GOVERNMENT COLLEGE OF ENGINEERING AND LEATHER TECHNOLOGY

CURRICULUM
OF
M.TECH. IN LEATHER TECHNOLOGY

CHOICE BASED CREDIT SYSTEM

VISION :

To become a premier Centre of Learning and Research in Leather and Allied Technologies and promote industry – academia synergism under the noble governance of the Department of Higher Education, Government of West Bengal

MISSION :

GCELT /M1 : To provide quality education in the area of Leather Technology and allied associated sciences with high professional and inductive values

GCELT /M2 : To share and disseminate knowledge of leather, leather product technology and allied sciences through symbiosis of intensive theoretical and practical interactions

GCELT /M3 : To inculcate an in house expertise based capsule of delivering technology to leather and allied sectors by the students.

GCELT /M4 : To provide a learning ambience for innovators, researchers and technologists

GCELT /M 5 : To provide solutions for the challenges faced by the Leather industry through collaborative and interactive mode through sustainable symbiosis of industry experts, in house experts and students

VISION : Government College of Engineering and Leather Technology foresees to be the regional / national / global hub that would serve the leather industry with rich student prowess and in expertise / transform the leather industry into one which is green concept based technology and innovation driven, thus steering our state and the nation to be the significant sustained sector in the Leather World

1. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs) :

PEO1 : To establish core competency in basic mathematics, scientific and engineering fundamentals to design , formulate, analyse and solve the problems of leather and allied sectors.

PEO2 : To motivate students to pursue lifelong multidisciplinary learning as professional technocrats, researchers and scientists and effectively communicate technical information to the recipient stakeholders i.e industry and society

PEO3 : To practice values and ethics and scientific prowess to exhibit leadership qualities and team spirit to promote entrepreneurship and indigenization and strong nation

2. PROGRAMME OUTCOMES (POs):

POs	Post Graduate Attribute	Programme Outcome
PO1	Technological attribute	Apply knowledge of mathematics, basic science and engineering science
PO2	Problem analysis	Identify, formulate and solve technological challenges
PO3	Design/development of solutions	Design a system or process to improve its performance, satisfying its acceptability
PO4	Conduct investigations of complex issues	Conduct experiments, collect, analyze and interpret the data and conclude substantially
PO5	Modern equipment usage	Apply various equipment and techniques to improve the efficiency of the system
PO6	Complete Technocrat and society	Conduct and behave themselves to uphold the professional and social obligations
PO7	Environment and sustainability	Design system with environment awareness and sustainable development
PO8	Values & Ethics	Interacting industry, business and society in a professional and ethical manner
PO9	Individual and team work	Function in a multidisciplinary team
PO10	Skilled communication	Proficiency i n oral and written Communication
PO11	Project management and finance	Implement cost effective and improved and sustainable system for industry
PO12	Pursuance of Life-long learning	Undertake oath to continue professional development and learning as a life-long activity

3. PROGRAM SPECIFIC OUTCOMES (PSOs):

PSO1 : Understand and steer knowledge to have lateral and vertical promulgation to make a successful career in leather/ leather products / allied sector

PSO2 : Ability to identify and address the challenges of the leather / allied sector and provide solutions

PSO3 : Ability in facing and managing leather sector towards its sustainable development and help the nation surge globally

4. MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVE WITH PROGRAMME OUTCOMES (As per AICTE mandate)

1 - Weak interrelation, 2 – Medium interrelation, 3 – Strong interrelation

Programme Educational Objectives	Programme Outcomes											
	GCELT											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PEO1	3	3	2	2	2	1	-	1	2	1	1	1
PEO 2	2	2	3	3	3	2	3	2	1	3	1	3
PEO3	-	-	1	-	1	3	3	3	3	1	3	1

CURRICULUM
OF
M.TECH. IN LEATHER TECHNOLOGY

CHOICE BASED CREDIT SYSTEM

First Semester

1A. Theoretical Papers:		**Contacts/wk**			
Subject code	**Subject Name**	**L**	**T**	**P**	**C**
MLT 101	Mathematical and Computational Methods	3	1	0	4
MLT 102	Chemistry & Technology of Leather Auxiliaries -I	3	1	0	4
MLT 103	Biotechnology - I	3	1	0	4
MLT 104	Polymers and Adhesives Technology	3	1	0	4
	Elective - I	3	1	0	4
List of Elective Papers:					
MOLT 105	Advanced Co-ordination Chemistry [For Leather Students]	3	1	0	4
MOLT 106	Chemistry and Technology of Leather manufacture [For Non-Leather Students]	3	1	0	4
TOTAL THEORETICAL PAPERS CONTACTS=20					20
1B. Practical Papers:					
MLT 191	Leather Auxiliaries Laboratory - I	0	0	3	2
MLT 192	Biotechnology Laboratory - I	0	0	3	2
TOTAL PRACTICAL PAPERS CONTACTS= 6					4
TOTAL SEMESTER CONTACTS (20 + 6)=26					24

