PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

I. To prepare students to excel in research or to succeed in Leather Technology profession through globally renowned rigorous post graduate education.

II. To provide students with a solid foundation in Leather Science and Technology required to excel in their profession for an inclusive growth in leather manufacture

III. To train students with good scientific and engineering knowledge so as to comprehend, analyze, design, and create novel products and solutions for the real life problems.

IV. To inculcate students in professional and ethical attitude, effective communication skills, teamwork skills, multidisciplinary approach, and an ability to relate leather manufacture to broader social context.

V. To provide students with an academic environment aware of excellence, leadership, written ethical codes and guidelines, and the life-long learning needed for a successful professional career

PROGRAMME OUTCOMES (POs):

On successful completion of the programme,

1. Graduates will demonstrate knowledge of mathematics, science and engineering.
2. Graduates will demonstrate an ability to identify, formulate and solve technological problems.
3. Graduate will demonstrate an ability to design and conduct experiments, analyze and interpret data.
4. Graduates will demonstrate an ability to design a system, component or process as per needs and specifications.
5. Graduates will demonstrate an ability to visualize and work on laboratory and multidisciplinary tasks.
6. Graduate will demonstrate skills to use modern engineering tools, software and equipment to analyze problems.
7. Graduates will demonstrate knowledge of professional and ethical responsibilities.
8. Graduate will be able to communicate effectively in both verbal and written form.
9. Graduate will show the understanding of impact of engineering solutions on the society and also will be aware of contemporary issues.
10. Graduate will develop confidence for self education and ability for life-long learning.

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TOTAL CREDITS : 69

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OBJECTIVES
This subject is to impart advanced physical and chemical concepts associated with the structure of collagen.

UNIT I - MOLECULAR STRUCTURE OF COLLAGEN

UNIT II - CHEMISTRY OF COLLAGEN AND ITS DISTRIBUTION
Collagen chains—Amino acid composition and primary structure—molecules of nomenclature—common and distinctive chemical features—pro and α chains—carbohydrates—structure and functions of pro collagens.

UNIT III - COLLAGEN CROSSLINKS
Chemistry and properties of crosslinks—intramolecular and intermolecular crosslinks—difunctional and multifunctional crosslinks—lathyrism and (functional significance of) crosslinks—analysis of collagen crosslinks.

UNIT IV - ISOLATION AND CHARACTERISATION OF COLLAGEN
Extractability—selective precipitation behaviour—chromatographic properties—Electrophoretic properties. Circular Dichroism—FTIR.

UNIT V - BIOSYNTHESIS OF COLLAGEN
Transcription and translation—collagen genes and mRNA—synthesis of pro chains—intracellular processing of collagen—extracellular modifications. Steps in collagen biosynthesis and their significance—specific enzymes and their reaction.

UNIT VI - COLLAGEN DEGRADATION

UNIT VII - PHYSICO-CHEMICAL TECHNIQUES FOR COLLAGENOUS MATRICES
Microscopy and spectroscopy techniques for collagen morphology. Non-invasive methods of liquid and solid imaging of biological specimen and their relevance to location of defects in hides/skins.

TOTAL : 45 PERIODS

Outcome
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.
REFERENCES:

7. 1962.
OBJECTIVES
To have thorough understanding on the theory of instrumentation and applications of analytical equipment used for characterization of various products with special reference to leather technology.

UNIT I - SPECTROSCOPIC TECHNIQUES
Electromagnetic spectrum and spectroscopic techniques, principles of electronic vibrational and rotational spectroscopic techniques, principles of magnetic resonance, mass and microwave spectroscopic techniques, block diagram of the instruments involved, the fields of application of spectroscopic techniques including study of solid surfaces.

UNIT II - CHROMATOGRAPHIC TECHNIQUES
Theory and application of different chromatographic techniques such as paper, TLC, HPLC, ion-exchange, gel permeation, gel filtration, GLC and affinity chromatography.

UNIT III - APPLICATIONS OF SPECTROSCOPIC AND CHROMATOGRAPHIC METHODS IN LEATHER SCIENCE
Application of spectroscopy to the analysis of mineral tanning salts, formaldehyde, dyes, pigments and effluents, NMR techniques in the characterization of synthetic tanning agents, fatliquors, finishing agents. Application of chromatographic techniques in separation, analysis and characterization of mixtures containing compounds such as biocides, peptides, proteins, mineral tanning salts, vegetable tannins, dyes and finishing agents with special emphasis on the characterization of polymers.

