
6. Leadership skills
7. Coaching skills
8. Negotiation skills
9. Meeting skills
10. Decision skills
11. Team dynamics

TOTAL : 60 PERIODS