Second Semester

2A. Theoretical Papers:		Contacts/wk			
Subject code	**Subject Name**	**L**	**T**	**P**	**C**
MLT 201	Colloid and Surface Chemistry	3	1	0	4
MLT 202	Instrumental Methods of Analysis	3	1	0	4
MLT 203	Chemistry of Vegetable Tannins and Syntans	3	1	0	4
MLT 204	Industrial Relations and Engineering Economics	3	1	0	4
	Elective-II	3	1	0	4
List of Elective Papers: (Select any one)					
MOLT 205	Leather Product Technology [For Non-Leather Technology Students]	3	1	0	4
MOLT 206	Advanced Organic Chemistry [For Leather Technology Students]	3	1	0	4
MOLT 207	Process Control in Tannery Operations	3	1	0	4
MOLT 208	Chemistry of Dyes and Colorants.	3	1	0	4
TOTAL THEORETICAL PAPERS CONTACTS = 20					20
2B. Practical Papers:					
MLT 291	Leather Auxiliaries Laboratory - II	0	0	3	2
MLT 292	Instrumental Analysis Laboratory	0	0	3	2
TOTAL PRACTICAL PAPERS CONTACTS = 6					4
TOTAL OF SEMESTER= (20+ 6) = 26					24

Third Semester

3A. Theoretical Papers:		Contacts/wk			
Subject code	**Subject Name**	**L**	**T**	**P**	**C**
MLT 301	Environmental Science and Technology	3	1	0	4
MLT 302	Biotechnology - II	3	1	0	4
MLT 303	Material Science and Engineering	3	1	0	4
TOTAL THEORETICAL PAPERS CONTACTS= 12					12
3B. Practical Papers:					
MLT 391	Biotechnology Laboratory - II	0	0	3	2
MLT 392	Advanced Techniques in Leather Processing	0	0	3	2
MLT 393	Materials Testing Laboratory	0	0	3	2
TOTAL PRACTICAL PAPERS CONTACTS = 09					06
3C. Sessional :					
MLT 394	Industrial Summer Training	0	0	0	6
TOTAL SESSIONALS CONTACTS = 06					06
TOTAL SEMESTER CONTACTS = 27					24

Fourth Semester

Sessionals:					
Subject code	**Subject Name**	**L**	**T**	**P**	**C**
MLT 491	Project	0	0	30	18
MLT 492	Comprehensive Viva voce	0	0	0	6
TOTAL SEMESTER CONTACTS = 30					24

MLT 101 MATHEMATICAL AND COMPUTATIONAL METHODS

3 - 1 - 0 - 4

First Half: Mathematical Methods

1. Linear Algebra.

Matrix- Matrix inversion, Rank of a matrix, solution of liner simultaneous equations, Eigen value and Eigen vectors, Diagonalisation, characteristic and minimal polynomial, cayle-Hamilton theorem, canonical form. Different methods of finding rank of a matrix.

2. Partial differential equations.

Solution of one dimentional and two dimentional laplace equation in Cartesion, polar and cylindrical coordinate system, method of separation of variables. Solution of Heat equation, Heat flow in an infinite bar, one and two dimentional wave equation. Diffusion equation.

3. Optimization techniques.

Basic problem of calcules of variation. Euler's equation, problem of minimum surface of revolution, Minimum energy problem, problems with constraint conditions, Isoperimetric problem, Brachistochrone problem. Problems with variable and conditions, Application in Engineering and economical problems.

4. Numerical Analysis.

Solution of differential equations:

Taylor series method, Picmd's method, Euler's Method, Milne's Method, Runge-kulta Method. Solution of differential equations of second order.

Second Half: Computational Methods

Evaluation of Microprocessor, its organisation and Architecture, Organisation of 8-bit microprocessor, Memories, Input/output, devices and interphasing. Machine and Assembly language programming, Instruction modes, Instruction classification, Software development, Flow chart, Fundamentals of CISC and RISC processors.

Computer System and programming concept. algorithons and charts, searching and sorting of computational Data, Linear an non-linear Data structure, comments in operating systems(DOS, UNIX) Programming in Basic, C and C++.

Any Other related topics of Current Interest.

References:

1. Mukhopadhyay A.K.: Mathematical Methods for Engineers and Physicists wheeler publishing.
2. Pipes and Harvil: Applied Mathematics for Engineers and Physicists.
3. Mukhopadhyay A,.K.: Microprocessor, Microcomputer and their application, Narose publishing.
4. Mukhopadhyay A.K.: Microprocessor bared laboratory Experiments and projects.
5. Gottfried - Programming in Basic
6. Gottfried- Programming in C
7. Balaguruswam- Object oriented programming with C++, Tata Mc.Grew Hill.

MLT 102 CHEMISTRY & TECHNOLOGY OF LEATHER AUXILIARIES - I

3 - 1 - 0 - 4

I. Syntan and resin tanning Agents - technology of preparing syntans based on phenol-for rnaldehyde, urea formaldehyde and sulphones . Preparation and properties of acrylic syntans.

2. Fatliquors : general chemistry of fats, oils and fatliquors. Manufacture of fatliquors from natural and modified oils. Relative merits and demerits of synthetic fatliquor over natural fatliqors. Physicochemical analysis of the fatliquors. Solvent based fatliquors , Shower proofing agents, reactive fatliquors, and foul free oil based fatliquors.

3. Binders and surface coating agents - preparation and properties of various types of binders. Factors controlling binder adhesion. Properties and uses in leather coating . Adhesives for shoe industries - their manufacture and application.