UNIT IV - ELECTROANALYTICAL METHODS
Theory and applications of electroanalytical techniques like - Polarography, coulometry, cyclic voltammetry and chrono-potentiometry.

UNIT V - PRINCIPLES OF MICROSCOPIC AND OTHER TESTING METHODS IN LEATHER SCIENCE
Principles involved in the morphological investigation on leather and polymers (conventional, core shell morphologies), various microscopic techniques including electron microscopy, mechanical testing devices and criteria for the measurement of mechanical properties - Imaging techniques for surface applications. Differential Scanning Calorimetry (DSC) / Hyper DSC. Thermo Gravimetric Analysis (TGA).

OUTCOME
At the end of the course the students can understand the principle and importance of various analytical instruments used for the characterization of various materials.

REFERENCES:
OBJECTIVE:

- The course objective is to impart knowledge on advanced numerical methods for solving differential equations in science and engineering.
- Analysis and application of advanced numerical methods for solving Partial Differential Equations (PDEs).

UNIT I ALGEBRAIC EQUATIONS


UNIT II ORDINARY DIFFERENTIAL EQUATIONS – IVPS

RungeKutta Methods, step size control and estimates of error, numerical stability, solution of stiff ODEs, ODE-IVPs coupled with algebraic equations;

UNIT III ORDINARY DIFFERENTIAL EQUATIONS – BVPS

Finite difference method, orthogonal collocation method, orthogonal collocation with finite element method, Galerkin finite element method, shooting technique.

UNIT IV PARTIAL DIFFERENTIAL EQUATIONS – FINITE DIFFERENCE METHOD

Parabolic equations – Different explicit and implicit methods, alternating direction explicit and implicit methods; Elliptic equations – Point iterative methods, line iterative methods, ADI methods; First order hyperbolic equations – method of characteristics, different explicit and implicit methods; numerical stability analysis, method of lines.

UNIT V PARTIAL DIFFERENTIAL EQUATIONS – FINITE ELEMENT METHOD


OUTCOME:

- Be familiar with numerical solution of ODEs.
- Setup and solve partial differential equations numerically

REFERENCES

OBJECTIVE
To provide practical knowledge in characterizing various leather chemicals and handle advanced instrumental techniques.

UNIT I - LEATHER CHEMICALS LABORATORY

Analysis and characterisation of natural and synthetic fatliquors in terms of charge, fat content, stability to acids and electrolytes - Evaluation of dyes and pigments in terms of hue, brilliance, particle size determination - Analysis of tannery effluents for their B.O.D., C.O.D., total solids, chrome, sulphide, and leathers for biocides & formaldehyde.

UNIT II - INSTRUMENTAL LABORATORY

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. Protein Purification techniques - Characterization of proteins viz., SDS-Page, Circular Dichroism, FTIR.

TOTAL : 90 PERIODS

OUTCOME
Students will have the practical skill to use advanced instruments associated science and technology.
OBJECTIVE
This subject is to impart advanced physical, chemical and biological concepts associated with the leather manufacture

UNIT I  CHEMICAL PRINCIPLES INVOLVED IN PRETANNING OPERATIONS  14
Salt less/less salt curing methods - Swelling mechanisms; porosity of hides and skins. Diffusion of lime and sharpening agents into skin; Osmotic and lyotropic opening of fibres. Nucleophilic displacement pathways in unhairing, mechanisms of unhairing based on chemical and enzymatic methods – concepts; changes in fibre structure during liming; mechanism of deliming, bating and degreasing - Role of mineral acids, neutral salts and non-swelling acids, in pickling, the chemistry of pickling and the fibre structure and the importance of pore size characteristics of pickled pelts.

UNIT II  CHEMISTRY OF TANNING MATERIALS  10
Classification, isolation, characterization and structural elucidation of vegetable tannins; biogenesis and biosynthesis of hydrolysable and condensed tannins - Aquous chemistry of Chromium (III), Aluminium (III), Iron (II) and (III), Titanium (IV), and Zirconium (IV) - coordinative interactions and hydrolytic behaviour of coordinated ligands, olation, oxolation and polymerisation and their relevance to mineral tanning.