4. Dyes and Pigments - chemistry and technology of acid,basic, direct, premetallised, reactive and solvent dyes, organic and inorganic pigments formulations with and without binders for leather finishing, Factors controlling brilliance, transparency , opacity, solvent, thermal and light resistances.

5 .Top coats - lacquers, lacquer emulsion and thinner. Production of lacquers from various sources - Nitrocellulose , polyvinyl chloride; cellulose acetate butyrate leather finishing aids - slip agents , wax emulsion and film modifiers, mat finishing auxiliaries.

Any Other related topics of Current Interest.

References:-

1. Polymer Science --F. W. Billmeyer Jr, -3rd. Edn. John. Willey & Sons.
2. Polyurethane Hand Book --G. Oertel Ed., 2nd Edn. Hanser Publisher , 1993,
3. Water- borne coating --K. Doren, W, Freitag & D. Stoye , Hanser publisher,1994.
4. Hand book of polymer synthesis (part - A& B)--H. R. Kricheldorf, Marcel Dekker,1992.
5. Polymer Science & Technology of Plastlcs &. Rubber --P. M. Ghosh, Tata Mc.Grow Hill, 1990.
6. Plastics Additives Hand Book --R. Gachter, H. Muller. 4th. Edn. Hanser Publisher, 1993.

MLT 103 **BIOTECHNOLOGY - I**

3 - 1 - 0 - 4

1. Molecular anatomy of prokaryotic and Eukaryotic cell -- structural and functional detail. Gene and operon concept - structure of a gene and its expression with special reference of lac gene.

2. Peptides and its use in biotech and drug industries. Definition and structure of small peptides. How the peptide works as a regulator of some biological activity and control diseases. Application of genetically Engineered bacteria and Microbial genomics; their importance in leather industries Idea about bacterial genome and how it can be engineered for specific function like antiprotease activity to prevent collagen degradation during the time gap between collection of animal skin and processing in tannery or in unhairing process.

3. Recombinant DNA technology:Transformation,Transduction and recombination in prokaryotes and eukaryotes,Cloning in bacteria and eukaryotic cell,Different ways of transfer of target gene in plant, animal and bacterial cell,

4. Transfection methods and Transgenic animals -- Basic idea of tissue culture and procedural detail to make transgenic animal according to necessity of leather industry

5. Nanotechnology in leather industries definition, possibilties and application of recently developed technology in leather technology

6.Overview of genomics and proteomics with special reference to Buffalo/Cow/Goat/Sheep genome

7. Structural and functional aspect.

Any Other related topics of Current Interest.

References:

1. Microbiology --- Pelezar - Mc Grew Hill
2. The cell - De Roberties - B.I. Waverly
3. Genes VII - B. Lewin
4. Biochemistry - Lehninger - MacMillan
5. Molecular Biology and biotechnology - R.A. Meyers (ed.)

MLT 104 **POLYMERS AND ADHESIVES TECHNOLOGY**

3 - 1- 0 - 4

1. **Introduction to Polymers**--Amorphous State, Crystalline State, Structure-Property relation, Plastics, Rubbers and Fibers.
2. **Plastics**- materials, additives, processing and products.
3. **Rubbers**- materials, additives, processing and products.
4. **Thermoplastic elastomers**- materials, additives, processing and products.
5. **Fibers-** materials, additives, processing and products.
6. **Reinforced polymers and composites**- FRP's.
7. **Adhesives**- historical development, theories of adhesion.
8. **Adhesive Classes**- Characterisation and Testing, Application of Adhesives.

Any Other related topics of Current Interest.

References:

1. Textbook of Polymer Science-Billmeyer, F.W. Jr. (1994), 3rd Edn. Wiley Interscience Publication N.Y.
2. Polymer Science and Technology of Plastics and Rubbers -Ghosh, P.M. (1990), 2nd Edn.Tata McGraw-Hill Publishing Co. N.D.
3. The Chemistry and Physics of Polymers -Kuleznev, V.N. and Shershnev, V.A. (1990) Mir Publishers, Moscow.
4. Principles of Polymer Chemistry - By P.J. Flory.
5. Introduction to polymer Chemistry - By D. Margerison & G. C East Pergomen Publication
6. Introduction to Polymer chemistry - By W.R. Moore. University of London Press.
7. Techniques of Polymer characterization . By P. W. Allen ,Butter Worth Publication.
8. Polymer chemistry - By D.B. V. Parker. Applied Sc. Publishers (London) .

MLT 191 **LEATHER AUXILIARIES LABORATORY - I**

0 - 0 - 3 - 2

The Laboratory will consist of at least the following experiments. Other Modern experiments may be performed.

1. Lab Scale Preparation of Synthetic Sulfated / Sulfited Fatliquor
2. Lab Scale Preparation of Semi Synthetic Sulfated / Sulfited Fatliquor
3. Lab Scale Preparation of Modified Natural Sulfated / Sulfited Fatliquor
4. Lab Scale Preparation of Phenol - Formaldehyde Based Syntan.
5. Lab Scale Preparation of Urea - Formaldehyde Based Syntan.
6. Lab Scale Preparation of Naphthalene - Formaldehyde Based Syntan.
7. Modified Urea - Formaldehyde Resin Preparation
8. Modification Of Vegetable Tannin Extracts -- 1. Indian Origin [i.) Goran; ii) Myrobalan]
   2. Foreign [i.) Chestnut; ii) Wattle]

MLT 192 **BIOTECHNOLOGY LABORATORY - I**

0 - 0 - 3 - 2

The Laboratory will consist of at least the following experiments. Other Modern experiments may be performed.

1. Growth curve of Bacterial culture.
2. Determination of doubling time of some pure culture of commonly available bacteria in leather industry.
3. Isolation and electrophoresis of DNA from eukaryotic and bacterial cell.
4. Quantification of DNA , RNA and protein by Spectrophotometer.
5. Cloning of a gene in E. coli -- Selection of a specific gene and vector, Designing of primer, amplification of gene by PCR, restriction, digestion of DNA, ligation, transformation and plating to get the right clone of a target gene.
6. Purification of toxic effluents produced in leather industry.
7. Bioabsorbents and Bioscrubbers.

ELECTIVE PAPERS FOR M.TECH. IN LEATHER TECHNOLOGY

MOLT 105 **ADVANCED CO-ORDINATION CHEMISTRY**

3 - 1 - 0 - 4

1. **Concepts in chemical bonding**
   Concepts of chemical bonding and type. Group theoretical approach to structure and reactivity.

2. **Theories of coordination**
   Theories of coordination with emphasis on ligand field theory, coordinative interactions and importance of ligand ---- stabilization energy.
   Coordination geometries and various oxidation states of metal ions .

3. **Synthesis, Structure and Spectrocopy of Transition Metal Complexes**
   Synthetic strategies to transition metal complexes, spectroscopy of coordination compounds, structure property relations in -d- block elements.
   Aqueous chemistry of chromium, titanium, iron, aluminum and zirconium including redox behaviour.
   Ligand substitution processes and their kinetics and mechanisms.

4. **Reactivities of Transition Metal Complexes**
   Metal ion-solvent interactions and gel structures with reference to silicates ; stabilizing and destabilizing roles of small molecules on gel structure of silicates , alumina and zirconates.

5. **Metal Protein Interactions and the Structural Stability**
   Metal - protein interactions and their role in structural stability of protein.

6. **Reaction Mechanisms of Transition Metal Complexes**
   Classification of ligand substition mechanism ; characterisation of reaction intermediates; techniques for reaction kinetics; factors for reaction kinetics; substitution reaction of T. M. complexes of different structures; electron transfer reactions; isomerization & racemization reactions;

Any Other related topics of Current Interest.

Reference:

1. Fundamental principles of inorganic chemistry -- D. Banerjee. Sultan Chand & Co., New Delhi.
2. Advanced Inorganic chemistry -- F A Cotton & G Wilkinson Wiley – Interscience Publication.
3. The chemistry of tanning processes -- K H Gustavson -- Academic Press
4. Fundamental chemistry of leather manufacture -- E. Heidemann, Kreyzig Publishers.
5. An introduction to the principles of leather manufacture – S S Dutta, Indian Leather Technologists Association, Calcutta.

MOLT 106 CHEMISTRY AND TECHNOLOGY OF LEATHER MANUFACTURE

3 – 1 – 0 – 4

1. Structure of Skin and Collagen

Matrix structure of skin and molecular structure of collagen including functional groups and ultra as well as microstructural details. Collagen as a membrane and enzymatic hydrolysis of connective tissue proteins. Chemical basis for osmotic and lyotropic factors in fibre opening in skin.

2. Chemical Principles involved in pretanning operations

Saltless/less salt curing methods-Swelling mechanisms and porosity of hides and skins. Diffusion of lime and sharpening agents into skin; nucleophilic displacement pathways in unhairing, mechanisms of unhairing based on chemical and enzymatic methods-Role of non-swelling acids, neutral salts and mineral acids in pickling, chemistry of pickling, fibre structure and the importance of pore size characteristics of pickled pelts.

3. Chemistry of tanning materials

Biogenesis and biosynthesis of hydrolysable and condensed tannins - aqueous chemistry of Chromium(III), Aluminium(III), Iron(II) and (III), Titanium (IV) and Zirconium(IV), coordinative interactions and hydrolytic behavious of coordinated ligands, olation, oxolation and polymerisation of aquaions and their relevance to mineral tanning.

4. Physics and Chemistry of tanning methods

Transport of tanning materials into pelt and mechanisms of vegetable, mineral and combination tannages, role of crosslinking and fibre coating in matrix stability.

5. Physics and Chemistry of post tanning operations

Physicochemical interactions of syntans, fatliquors and dyes with collagen and leather, Role of surface charge and importance of electrostatic dipole-dipole and hydrophobic interactions. Theory of finishing with special emphasis to optical phenomena in leather finishing.

Any Other related topics of Current Interest.

References:

1. The Chemistry and Technology of Leather Preparation for tannages --0' Flaherty, William T. Roddy and Robert M.Lollar, Vol.I, E. Robert Krieger Publishing Company, New York, 1978.

2. The Chemistry and Technology of Leather -- 0' Flaherty, William T. Roddy and Robert M.Lollar, Vol.II, Type of tannages' E. Robert Krieger Publishing Corporation, New Yordk 1977.

3. Physical Chemistry of Leather Making -- Bienkiewicz, Krieger Publishing Co., Florida 1982.

MLT 201 **COLLOID AND SURFACE CHEMISTRY**

3 - 1 - 0 - 4

1. Colloids

Definition,Type, Optical and Electrical properties, stability, zeta Potential and its application, coagulation and gold number.