UNIT III  MECHANISM OF TANNING  10
Transport of tanning materials into pelt, diffusion equilibria and mechanism of vegetable, mineral and combination tannages, role of crosslinking and fibre coating in matrix stability.

UNIT IV  POST TANNING AND FINISHING  11
Physicochemical interactions of syntans, fatliquors and dyes with collagen and leather - Role of surface charge and importance of electrostatic, H-bond, dipole-dipole and hydrophobic interactions. Importance of Iso Electric Point (IEP) during tanning/post tanning, Theory of finishing with special emphasis to optical properties of pigments, hollow spheres and binders. Role of interfacial phenomena, adhesion/cohesion and film formation mechanism in leather finishing.

TOTAL :45 PERIODS

OUTCOME
At the end of this course the students will be able understand the underpinning science in leather manufacture

REFERENCES:
OBJECTIVE
This course aims at imparting knowledge on the technology of making different types of leathers with cleaner and greener approach.

UNIT I - SPECIALITY LEATHERS 10
Different types of raw materials used, properties required, physical and chemical standards required and process details to achieve the specifications of different types of leathers such as upholstery, washable garment, water resistant leathers, chamois, glove and fashion leathers. Processing of exotic leathers such as reptiles, crocodiles, lizards, fish, ostrich etc.

UNIT II - CLEANER PROCESSING - BEAMHOUSE 8
Eco-friendly process technologies: Salt free curing options, sulphide free unhairstystems, 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 III - CLEANER PROCESSING: TANNING, POST TANNING AND FINISHING 8
Less chrome and chrome-free tanning systems. Avoidance of eco sensitive substances viz., Formaldehyde, APE, Cr(VI), VOX, AOX free post tanning; solvent free finishing systems; Latest concepts and trends in leather processing. ECHA/REACH guidelines, Brand/Eco-labelling requirements and trend integrated strategies to achieve permissible BOD, COD and TDS standards of tannery effluents;

UNIT IV - ADVANCED FINISHING TECHNIQUES 13
Role of following finishing equipments; techniques for newer and novel finishing system viz., aqueous based patent finishing, cationic finishing, foam 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. New textures with enhanced properties; Transfer foil/coating, lamination techniques, etc in split finishing. Latest trends.

UNIT V - NEWER CONCEPTS IN LEATHER MANUFACTURE 6
Process controls and automation – productivity – quality consistency – Water management and Zero Discharge approaches - energy audit - Environmental footprints

TOTAL : 45 PERIODS

OUTCOME
At the end of the course, the students will be in a position to make conceptual design to make cleaner leather

REFERENCES:
OBJECTIVE
This subject is to impart knowledge on primary, secondary and tertiary treatment associated with the
management of waste water and safe disposal of solid wastes.

UNIT I - PHYSICO-CHEMICAL TREATMENT OF WASTEWATER 8
Screening – Flow Equilisation – Theory on Coagulation & Flocculation – Sedimentation – Filtration –
Detail study and design aspects with reference to tannery wastewater.

UNIT II - INTRODUCTION TO BIOLOGICAL TREATMENT OF WASTEWATER 7
Introduction to microbial metabolism – Bacterial growth – Kinetics of Biological Growth

UNIT III - BIOLOGICAL TREATMENT OF WASTEWATER 8
Aerobic suspended growth system - Aerobic attached growth system - Anaerobic suspended growth
system - Anaerobic attached growth system – Advanced Biological System – UASB – EGSB

UNIT IV - ADVANCED WASTEWATER TREATMENT FOR THE REMOVAL OF
REFRACTORY ORGANIC COMPOUNDS 12
Theories on Advanced Oxidation Process viz., Photocatalytic treatment, Membrane Separation,
Homogenous catalysis system using hydrogen peroxide, ozone etc - Heterocatalytic systems using
metal oxides, activated carbon – Removal of Inorganic Componds through electro dialysis, reverse
osmosis, multiple effect evaporator, ion-exchange.

UNIT V - SOLID WASTE DISPOSAL 10
Secured land fill: leachability studies and management of leachates – Biomethanisation of Solid waste:
with reference to energy recovery – Thermal incineration – Bacterical compositing – Vermi composting –
Bioremidiation-RO reject management.