2. Surface Tension and Interfacial Tension

Surface energy and interfacial surface energy, additivity of forces at interfaces, Young-Laplace equation, Kelvin equation, Traube's rule, Measurement of surface and interfacial tensions, variation of surface tension with temperature, Gibb's absorption equation and its application, contact angles and wetting types, factors affecting contact angles and wetting , wetting agents, spreading co-efficient and pressure.

3. Bulk properties of surfactants and monolayers

Types of surfactants and their properties, micelle formation, types of micelles and their characteristics, shape, size, weight etc., factors affecting Critical Micelle Concentration (**CMC**), structure of micelles, solubilisation, energies of micellisation, Krafft phenomenon, monolayers---types, their behaviour and applications, membrane technology.

Emulsion types and their characteristics, emulsifiers and their
properties, rate of coalescence of droplets, gels- properties and applications.

4. Adsorption by solids

Physical adsorption and chemical adsorption, classification of adsorption isotherms, Langmuir BET isotherms and their applications, adsorption energies, Pore size distribribution, mercury intrusion porosimetry, Composition and structure of solid surfaces, electron spectroscopy, Low Energy Electron Diffraction(**LEED**).

5. Applications to Leather Technology

Wetting emulsion, detergency, surface properties, adhesion, membrane technology.

Any Other related topics of Current Interest.

References:

1. H.E.Garret, " Surface active chemicals " Pergamon Press, London.
2. L.Ossipow, " Surface Chemistry, Theory & Industrial application" Reinhold Publishing.
3. Dunca J. Shaw, " Introduction to Colloid and Surface Chemistry (4th Edition) "
4. Butter Heinemann.
5. Glasstone -- Text Book of Physical Chemistry.
6. P.C.Rakshit -- Physical Chemistry. Sarat Book House.

MLT 202

3 - 1 - 0 - 4

Electro magnetic spectrum and introduction to Spectroscopic techniques.
Principles of U-V, Visible , Infra - red Magnetic resonance, micro wave spectrscopic techniques, Photo acoustics spectra adsorption and reluctance methods in U-V, Visible, Infra red spectra, the field of application of spectroscopic techniques. Construction and working of the different type of spectrophotometers.

Colour value determination with spectrophotometer based on CLE and L,a,b systems.

Emission and atomic absorption spectra and their analytical applications. Colorimetry and it's application to analysis of tanning salts, dyes, pigments and effluents.

Introduction to ESR and NMR methods for structural ellucidation. Atomic absorption spectrophotometer for analysis of tannery waste water.

Introduction to FTIR and its application in tannery operations.

Principles and application of different chromatographic techniques such as TLC, Paper chromatography, Ion-exchange, gel permeation, GLC and HPLC. Application of chromatographic techniques for analysis and characterization of mixtures such as proteins, peptides , mineral tanning salts ,vegetable tannins , dyes, finishing agents etc.

Theory and application of electro-analytical techniques like potentiometry, AC/DC and differential pulsed polarography, amperometry, coulometry, cyclic voltametry, uses of electrodes in the electro estimation.

Any Other related topics of Current Interest.

References:

1. H.H.Willard, L.L.Merritt, Jr. J.A.Dean and F.A. Selte.
'Instumental Methods of Analysis' - 6 th Edition CBS Publishers & Distributors, Delhi.
2. Snell F.D. and Snell F.D. - 'Calorimetric methods of Analysis' D. Van Nostrand, New York.

MLT 203 CHEMISTRY OF VEGETABLE TANNINS AND SYNTANS

3 - 1 - 0 - 4

Classification and genera of vegetable tanning materials. Chemistry and properties of hydrolysable and condensed tannins.

Biosynthesis of tannins. Biological activities and assay of tannins.

Different methods of estimation of functional groups of tannins.

Chemistry and estimation of leuco-antho-cyanidins. Constitution and formation of flavonoid tannins. Chemistry and biogenesis of tannins in some tanniferous plants.

Lignins -- Biogenesis of Lignins -- Lignin sulfiting -- formaldehyde free Synthetic tannins -- Formaldehyde condensates of Phenol, Naphthol, Naphthalene -- sulfone syntans -- classification of syntans -- Uses.

Physico-chemical and biological properties of Indigenous tea tannins. Studies of collagen-tannin systems and comparison with tannin-polyamide compounds on the nature of vegetable tannage. Factors affecting interaction of Collagen-Tannin systems.

Production of vegetable tanning materials. Role of different parametors on the qualitative and quantitative characterization of tanning agents. Modification and Improvement of tanning extracts. Artificial simulation of one tanning agent with the other. Properties of some important vegetable tanning materials.

Principles of Heavy Leather manufacture by (a) Pit, (b) Pit/Drum and (c) Drum Processes.

Vegetable tannage of skins & principles of combination tannages.

Influence of vegetable tannage on leather properties. Leather specification, control and physico- chemical analysis.

Any Other related topics of Current Interest.

References:-

1. Dr. Heidemann, “Fundamentals of Leather Manufacture” -- Edward Roether KG. Darmstadt,1993.
2. S.H. Pine -- Organic T.M.G.H. 1987.
3.F.A. Carey & R.J. Sundberg -- Advanced Organic Chemistry . Part A & B -- Plenum, 1990.