TOTAL : 45 PERIODS

OUTCOME
At the end of the course, the students will be in a position to understand the methods and means to
manage tannery wastes

REFERENCES:
2. Metcalf and Eddy, H `Tchobanoglous, G. and Burton, F.L. (Ed), Waste water Engineering,treatment,
McGraw Hill.

LE7211 LEATHER PROCESS DESIGN LAB L T P C 0 0 6 3

OBJECTIVE
To impart practical exposure in making different types of leathers using cleaner approaches

Advanced processing techniques with emphasis on eco friendly leather manufacture. Case studies for specific product mix (upper, garment, upholstery, glove) with details of chemical audit, energy audit, water consumption during processing.

OUTCOME
At the end of the course, the students will be in a position to make different types of leather using cleaner methods

TOTAL: 90 PERIODS

LE7301 SCIENCE AND TECHNOLOGY OF LEATHER CHEMICALS L T P C 3 0 0 3

OBJECTIVE
The course provides advanced concepts on the technology of making different auxiliaries viz., fatliquors, syntans, dyes and finishing chemicals used for leather manufacture.

UNIT I
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
Chemical classification of syntans, sulphonation of naphthalene, phenols, Napthols, Phenol formaldehyde condensation reactions, chemistry of light fast syntans, chemistry of amino resins and PU, Unit operations in syntan manufacture.

UNIT III
Composition of fatliquors; Functionalisation of oils for surface active function, chemical classification natural and synthetic oils, sulphation, sulphonation, sulphitation reactions of oils, role of double bonds and iodine value in functionalisation of oils, sulphochlorination, sulphoamidation, transesterification, phosphorylation reactions for fatliquor preparation. Stability of emulsions, grain and particle sizes of emulsions, factors controlling grain sizes of emulsions. Fatliquor manufacturing technology.
Theory of colors, chromphoric groups, structural features of dyes; acid, basic and reactive dye classification. Chemistry and technology of dye manufacture.
UNIT IV
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
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

OUTCOME
At the end of the course students would know the science of making different types of leather auxiliaries

TEXT BOOKS AND REFERENCES

LE7311 LEATHER CHEMICALS PREPARATORY LAB L T P C
0 0 4 2

OBJECTIVE
To impart practical exposure on the synthetic approaches for leather chemicals manufacture
Preparation and characterization of Phenol, Naphthalene condensation products; Mineral syntans; Vegetable tannin extracts; Various types of Fatliquors; Pigment formulations.

TOTAL : 60 PERIODS

OUTCOME
At the end of the course, the students will be in a position to synthesize different leather chemicals

LE7313 SEMINAR L T P C
0 0 2 1

OBJECTIVE
The industrial internship is expected to enhance the technical employability skills of the students.
Students are expected to pursue one month industrial/laboratory training during the summer vacation.
Seminar presentations need to be made based on their comprehension of their exposure.

OUTCOME
At the end of this course the students will have confidence in handling practical aspects in a tannery or leather chemicals manufacture and also to improve the presentation skills of the students
OBJECTIVE
The objective of this course is to facilitate the students to identify innovative projects that promotes creativity.

Under Project Work Phase I the students are expected to pursue preliminary work on a project undertaken by and assigned to him/her by the Department. A report should be submitted based on the information available in the literature or data determined in the laboratory/industry. The objective of the project work is to make use of the knowledge gained by the student at various stages of the degree programme. Project Work Phase I is intended to facilitate the better completion of project extended through Project Work Phase II in Semester IV.

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.

OUTCOME
At the end of the project phase I period, students should be familiar with current thinking in their field, and able to apply the concepts to relevant research problems or practical applications.

OBJECTIVE
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.

The students should continue their work proposed in Project Work Phase I and are expected to complete the proposed work. A report should be submitted based on the data determined in the laboratory/industry. The objective of the project work 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.

OUTCOME
The project work is expected to shape the student to think originally, plan/execute work properly, analytical abilities and reporting/communication skills.
OBJECTIVE
Objective of this course is to understand the advanced biotechnology concepts in various unit processes and operations in leather manufacture.

UNIT I - MICROBIAL BIOTECHNOLOGY
Microbial fermentation methods. Types of fermentations. Fermentation equipments, preparation of media, preparation of inoculum, sterilization, separation and purification of products. Examples of microbial biotechnology in industry.

UNIT II - PROTEIN AND ENZYME CHEMISTRY
Protein classification, separation, chromatographic and electrophoretic techniques, criteria of homogeneity. Enzyme classification, methods of estimation, sources of enzymes, purification and properties, specificity, activation, inhibition. Immobilization of enzymes and microbial cells for industrial applications.

UNIT III - MOLECULAR BIOLOGY

UNIT IV - BIOCHEMICAL ENGINEERING
Basic principles, kinetics of growth, batch, fed-batch, continuous, well-mixed, plug flow/tubular, mass and enthalpy balances, choice of reactor - Transport phenomena in biosystems - mass transfer in gas-liquid systems, Design of fermentor and other fermentation vessels - instrumentation and control - downstream processes - application of various systems.

UNIT V - BY-PRODUCT UTILISATION
Animal based raw materials for industries with particular reference to India; Role of enzymes and microorganisms in animal wastes utilization. Biological treatment of waste water.

TOTAL: 45 PERIODS

OUTCOME
At the end of the course the students would have gained knowledge on the role of biotechnological approaches in leather manufacture.

REFERENCES:
4. A. Wiseman, "Topics in Enzyme and Fermentation Biotechnology" (Several volumes). Vol. 2.
OBJECTIVE
To impart advanced knowledge on inorganic and organic chemistry that is essential for leather technologists.

UNIT I - BONDING MODELS

Ionic compounds
Crystal systems, Structures of crystal lattices, Lattice energy and the Born-Haber Cycle, Atomic size revisited - ionic radii

Covalent compounds
Valence bond theory
Lewis structures: (1) resonance, (2) formal charges
Hybridization
VSEPR theory
Molecular orbital theory
Linear combination of atomic orbitals: (1) delocalization, (2) antibonding orbitals
Symmetry and overlap
Homonuclear diatomic molecules
Heteronuclear diatomic molecules
Bond order and bond strength
Polyatomic molecules

UNIT II - MECHANISM OF ORGANIC REACTIONS USED IN THE MANUFACTURE OF LEATHER CHEMICALS

Methods of determining reaction mechanism, factors influencing SN1 and SN2, E1, E2 reactions. Electron displacements, inductive effect, inductometric effect, mesomericeffect,electrometric effect, hyperconjugation, steric inhibition of resonance.Aromatic electrophilic and nucleophilic substitution reactions.

UNIT III - ORGANIC REACTION TYPES ENCOUNTERED IN LEATHER SCIENCE

Free radical reactions, addition to carbon- carbon, carbon – oxygen multiple bonds, elimination reactions, molecular rearrangements, oxidation and reduction reactions.

UNIT IV - CHEMISTRY OF TRANSITION METALS

D-block element with special emphasis on Chromium, Titanium, Iron, Aluminium and Zirconium including their redox behaviour.Variable oxidation statics, stabilization of oxidation statics.
UNIT V - REACTION MECHANISMS OF METAL COMPLEXES

Ligands in a metal ion complex; ligand substitution mechanisms; oxidative addition” or” reductive elimination” of ligands, electron transfer reactions, redox reaction.

TOTAL: 45 PERIODS

OUTCOME
Students would gain knowledge on some of the advanced aspects of inorganic and organic chemistry.

REFERENCES:

LE7010 ORIENTATION TO LEATHER SCIENCE AND TECHNOLOGY

[Bridge Elective Course for M.Sc (Chemical Sciences, Environmental Science, Biotechnology), B.Tech (Biotech)]

OBJECTIVE
This course objective is to orient the non-leather students on the fundamental science and technology of leather manufacture.

UNIT I - HIDES, SKINS and PRESERVATION

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 AND OPERATIONS

Principles and objectives of beamhouse processes viz., soaking, liming, reliming, deliming, bating, pickling, depickling and degreasing; Various unit operations in pretanning.

UNIT III - TANNING

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 AND OPERATIONS 10

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

OUTCOME

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

REFERENCES:

LE7001 ADVANCED COORDINATION CHEMISTRY L T P C 3 0 0 3

OBJECTIVE

This objective of the course is to present the students on the advanced concepts associated with coordinate covalent complexes.

UNIT I - CONCEPTS IN CHEMICAL BONDING 5
Concepts and types of chemical bonding, group theoretical approach to structure and reactivity.