MLT 204 INDUSTRIAL RELATIONS AND ENGINEERING ECONOMICS

3 - 1 - 0 - 4

1. **Definition and Scope:-**
   Definition aims and scope of industrial psychology, Indian labour laws and their administration their impact on business and economy.

2. **Workers Education:-**
   Workers education – social responsibility - industrial harmony and national welfare. Labour unrest - collective bargaining.

3. **Industrial Disputes:-**
   Methods of settlement of industrial disputes - reconciliation - arbitration - role of labour welfare officer.

4. **Human Relations:-**
   Workers participation in industry - human relation in industry.

5. **Hides and Skins- Market**
   Indian livestock population over two decades- Hides and skins availability, their sizes, marketing centers, Channel prices over two decades- leather production centers – channels, prices – leather products – centres and marketing channels.

6. **Export Trade of India**
   India's export trade in leather and leather products – Indian's share at 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.

7. **Project Identification and Preparation:-**
   General considerations–choice of project between alternative Propositions-engineering aspects-cost estimated and demands forecasting for leather tanning industry.

8. **Principles of Project Appraisal:-**
   Investment appraisal and financial analysis through the measurement Of project return – by discounted cash flow method – not present period – cash flow accounting Profit – intangible returns inflation and project appraisal.

9. **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.

10. **Methods of Budgeting :-**
    Marketability method – benefit method - use of facilities method – special cost method alternative Single purpose expenditure method.

Any Other related topics of Current Interest.

Reference:

1. Indian Leather 2010 (A Technology, Industry and Trade Forecast) – Central Leather Research Institute, Madras.
2. The Indian Leather Industry – Secretariat for industrial assistance, Ministry of Industry, Govt. of India.
3. How To Export (Handbook on export business) – Small Industry Research Institute, Govt. of India.

4. Kothari's Desk Book Series - The Leather Industry.
5. Persional Management And Industrial Relations -Yoder, D., D. Paul Standohar, Prentice Hall Of India (P) Ltd, New Delhi ,1984.
6. Persional Management And Industrial Relations- Tripathi , P.C. , Sultan Chand and Sons, New Delhi, 1988.

MLT 291 LEATHER AUXILIARIES LABORATORY - II

0 - 0 - 3 - 2

The Laboratory will consist of at least the following experiments. Other Modern experiments may be performed.

1. Lab Scale Preparation of N.C. Lacquer.
2. Lab Scale Preparation of N.C. Lacquer Emulsion.
3. Lab Scale Preparation of Wax Emulsion.
4. Lab Scale Preparation of Slip Agents.
5. Lab Scale Preparation of Acrylic Emulsion Binders -- a) Anionic; b) Non-Ionic.
6. Lab Scale Preparation of Pigment Paste.
7. Lab Scale Preparation of Styrene - Butadiene Emulsions.
8. Lab Scale Preparation of Casein Binder
9. Lab Scale Preparation of Modified Casein Binders.
10. Lab Scale Preparation of Shoe Polishes.

MLT 292 **INSTRUMENTAL ANALYSIS LABORATORY**

0 - 0 - 3 - 2

The Laboratory will consist of at least the following experiments. Other Modern experiments may be performed and included as per the need of the industry

Application of spectrophotometry, spectroscopy, FTIR, chromatography, atomic absorption spectrometry, electroanalytical methods, potentiometry, polarography and coulometry for analysis and determination of quality of raw materials, processing chemicals and finished products as required in the leather and allied industries.

References:

1. H.H.Willard, L.L.Merritt, Jr. J.A.Dean and F.A. Selte. 'Instumental Methods of Analysis' - 6 th Edition CBS Publishers & Distributors, Delhi.
2. Snell F.D. and Snell F.D. - 'Calorimetric methods of Analysis' D. Van Nostrand, New York.

ELECTIVE PAPERS FOR M.TECH. LEATHER TECHNOLOGY

MOLT 205 **LEATHER PRODUCT TECHNOLOGY**

3 - 1 - 0 - 4

1. Introduction:
History of footwear evolution . Nomenclature of different types of footwear. Different parts of footwear.

2. Anatomy of human foot:
Bones, joints, muscles, ligaments, arches of skin of human foot. Common foot defects and their remedies. Internal & External changes of human feet from infant to adult stage . Functions of human foot. Analysis of human locomotion. Foot measurement. Foot comfort and Foot-care.

3. Last:
Definition, classification of last, different parts of last, methodology of seasoning of wood for wooden last; Last measurement; Comparison of last with human foot.

4. Designing and 'shoe sizes & fittings':
Introduction to Designing. Elements of Design. Elements of Fashion. Functions of a Designer. Design procedure related to footwear & other leather products. design documentation. Limitations imposed by purpose, material and technical considerations. Concept of inside form, outside form and mean form. Different techniques to get these three forms. Concept of Bio-mechanical designing of shoe. . Relation between foot 'sizes & fittings' and shoe 'sizes & fittings'. English, American, French, Continental and Mondopoint shoe sizes and fittings system.

5. Pre-closing & closing operation:
Principle of clicking operation, different size & stitch marking system; skiving operation – its objectives & different types ;different types of edge –treatment ; lock-stitch & chain-stitch; different types of seam;

6.Construction :
Material selection, flow chart, methodology, advantages & disadvantages of Cemented construction, Good-year wetted construction, Veldtschoen construction, D.V.P. construction, D.I.P(PVC) construction & D.T.P (PU) construction.