UNIT II - THEORIES OF CO-ORDINATION 10
Valance bond theory, ligand field theory, molecular orbital theory, importance of ligand field stabilization energy, coordination geometrics and various oxidation states of metal ions.

UNIT III - SYNTHESIS, STRUCTURE AND SPECTROCOPY OF TRANSITION METALCOMPLEXES 15
Synthetic strategies to transition metal complexes, spectroscopy of co-ordination compounds, structure and property relations in ‘d’ block elements. Aqueous chemistry of chromium, titanium, iron, aluminium and zirconium including their redox behaviour.
UNIT IV - REACTIVITIES OF TRANSITION METAL COMPLEXES 10
Ligand substitution process and their kinetics and mechanisms. Electron transfer reactions of metal complexes. Stability constant and equilibrium constants.

UNIT V - METAL PROTEIN INTERACTIONS 5
Metal-protein interactions and their role in structural stability of protein.

TOTAL: 45 PERIODS

OUTCOME
At the end of this course the students would be in a position to understand the coordination chemistry of transition metals.

REFERENCES:

LE7004 COLLOID AND SURFACE CHEMISTRY L T P C
3 0 0 3

OBJECTIVE
This objective of the course is to present the students on the advanced concepts associated with coordinate covalent complexes.

UNIT I - SURFACE TENSION, INTERFACIAL TENSION AND SURFACE ACTIVITY 9
Definition, effect of temperature, spreading, wetting etc. - Young Laplace and Kelvin equations - Gibbs Law and its application - Critical evaluation of methods of surface tension determination.

UNIT II - BULK PROPERTIES OF SURFACTANT SOLUTIONS AND MONOLAYERS 9
Critical micelle concentration (CMC) - Shape, Size, Aggregation, Hydration, Correlation times, Weight of micelles, etc. Different models and thermodynamics of micelle formation. Factors affecting CMC, Monolayers, types, their behaviour and industrial application. Lyophobic sols, Lyophilic systems and stability.

UNIT III - ADSORPTION BY SOLIDS 9
Solid-liquid interfaces (changing of surfaces, Electrical Double Layer, adsorption)
Particle-particle interactions: electrostatic forces; Analysis of surface change and surface chemistry (electrokinetics, electrophoresis, streaming potential, electro-osmotic, sedimentation, electroacoustics, surface spectroscopy, ESR)

Particle-particle interactions: steric forces & polymer-mediated forces; Particle-particle interactions: hydrophobic forces; Analysis of particle interactions (rheometry, AFM, CFM, MASSIF, SFA)

Flocculation & coagulation – Schulze-Hardy rule, inorganic coagulants, polymeric flocculants, wastewater treatment; Surface Active Agents & Association Structures of Amphiphilic Molecules

UNIT IV - SURFACTANTS

Surface activity – adsorption at interfaces, Gibbs, Traube’s rule, Rose-Nishioka rule structure of a surfactant Measuring surfactant adsorption – by difference, SPR, TIRF, FTIR, ellipsometry association structures – micelles, vesicles, surface mecelles, giant worm-like micelles Structure of adsorbed films, SAMS, L-B films, surface micelles

An extra unit on Bubbles and Foams (gases dispersed in liquids) may be introduced

Foam stability

Film Drainage

Film rupture

Film rheology

Emulsion and pseudo-emulsion films

Phase diagrams

Measuring thin film properties – disjoining pressure, thin film balance

Frothing agents

Foam breaking

Antifoaming agents & mechanisms

Measuring foam properties

Flotation

Purification of surface active agents using foams

UNIT V - APPLICATION TO LEATHER TECHNOLOGY

Wetting, cohesion & adhesion, contact angle, foams, detergency, emulsions, stability, surface properties and membrane technology.

OUTCOME

At the end of this course the students would be in a position to understand the coordination chemistry of transitions metals

TOTAL: 45 PERIODS

REFERENCES:

OBJECTIVE
This objective of the course is to orient the students to assess the energy requirement and management in leather manufacture.

UNIT I - ENERGY SCENARIO

UNIT II - ENERGY FORMS
Energy forms: (a) thermal (b) Electricity (c) Non-Conventional Sources

UNIT III - ENERGY MANAGEMENT

UNIT IV - ENERGY AUDIT
Requirements for Energy Audit, Different Approaches viz, Preliminary and Detailed Energy Audit, Case Studies for Real Systems.

UNIT V - ENERGY MANAGEMENT AND AUDITING IN LEATHER INDUSTRY

TOTAL : 45 PERIODS

OUTCOME
At the end of this course the students would be in a position to understand the energy requirement and controls in leather manufacture

REFERENCES:
OBJECTIVE
The objective of this course is to present students on project feasibility analysis, management, organization and budgeting that will enable the students to perform as efficient managers.

UNIT I - PROJECT IDENTIFICATION AND PREPARATION
General considerations - choice of project between alternative propositions - engineering aspects- cost estimates and demand forecasting for leather tanning industry.

UNIT II - PRINCIPLES OF PROJECT APPRAISAL
Investment appraisal and financial analysis through the measurement of project return –by discounted cash flow method - net present value of a project - internal rate of return - project payback period - cash flows accounting profit - intangible returns - Inflation and project appraisal.

UNIT III - IMPLEMENTATION AND MANAGEMENT
Methodological and organisational aspects of implementation - pert and other methods - risk and uncertainty - probability theory.

UNIT IV - SOURCES OF FINANCE AND BUDGETING
Different sources of finance - ownership finance - ordinary share, short, medium and long term loan - budget preparation - annual cost, variable costs - allocation of costs.

UNIT V - METHODS OF BUDGETING
Marketability method - benefit method - use of facilities method - special cost method, alternativesingle purpose expenditure method.

TOTAL :45 PERIODS

OUTCOME
Engineering economics concepts will facilitate the students in better management of the leather industry

REFERENCES:

OBJECTIVE
This course will make the students to understand the regulations and practices associated with safety and occupational health.

UNIT I - SAFETY PHILOSOPHY
Place of industry in society Industrial management role - supervisors role - role of workers – role of trade unions - role of govt. and various other agencies - Factory Act 1948 and the rules. Hazardous Industry - need for safety, legal humanitarian, economic safety and productivity. Factors impeding safety.
UNIT II - ACCIDENT PREVENTION & SAFETY TRAINING 9
Definition of accident, injury, dangerous occurrence, unsafe act, unsafe condition. Theories of accident occurrence - principles of accident prevention - accident inventive methods - industrial accident inventive methods - industrial accidents - frequencies of industrial accidents in India and foreign countries - classification of accidents - industry wise and causation wise.

PREVENTION - ACCIDENT INVESTIGATION
Methods - developing safety training programme - training of supervisors - training of workers-Inplant & External courses - training of new workers - role of supervision - need for re-training.

UNIT III - SAFE GUARDING OF MACHINERY AND MATERIAL HANDLING 9

UNIT IV - FIRE HAZARDS AND CONTROL 9
Chemistry of fire, classification of fire, portable fire extinguishers and their operation - Industrial fire. Types of all fire protection equipment. Hazard Identification: Fire, explosions, indices consequence analysis, HAZOP, likelihood analysis, risk concepts and criteria, risk management Toxicity.

UNIT V - OCCUPATIONAL HEALTH 9
Physical hazard, noise vibration, x-rays - ultra violet radiation - permissible exposure limits - effects of exposure - preventive & control measures. Chemical Hazards: toxic chemicals, dirt gases, furies, mists, vapours. Noise pollution, exposures evaluation, common occupational diseases, etc.

OUTCOME
The importance of safety in tanneries will be known and implementation of safety procedures will be gained at the end of the course

REFERENCES:

TOTAL : 45 PERIODS

LE7008 MARKETING OF LEATHER AND LEATHER CHEMICALS L T P C 3 0 0 3

OBJECTIVE
The knowledge on marketing of leather and leather chemicals in international market and foreign trade policies will be gained from this course.

UNIT I - MARKETING CONCEPTS 8
Definition of basic management and marketing concepts - role of marketing in the production function - marketing concepts relevant to consumer durable like leather and leather chemicals.
UNIT II - HIDES AND SKINS - LEATHERS
Indian livestock population over two decades - hides and skins availability, their sizes, marketing centres, channels, prices over two decades - leather production centres - channels, prices - leather products - centres and marketing channels.