7. Footwear materials:
Upper & Lining Materials : Different natural & synthetic materials; comparison between natural & synthetic materials.

8. Adhesive:
Defination; different types of adhesion; different types of adhesive used in footwear industry-and their relative advantages & disadvantages.
Sole, Insole, Toe-puff, Shank, Stiffner, Heel, Thread and Needle: Required properties of these materials, different types of these material and their relatives advantages & disadvantages.

9. Leather goods :
Classification of Leather Goods; different types of tool used for making of footwear and Leather-goods.Designing and pattern cutting; fashion designing.

Selection criteria for manufacure of different types of articles.

Any Other related topics of Current Interest.

Suggested Books :
1. Manual of Shoe Making - Clark.
2. Text book of Footwear Manufacture- J.H.Thronton.
3. Footwear Materials – Harvey.
Leather Work - I.P.Roseman ; The Manual Arts Press.

MOLT 206 **ADVANCED ORGANIC CHEMISTRY**

3 - 1 - 0 - 4

Chemical Bonding of Carbon compounds - Localised - Delocalised - Stereochemistry - 'Structure-Reactivity' Relationship - Substitution - 'S_N - S_E' - Aromatic as well as Aliphatic - Free Radical Substitution - Rearrangement Reaction - Elimination reaction - 'Oxidation-Reduction' Reaction - Mechanisms - Different Photochemical Reactions.

Any Other related topics of Current Interest.

MOLT 207 **PROCESS CONTROL IN TANNERY OPERATIONS**

3 - 1 - 0 - 4

1. Industrial. Instrumentation:

Qualities of measurement. Measurement of temperature. flow, pressure and vacuum, level and pH. Methods of composition analysis. Process instrumentation.

2. Process Control:

Types of Control. Controller combination. Feedback control System, modes of control, stability analysis, design of feedback controllers, frequency response analysis of linear process, stability criterion and stability analysis. Modelling of a process, State variables and state equations, examples, the input-output model, degrees of freedom. Dynamic behaviour of systems. Pneumatic, Hydraulic and electronic control circuits. Measurement and control in tannery operations, process control parameters, control of flow, temperature, pressure, pH etc. Advantages of process control in tannery.

3. Computers In Process Control:

Computer and micro-computer controlled systems and case studies.

Any Other related topics of Current Interest.

References:

1. D.P.Eckman,"Industrial Instrumentation".
2. Millard H.Lajoy,"Industrial Automatic Control".
3. Patranobis,D"Transducers and application" Wheeler Publishing.
4. Mukhopadhyay A.K.,"A text book on Microprocessor basedlaboratory experiments and projects"-Wheeler Publishing.

MOLT 208 **CHEMISTRY OF DYES AND COLORANTS**

3 - 1 - 0 - 4

Colour and Chemical Constitution - Factors of absorption of light - VB Approach - MO theory for Colour - Relation between Colour and Structure - Electronic Interactions between Dye Molecules - Classification of Dyestuff - Chemistry of different types of Dyestuffs - Brightening Agents - Interactions between Dyestuff and Fabric - Lightfastness properties of Dyestuff.

Pigments - Organic and Inorganic - Classification - Nacreous (Pearlescent) Pigment - Luminescent Pigments - Pigment Powders and Dispersions - Improving Physical Properties of Pigments - Surface Characteristics of Pigments - Pigment Opacity, Hiding Power and tinting Strength - Color Theory of Pigments - Surface appearance of Pigmented Coatings - Pigment Binder Geometry.

Any Other related topics of Current Interest.

MLT 301 ENVIRONMENTAL SCIENCE AND TECHNOLOGY

3 - 1 - 0 - 4

I. Environment and environmental pollution; air and water quality parameters; characterization of waste water - BOD, COD, heavy metals, pathogens, hazardous substances, characterization of air pollution-particulates, volatile organic compounds, oxides of sulfur and nitrogen. Effects of environmental pollution on human health, life forms and materials.

2. Sources of pollution in tanneries and leather processing industries, characterization of water and air pollutants, analysis and measurement, solid and hazardous wastes

3. Wastewater treatment in tanneries and leather industries - design and operation of treatment units.

4. Control of air pollution -- control equipment and selection.

5. Solid wastes in Leather industries: environmental impact, treatment and disposal. Sludge handling, treatment and disposal. Soil pollution.

6. Occupational health hazards, safety measures, control of noise.

7. Environmental protections, technology modification, waste minimization and recycle.

8. Environmental laws and regulations, standards, ISO 14,000.

Any Other related topics of Current Interest.

References.

01. A. K. Dey -- Environmental Chemistry – 3rd Edn. New Age International. N.D.1994
02. P. Michael- Ecological methods for field and laboratory investigation T.M.G.II New Delhi. 1990.
03. APHA - Analytical methods of water and wastewater - American Public Health Association.

MLT 302 **BIOTECHNOLOGY - II**

3 - 1 - 0 - 4

1) Basic ideas of genetic toxicology and its implication in environmental health.
2) Bioindicator organism and its significance in sustainable use of leather effluent.
3) Protein synthesis and its purification.
4) Outline of structure of protein and prediction of their function through computer simulation.
5) Protein folding, chaperonin and inclusion body.
6) Isolation and purification of aminoacids from tannery effluent.

Any Other related topics of Current Interest.

References:

1. Microbiology --- Pelezar - Mc Grew Hill
2. The cell - De Roberties - B.I. Waverly
3. Genes VII - B. Lewin
4. Biochemistry - Lehninger - MacMillan
5. Molecular Biology and biotechnology - R.A. Meyers (ed.)

MLT 303 **MATERIAL SCIENCE AND ENGINEERING**

3 - 1 - 0 - 4

Structure of solids: The crystalline and the noncrystalline states, geometry of crystals, geometry of crystals, the space lattice, crystal directions and planes, structure determination by X-ray diffraction, Bragg's Law, crystallinity in long chain polymers.

Inorganic solids: covalent solids, ionic solids, the structure of silica and silicates (clay).

Phase diagrams: The phase rule, idea about single component system and binary phase diagrams, the lever rule, some typical phase diagrams, applications of phase diagrams. Diffusion: Fick's Law of diffusion.

Elastic, anelastic ans viscoelastic behavior: Elastic behavior: atomic model of elastic deformation, elastic modulus and rubber like elasticity.
Anelastic behavior: stress relaxation.
Viscoelastic behavior: spring-dashpot model, creep and creep resistant materials.

Deformation in viscoelastic materials: Detailed studies on stress-strain behavior, hysterisis,
Hardness, strain hardening, deformations under static and dynamic loads, compressive properties.

Fracture studies: Ductile and brittle fractures, fracture toughness, the ductile-brittle transitions, fatigue fracture, crack propagation, mechanism of crack propagation.

Degradation and stability: Idea about thermo-oxidative degradation, mechanism of oxidation, heat stabilizers, antioxidants.

Characterization and processing of reinforced polymer composites: FRP, Metal-matrix composites, ceramic-matrix composites, hybrid composites.

References:

MLT391 **BIOTECHNOLOGY – II**

0 – 0 – 3 – 2

- Growth curve of Bacterial culture
- Isolation and electrophoresis of DNA from eukaryotic and bacterial cell
- Quantitation of DNA , RNA and protein by Spectrophotometer
- Cloning of a gene in E. coli -- Selection of a specific gene and vector, Designing of primer, amplification of gene by PCR, restriction digestion of DNA, ligation, transformation and plating to get the right clone of a target gene).
- Expression and Purification of microbial protein.
- Characterization of some microbial and integument protein.

MLT 392 **ADVANCED TECHNIQUES LEATHER PROCESSING**

2 – 1 – 0 – 3

1. Upper and Garment Leathers

Different types of raw materials used in the manufacture of upper leathers, garment leathers (Grain and suede)-Properties-Physical an
d chemical standards; required process details to achieve the specifications.

2. Sole and other types of leathers

Sole leather and Insole leather: specifications, processing by newer methods. Other types of leathers such as upholstery, washable, water resistant, Chamois, glove and fashion leathers. Upgradation of lower ends products for better utilisation including split finishing.

3. Dyestuffs and finishing methods

Choice of dyestuffs for different types of leathers: characteristics and application. Colour matching-finishing formulations-Properties of finish film-various types of auxiliaries used in finishing and their functional properties. Problems in finishing such as gloss, poor anchorage-wet rub and dry rub fastness.

4. Leathers for Leather goods

Requirements for different types of leather goods various types of leathers such as printed leathers, bag leathers, fancy leathers-Process details.

5. Machinery and Process Optimisation

Newer machinery in leather processing in tanning, post tanning and finishing operations. Process optimisation for energy, water and materials saving and processes based on cleaner technologies. Modern practices followed in grading assessment of leathers for various end uses.

Manufacture of water resistant sole leathers from buffalo hides, upholstery leathers from buffalo hides, nappa leathers from goat skins, glove leathers from goat skins, nubuck garment leathers from sheep skins, water resistant - oil pull-up leathers, nappa garment leathers from sheep skins, wet rub fast, rich dyeing in nubuck leathers.

Studies on recovery and reuse of chrome in tannery operations, optimization of water consumption in beam house operations, recycling of salt in pickling operation, high exhaust chrome tanning, chromeless tanning practices, uniform uptake of chromium in semi-chrome process, on finishing techniques for upgradation of lower end products.

Practices in rapid chamois leather processing, dyeing of semi-chrome black suedes without using basic and benzidine based dyes, on finishing of ready to use crust leathers.

References:

1. P.S.Briggs, Gloving, Clothing and special leathers, Tropical Products Institute, London 1981.
2. D.H.Tuck, The Manufacture of upper leathers, Tropical Products Institute, London 1981.
3. J.H. Sharphouse, Leather Technicians Hand Book, London, 1983.

MLT 393 **MATERIALS TESTING LABORATORY**

0 – 0 – 3 – 2

1. Construction of a Phase Diagram using a three component liquid system.
2. Determination of viscosity average molecular weight of polystyrene.
3. Studies on UV degradation and UV stabilization of natural rubber.
4. Studies on thermal decomposition of polyvinyl chloride.
5. Differential scanning calorimetric and thermo-gravimetric analysis of some typical polymers.
6. Construction of a calibration curve for determination of filler concentration in a polymer sample.
7. Determination of surface area of different grades of carbon blacks.