UNIT III - MARKETING FUNCTION
Market classification and segmentation - consumer market and buying behaviour – market management and forecasting - market planning and control - competition marketing strategy - product life cycle strategy - product and price strategy - sales promotion, publicity, advertising, packaging - marketing organisations - techniques of marketing research for consumer products.

UNIT IV - INTERNATIONAL TRADE
General concepts of international marketing, principles relevant to leather and leather chemicals - global market for leather and leather chemicals - important production and consumption centres, product wise in the world - major world suppliers of leather chemicals.

UNIT V - EXPORT TRADE INDIA
India's export trade in leather. India's share in the global level - India's competitors and their strength. International prices. Indian Government policies in the export promotion. Role of Indian and overseas promotional institutions for export growth - strategies for export promotion. Market constraints - quality, image, brand name, merchandising methods.

OUTCOME
At the end of the course the students would understand the international trade, government policies in export aspects of world trade related to leather sector, custom tariff and international marketing

REFERENCES:
5. Footwear (FAO of UN).

TOTAL : 45 PERIODS
OBJECTIVE
This objective of the course is to present the students on nano technology concepts and their applications in leather manufacture.

UNIT I - INTRODUCTION TO NANOTECHNOLOGY
The nanoscale. What is nanotechnology? Consequences of the nanoscale for technology and society. Beyond Moore’s Law.

UNIT II - NANOMATERIALS: FABRICATION
- Structure and bonding
- Electronic band structure
- Electron statistics
- Bottom-up vs. top-down
- Epitaxial growth
- Self-assembly
- Chemical Synthesis
- Green Synthesis

UNIT III - NANOMATERIALS: CHARACTERIZATION
- Structural
  XRD, TEM, SEM, STM, AFM, TGA, DSC, N2 adsorption, FTIR spectroscopy, Raman spectroscopy
- Chemical
- Optical

UNIT IV - APPLICATION OF NANO TECHNOLOGY IN TANNING, POST TANNING AND FINISHING

UNIT V - NANO LEATHER CHEMICALS
Manufacture of Nano based materials for leather manufacture: syntans, fatliquor, coloring and finishing chemicals

UNIT VI - ENVIRONMENTAL ASPECTS OF NANOTECHNOLOGY
Synthesis, Water purification, Beneficial and adverse affect of nanomaterials

TOTAL : 45 PERIODS

OUTCOME
At the end of this course the students would be in a position to understand the advancements in nano technology and their impact in leather manufacture

REFERENCE:
OBJECTIVE
The objective of this course is to present concepts 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 - POLYMERS
Polymer and rubber industries in India. Chemistry and Technology of the most common polymeric materials used in leather industry as supplements.

UNIT II - POLYMERIZATION TECHNIQUES
Concept of a macromolecule, natural and synthetic polymers, modes of polymerization, radical, condensation, stereo-regular polymerization, polymerization kinetics, mechanism, anionic and cationic polymerization. Polymers with linear, branched and cross linked structure, thermoplastic and thermosetting polymers, bulk, solution, suspension and emulsion polymerization.

UNIT III - ANALYSES AND TESTING OF POLYMERS
Molecular weight and distributions of polymers, different methods of molecular weight determinations, colligative properties, viscometry, light scattering techniques, thermal analysis of polymers, crystallinity, glass transitions and other mechanical properties, spectral analysis such as IR, UV and NMR of polymers.

UNIT IV - INDUSTRIAL POLYMERS
Manufacture of industrially important polymers for plastics, fibres and elastomer - Polyethylene, polypropylene, polyvinyl chloride, polyvinyl acetate, copolymers, formaldehyde resins, polyvinyl alcohol, polyacrylonitrile, polystyrene, polyurethane, fluoro-carbon polymers, epoxy resins, polyamides, polyesters, alkyd resins, silicone polymers, cellulosics.

UNIT V - FABRICATION
Fabrication of polymeric materials, compounding and mixing, casting, extrusion, fibre spinning, moulding, coating foam fabrication. Manufacture of rubber and elastomers, Natural rubber, processing, vulcanizing synthetic elastomers, butadiene copolymer, nitrile rubber, polyisoprene, polybutadiene.

OUTCOME
At the end of this course, the students would have gained knowledge on the chemistry of most common polymeric materials used in leather industry as supplements.

REFERENCES: