ANNA UNIVERSITY, CHENNAI
UNIVERSITY DEPARTMENTS
M. TECH. LEATHER AND FOOTWEAR TECHNOLOGY
REGULATIONS – 2023
CHOICE BASED CREDIT SYSTEM

I TO IV SEMESTERS CURRICULA AND I SEMESTER SYLLABI

Semester I

S. No.	Course Code	Course title	Category	Periods Per Week			Total Contact Periods	Credits
				L	T	P		
Theory								
1	LF3101	Orientation to Leather & Footwear Manufacture	FC	3	0	0	3	3
2	RM3151	Research Methodology and IPR	RMC	2	1	0	3	3
3	LE3202	Innovations and Green Concepts in Leather Process	PCC	3	0	0	3	3
4	FW3102	Design and Fabrication of Footwear	PCC	3	0	0	3	3
5	LF3102	Footwear Components and Accessories	PCC	3	0	0	3	3
6	LF3103	Colloids and Surface Chemistry	PCC	3	0	0	3	3
Practicals								
7	LE3211	Leather Process Design Engineering Laboratory	PCC	0	0	6	6	3
8	LF3111	Footwear Fabrication Laboratory	PCC	0	0	6	6	3
			Total Credits	**17**	**1**	**12**	**30**	**24**

Semester II

S. No.	Course Code	Course title	Category	Periods Per Week			Total Contact Periods	Credits
				L	T	P		
Theory								
1		Polymers and Auxiliaries for Leather & Footwear	PCC	3	0	0	3	3
2		Professional Elective I	PEC	3	0	0	3	3
3		Professional Elective II	PEC	3	0	0	3	3
4		Professional Elective III	PEC	3	0	0	3	3
5		Professional Elective IV	PEC	3	0	0	3	3
Practicals								
6		Modern Practices in Footwear Manufacture	PCC	0	0	6	6	3
7		Chemical and Physical Testing Laboratory	PCC	0	0	6	6	3
			Total Credits	**15**	**0**	**12**	**27**	**21**

Semester III

S.No.	Course Code	Course Title	Category	Periods Per Week			Total Contact Periods	Credits
				L	T	P		
Theory								
1		Professional Elective V	PEC	3	0	0	3	3
2		Professional Elective VI	PEC	3	0	0	3	3
3		Professional Elective VII	PEC	3	0	0	3	3
Practicals								
4		Internship/Training	EEC	0	0	4	4	2
5		Project Work I	EEC	0	0	12	12	6
			Total Credits	**9**	**0**	**16**	**25**	**17**

Semester IV

S. No.	Course Code	Course Title	Category	Periods Per Week			Total Contact Periods	Credits
				L	T	P		
Practicals								
1		Project Work II	EEC	0	0	24	24	12
			Total Credits	**0**	**0**	**24**	**24**	**12**

Total Credits for the programme = 74

Professional Electives Courses (PEC)

S. No.	CODE NO	COURSE TITLE	CATE GORY	L	T	P	C	CONTACT PERIODS
1.		Advanced Coordination Chemistry	PEC	3	0	0	3	3
2.		Advanced Leather Biotechnology	PEC	3	0	0	3	3
3.		Advanced Organic and Inorganic Chemistry	PEC	3	0	0	3	3
4.		Energy Management in Industries	PEC	3	0	0	3	3
5.		Tannery Waste Management and Engineering	PEC	3	0	0	3	3
6.		Collagen Science and Technology	PEC	3	0	0	3	3
7.		Quality Management and Assurance	PEC	3	0	0	3	3
8.		Project Management Systems	PEC	3	0	0	3	3
9.		Ecological Concepts in Leather Manufacturing	PEC	3	0	0	3	3
10.		Advanced Instrumental Methods	PEC	3	0	0	3	3
11.		Practice on Leather Chemicals	PEC	3	0	0	3	3
12.		Materials for Footwear	PEC	3	0	0	3	3
13.		Modern Techniques in Footwear Manufacture	PEC	3	0	0	3	3
14.		Footwear Machinery	PEC	3	0	0	3	3
15.		Computational Methods and Computer Graphics	PEC	3	0	0	3	3
16.		Regulations and Compliances for Footwear Industry	PEC	3	0	0	3	3
17.		Footwear Performance and Customer Services	PEC	3	0	0	3	3
18.		Biomechanics for Footwear	PEC	3	0	0	3	3
19.		Modern Footwear Styling	PEC	3	0	0	3	3
20.		Pedorthic Footwear	PEC	3	0	0	3	3
21.		Quality Control Management in Footwear Industries	PEC	3	0	0	3	3
22.		Athleisure	PEC	3	0	0	3	3
23.		Moulded Footwear	PEC	3	0	0	3	3
24.		Open Footwear	PEC	3	0	0	3	3
25.		Standards for Footwear	PEC	3	0	0	3	3

26.		Sustainable Footwear Industry	PEC	3	0	0	3	3
27.		Sustainability Engineering	PEC	3	0	0	3	3
28.		AI for Leather & Footwear Industries and Industry 4.0*	PEC	3	0	0	3	3
29.		Performance coating and its techniques on flexible materials*	PEC	3	0	0	3	3
30.		Sole and Sole Mould Design*	PEC	3	0	0	3	3

Foundation Courses (FC)

S. No	Course Code	Course Name	Periods Per Week			Credits	Semester
			L	T	P		
1.		Orientation to Leather & Footwear Manufacture	3	0	0	3	I
Total Credits						**3**	

Professional Core Courses (PCC)

S. No	Course Code	Course Name	Periods Per Week			Credits	Semester
			L	T	P		
1.		Innovations and Green Concepts in Leather Process	3	0	0	3	I
2.		Design and Fabrication of Footwear	3	0	0	3	I
3.		Footwear Components and Accessories	3	0	0	3	I
4.		Colloids and Surface Chemistry	3	0	0	3	I
5.		Leather Process Design Engineering Laboratory	0	0	6	3	I
6.		Footwear Fabrication Laboratory	0	0	6	3	I
7.		Polymers and Auxiliaries for Leather & Footwear	3	0	0	3	II
8.		Modern Practices in Footwear Manufacture	0	0	6	3	II
9.		Chemical and Physical Testing Laboratory	0	0	6	3	II
Total Credits						**27**	

Research Methodology and IPR Courses (RMC)

S. No	Course Code	Course Name	Periods Per Week			Credits	Semester
			L	T	P		
1.		Research Methodology and IPR	2	1	0	3	I
					Total Credits	**3**	

Employability Enhancement Courses (EEC)

S. No	Course Code	Course Name	Periods Per Week			Credits	Semester
			L	T	P		
1.		Internship/Training	0	0	4	2	III
2.		Project Work I	0	0	12	6	III
3.		Project Work II	0	0	24	12	IV
					Total Credits	**20**	

SUMMARY

Name of the Programme: M. Tech. Leather and Footwear Technology						
S. No.	Subject Area	Credits Per Semester				Credits Total
		I	II	III	IV	
1.	FC	3	0	0	0	03
2.	PCC	18	9	0	0	27
3.	PEC	0	12	9	0	21
4.	RMC	3	0	0	0	03
5.	EEC	0	0	8	12	20
	Total Credits	**24**	**21**	**17**	**12**	**74**

Semester I

LF3101	ORIENTATION TO LEATHER & FOOTWEAR MANUFACTURE	L	T	P	C
		3	0	0	3

OBJECTIVES

- This course objective is to orient students on the fundamental science and technology of leather and footwear manufacture
- To understand the Principles and objectives and concepts of beam house and of tanning
- To understand the concept of post tanning and Finishing of leather
- To provide knowledge about the structure and function of lower limb, foot and deformities
- To enable the students to gain knowledge on the principles of foot Bio-Mechanics and Gait analysis
- To enable the students to understand the fundamentals of data collection and statistical analysis of foot data using solid modelling

UNIT I HIDES, SKINS, PRESERVATION, PRETANNING AND TANNING PROCESSES 10

Origin and characteristics of hides and skins; Categories of livestock; Grading systems; Defects in hides and skins; Various preservation techniques Principles and objectives of various unit operations in pretanning viz., soaking, liming, reliming, deliming, bating, pickling, depickling and degreasing; Definition and objectives of tanning; Principles involved in vegetable and chrome tanning and their mechanism in brief

UNIT II POST TANNING PROCESSES AND FINISHING TECHNIQUES 9

Principles and objectives of Various unit operations involved during pot tanning viz., neutralization, retanning, dyeing and fatliquoring; Principles and objectives of finishing; Classification of finishing; Types of auxiliaries and finishes; Types of pigments; Basic characteristics of pigments; Types of binders; Basic chemistry of protein, resin and PU binders; Basic theory of coating

UNIT Ill FOOT GROWTH, DEFORMITIES AND ANATOMY OF LOWER LIMB 9

Growth of foot from infancy to maturity, arches of foot, relationship between foot shape and last. Different types of foot deformities like PesCavus, Valgus, Blisters, Gangrene, -, methods of prevention etc.; Lower limb - bones, muscles, nerves and fascia, their functions in structural stability (static & dynamic).

UNIT IV PRINCIPLES OF BIO MECHANICS AND FUNDAMENTALS OF GAIT 8

Reference planes of motion; Kinematics; Limb Movements; Motion of Joints; Kinetics;. Terminology used in Gait; Gait Parameters Definition; Phases of Gait Cycle; Fundamentals in Gait Analysis; Balance and Posture; Ground Reaction Force. Introduction to gait analysis techniques.

UNIT V SOLID MODELLING 9

Basic principles of solid modelling and surface modelling using contours and geometry. Use of solid modelling in designing and developing modern footwear. Introduction to Foot Anthropometry;

Lasts: Different measurement of feet and lasts - methods, units, sizing systems such as

Indian, English, French, American, German, Japan Mondo-point their conversion and comparison. Principles of pattern grading

TOTAL: **45 PERIODS**

COURSE OUTCOME

At the end of the course, the students are expected to

CO1 Have knowledge on pre-tanning and tanning processes.

CO2 Comprehend the process rational for making specific types of leather through various post tanning and finishing techniques.

CO3 Evaluate the foot growth and its deformities and to Understand the anatomy of human lower limb and foot

CO4 Apply the knowledge on principles of biomechanics of foot and Gain a basic knowledge of gait analysis.

CO5 Design and develop modern footwear using the solid modelling

REFERENCES:

1. Sarkar, K.T., "Introduction to the Principles of Leather Manufacture", Ajay Sarkar, 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., Malabar, 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, Rober E. Krieger Publishing Co., New York, 1977.
5. Tchobanoglous, G., Burton, F.L. and Stensel, H.D. (Eds), "Waste water Engineering, treatment, disposal and reuse: Metcalf and Eddy", 3rd edn. Tata-McGraw Hill Publishing, New Delhi, 1991.
6. Chaurasia, B.D., "Human Anatomy: Regional and Human Osteology", 7th Edition, CBS Publishers and Distributors, New Delhi. 2016.
7. Hollinshead, H., "Text book of Anatomy", LWW Publishers, 5th Revised Edition (1997) Oxford IBH London.
8. Morton, D.J., "The Human Foot", Hafner Publishing Co., New York, London, 1964.
9. Thornton, J.H., "Text book of Footwear Manufacture", National Trade Press Ltd., London, 1970
10. Edwards, C.A., "Orthopaedic shoe technology", Precision Printing Co., Indiana, 1981
11. Whittle, M., "Gait Analysis: An introduction" Butterworth – Heinemann Publication, 2007.
12. Vincent G Duffy, "Digital Human Modelling", Springer, July 2011

RM3151	RESEARCH METHODOLOGY AND IPR	L	T	P	C
		2	1	0	3

OBJECTIVES:

To impart knowledge on

- Formulation of research problems, design of experiment, collection of data, interpretation and presentation of result
- Intellectual property rights, patenting and licensing

UNIT I RESEARCH PROBLEM FORMULATION 9

Objectives of research, types of research, research process, approaches to research; conducting literature review- information sources, information retrieval, tools for identifying literature, Indexing and abstracting services, Citation indexes, summarizing the review, critical review, identifying research gap, conceptualizing and hypothesizing the research gap

UNIT II RESEARCH DESIGN AND DATA COLLECTION 9

Statistical design of experiments- types and principles; data types & classification; data collection - methods and tools

UNIT III DATA ANALYSIS, INTERPRETATION AND REPORTING 9

Sampling, sampling error, measures of central tendency and variation; test of hypothesis- concepts; data presentation- types of tables and illustrations; guidelines for writing the abstract, introduction, methodology, results and discussion, conclusion sections of a manuscript; guidelines for writing thesis, research proposal; References – Styles and methods, Citation and listing system of documents; plagiarism, ethical considerations in research

UNIT IV INTELLECTUAL PROPERTY RIGHTS 9

Concept of IPR, types of IPR – Patent, Designs, Trademarks and Trade secrets, Geographical indications, Copy rights, applicability of these IPR; , IPR & biodiversity; IPR development process, role of WIPO and WTO in IPR establishments, common rules of IPR practices, types and features of IPR agreement, functions of UNESCO in IPR maintenance

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UNIT V PATENTS 9

Patents – objectives and benefits of patent, concept, features of patent, inventive steps, specifications, types of patent application; patenting process - patent filling, examination of patent, grant of patent, revocation; equitable assignments; Licenses, licensing of patents; patent agents, registration of patent agents.

TOTAL: 45 PERIODS

COURSE OUTCOMES

Upon completion of the course, the student can

CO1: Describe different types of research; identify, review and define the research problem
CO2: Select suitable design of experiment s; describe types of data and the tools for collection of data
CO3: Explain the process of data analysis; interpret and present the result in suitable form
CO4: Explain about Intellectual property rights, types and procedures
CO5: Execute patent filing and licensing

REFERENCES:

1. Cooper Donald R, Schindler Pamela S and Sharma JK, “Business Research Methods”, Tata McGraw Hill Education, 11e (2012).
2. Soumitro Banerjee, “Research methodology for natural sciences”, IISc Press, Kolkata, 2022,
3. Catherine J. Holland, “Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets”, Entrepreneur Press, 2007.
4. David Hunt, Long Nguyen, Matthew Rodgers, “Patent searching: tools & techniques”, Wiley, 2007.
5. The Institute of Company Secretaries of India, Statutory body under an Act of parliament, “Professional Programme Intellectual Property Rights, Law and practice”, September 2013.

LE3202 INNOVATIONS AND GREEN CONCEPTS IN LEATHER PROCESS

L	T	P	C
3	0	0	3

OBJECTIVE

- To provide knowledge on the technology of making different types of leathers with cleaner and greener approach
- To provide knowledge on the processing of specialty leathers
- To provide knowledge on eco-labelling certification and restricted chemicals usage guidelines in leather manufacturing
- To provide knowledge on various finishing techniques
- To provide knowledge on wastes reduction and management through various approaches

UNIT I SPECIALITY LEATHERS 9

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 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 III CLEANER PROCESSING: TANNING, POST TANNING AND FINISHING 9

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 9

Role of following finishing equipment; techniques for newer and novel finishing system viz., aqueous based patent finishing, cationic finishing, foam finishing. Shoe suede, garment suede, grain finished effect and specialty finishes at split leather -processing technologies and finishing techniques especially suited for the purpose. Upgradation of lower ends for better utilization. New textures with enhanced properties; Transfer foil/coating, lamination techniques, etc., in split finishing. Latest trends.

UNIT V NEWER CONCEPTS IN LEATHER & FOOTWEAR MANUFACTURE 9

Process controls and automation – productivity – quality consistency – Water management and Zero Discharge approaches - energy audit - Environmental footprints.

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of the course, the students will be able to

CO1. Apply the conceptual design to make leather.

CO2. Explain the concepts in cleaner leather processing.

CO3. Analyze newer concepts in leather manufacture.

CO4. Develop knowledge about eco-benign chemicals and restricted chemicals in leather process.

CO5. Describe advanced knowledge in waste management

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.
3. Exploration of GSK'S solvent selection guide in leather industry: A CSIR-CLRI tool for sustainable leather manufacturing. (2016) Green Chemistry.
4. Alternative carrier medium for sustainable leather manufacturing–A review and perspective. (2016) Journal of Cleaner Production, 112(1)*, 49-58*
5. Buljan, J., and I. Kral. "The framework for sustainable leather manufacture." United Nations Industrial Development Organization 12 (2015): 145-147.

FW3102	DESIGN AND FABRICATION OF FOOTWEAR	L	T	P	C
		3	0	0	3

OBJECTIVE

The objective of this course is to enable the students to understand

- The various unit operations in footwear manufacture
- The Development of fashions & designs in footwear
- The various sequence of operation in a footwear manufacture
- The principles and types of lasting
- The principles and methods of various post lasting and finishing operation

UNIT I DESIGN AND PATTERN DEVELOPMENT 7

Introduction to footwear and shoe – Historical evolution of shoes in different era's – purposes and basic styles in footwear – Development of fashions & designs in footwear – Introduction to Last and its importance - selection criteria for last - Terminologies on the Last and its parts – Preparation of mean forme by using last – Preparation of upper and lining standards – Grading methodology - Designing of Bottom Parts –Insole pattern, Socks, stiffener- Principles of Grading.

UNIT II CUTTING 7

Introduction and importance - Responsibilities of Clicker - Selection of leathers and non- leather materials for clicking – Layout preparation – Materials Economy - Principles of cutting – Hand, machine, Scope for automation, Standard time – Quality Control – Clicking room design and management. Fabric, rolls and sheet materials cutting technique – Characteristics of Clicking dies

UNIT III PRE-CLOSING AND CLOSING 11

Preparation for closing: Checking incoming work, stitch making, skiving, punching and gimping, heat embossing, toe puff attachment, attaching linings and scrims, trimming linings, finishing off closed seams. Top line and other edge treatments, local reinforcements, attaching fasteners and trims. Threads, needles, Seam and stitch types, Closing: Dealing with thread breakages, automatic stitching, working environment faults and remedies, Types of stitching machines, Design of assembly section and Stitching machine management.

UNIT IV LASTING 9

Introduction to Lasting process –Counter moulding – Insole attaching - Hand lasting / drafting – Quality control in hand lasting -Various methods of conditioning the lasted uppers – Heat setting – Back part moulding - Machine lasting (forepart, side & seat)- Health and Safety control measures follows in shoe manufacturing line – – Quality checking parameters for finished shoe – Quality control measure in lasting operation.

UNIT V POST LASTING AND FINISHING 11

Principles and methods of various post lasting and finishing operation; Sole attaching – preparation of lasted margin, upper preparation, sole preparation, sole cementing, upper cementing, halogenations; bottom fillers and shanks adhesive drying, heat activation, spotting, pressing, last slipping, quality control and fault-finding problems- solving, recommended bonding systems between upper and outsole. Shoe room techniques.

TOTAL :45 PERIODS

COURSE OUTCOME

At the end of the course, the students are expected to

CO1 Understand the design and pattern development.

CO2 Implement the cutting operation by knowing its importance.

CO3 Have knowledge on pre-closing and closing.

CO4 Design, assemble and construct the full shoe.

CO5 Understand the principles and methods of post lasting and finishing operation.

REFERENCES:

1. Patrick, H.J., “Modern pattern cutting and design”, Mobbs and Lewis Ltd., Kettering, England,1990.
2. Lyon, D., “Modern approach to Footwear pattern cutting”, 1994.
3. Thornton, J.H., “Text book of Footwear Manufacture”, National Trade Press Ltd., London,1970.
4. “Manual of Shoe Making” – Clarks Ltd. (London) 2nd edition, 1989.
5. Wilhelm, A., “Tips for shoe production” Vol. I, II & III, Huthig Buch Verlag, Heidelberg, 1988.

LF3102	FOOTWEAR COMPONENTS AND ACCESSORIES	L	T	P	C
		3	0	0	3

OBJECTIVE

To enable the students

- To acquire knowledge on various components used for footwear manufacture
- To understand the role of grinderies in footwear manufacturing
- To inculcate an understanding of fasteners and its types
- To learn about accessories and its manufacturing method
- To know about the importance of reinforcements and non-metallic grinderies

UNIT I COMPONENTS 9

Basic, comfort, fastness and functional properties of Upper & lining: Raw material- leather, fabrics and its construction, coated fabric In-sock: Raw material-leather/Textile, molded in-sock such as EVA, PU, MCR, Insole: Raw material –leather, cellulose board, strobel insole, back part & forepart insole and stiffener board

UNIT II SOLE, MIDSOLE AND HEEL 9

Outsole and Midsole: Basic and functional properties - Raw material- Leather sole, synthetic sole-Rubber, Thermoplastic Rubber (TPR), Thermoplastic polyurethane (TPU), polyurethane sole (PU), ethylene vinyl acetate (EVA), poly vinyl chloride (PVC), micro cellular rubber (MCR), mould design of sole and other new/non-leather materials.

Heel: Injection moulded heels: mould design, raw materials selection - injection moulding and finishing. polystyrene sole, leather heel, Top lift-Rubber, heel filler- wood board

UNIT III GRINDERIES 9

Last: Raw material - Manufacture of wooden last, Plastic last and metal last. Constituents and Manufacture of fibre boards. Shank, Raw Material - Wood, Fibre board Steel, combined wooden board or steel and board, manufacture technique. Grinderies: Metallic grinderies - tack, rivet and nails, wires - raw materials - sorting and polishing.

UNIT IV FASTENERS & ACCESSORIES 9

Fasteners: Threads, Lace Fabrics: Raw Material – Manufacture Technique and Finishing. Eyelets: Raw materials - designing and manufacturing processes. Slide fasteners: Types of materials used in slide fasteners - manufacturing processes. Touch and close fastener, Buckles, D-ring, SKI-hooks, Elastic Tape, Ornaments, embellishments, studs, methods of manufacture, moulding, electroplating and polishing.

UNIT V REINFORCEMENTS 9

Toe-puff and Stiffeners: Types of Toe-puff and stiffeners, manufacture techniques - Paint on liquids, impregnated fabrics, print on hot-melt resin, filmic. Recommended use. Non-metallic grinderies: Reinforcement tape –Binding, seam, eyelet reinforcement, Protective toe cap and inserts- metallic and non-metallic.

TOTAL: 45 PERIODS

COURSE OUTCOME

At the end of the course, the students are expected to

CO1 Understand about various footwear components.

CO2 Analyze and evaluate the characteristics of various footwear grinderies and accessories.

CO3 Know about fasteners and its types.

CO4 Have knowledge on different manufacturing techniques of accessories and are able to design them.

CO5 Know the importance of various reinforcement materials.

REFERENCES:

1. Thornton, J.H., “Text book of Footwear Materials”, The National Trade Press Ltd., London,1970.
2. Harvey, A.J., “Footwear Materials and Process Technology”, N.Z. Shoe Research Association, New Zealand,1982.

LF3103	COLLOIDS AND SURFACE CHEMISTRY	L	T	P	C
		3	0	0	3

OBJECTIVE

- To provide knowledge on the advanced concepts of colloids and surface chemistry associated with leather processing.
- To have a basic understanding on surface and interfacial tension.
- To provide knowledge on the bulk properties of surfactants.
- To give insight on soft condensed matter and solids.
- To understand the various properties and preparation of emulsions.

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 behavior and industrial application. Lyophobic sols, Lyophilic systems and stability, HLB number and tuning them to designed surface and interfacial properties — leather applications Wetting, cohesion & adhesion, contact angle- tuning surface and interface properties of materials

UNIT III SOFT CONDENSED MATTER AND COLLOIDS 9

Functional and adaptive surfactants, polymers, gels and bio colloids Types of colloids and their characterization, Phase behavior and aggregated structures in self-assembling colloids- Applications in leather processing Stability of colloids- Sources of surface charge, short range forces, zeta potential, DLVO theory Aggregation, flocculation and precipitation, Schulze-Hardy rule, inorganic coagulants, polymeric flocculants, wastewater treatment; Surface Active Agents & Association Structures of Amphiphilic Molecules Transport and fate of colloids in porous media - pores sizes and their distributions and adsorption of emulsions/colloids in such porous materials

UNIT IV EMULSIONS 9

Emulsion and pseudo emulsion films, Phase diagrams, Foams and foam breaking Antifoaming agents & mechanisms Flotation, Purification of surface-active agents using foams, Designed responsive and functional interfaces - Pickering emulsions — In processes in Leather, food and textile. Designing Pickering emulsions for — surface and interface properties of leather

UNIT V 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 (electro kinetics electrophoresis, streaming potential, electro-osmosis, sedimentation potential, electroacoustic, 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)

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course, the students are expected to

CO1. Understand the role of colloid and surface chemistry in leather applications.

CO2. Gain knowledge on bulk properties of surfactant solutions and monolayers

CO3. Understand the adsorption phenomena of solids.

CO4. Understand the significance of HLB ratio in fat liquor preparation

CO5. Understand the advanced preparation methods for surfactants

REFERENCES :

1. Encyclopedia of Colloid and Interface Science" by Tharwat Tadros
2. Advances in Measurement and Control of Colloidal Processes" by R A F Williams and N C de Jaeger
3. Physical Chemistry of Surfaces" by A W Adamson and A P Gast
4. Interfacial Transport Processes and Rheology" by D A Edwards
5. Bienkienwicz, "Physical chemistry of leather making", Krieger Publishing Co., Florida, 1983.
6. Surfactant Science Series, John-Wiley Interscience Publications, New York.
7. Surface and Interfacial Forces - From Fundamentals To Applications" by Doris Vollmer
8. Colloidal Dispersions : Suspensions, Emulsions, and Foams by I.D. Morrison and S. Ross (2002, Wiley Interscience, NY; ISBN : 0-471-17625-7)

LE3211	LEATHER PROCESS DESIGN ENGINEERING LABORATORY	L	T	P	C
		0	0	6	3

OBJECTIVE

- To provide practical exposure in designing of different types of leathers using cleaner approaches
- To provide the ability prepare chemical and energy audit based on process design
- To provide the ability to manage water resources during process design
- To provide knowledge on advanced processing techniques with emphasis on eco-friendly leather manufacture.
- To provide the ability to prepare and analyze case studies for specific product mix (upper, garment, upholstery, glove) with details of chemical audit, energy audit, water consumption during processing

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.

TOTAL: 90 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be in a position.

CO1. Make different types of leather using cleaner methods.

CO2. Analyze process efficiencies.

CO3. Construct process strategy for specialty leathers.

LF3111	FOOTWEAR FABRICATION LABORATORY	L	T	P	C
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OBJECTIVE

To enable the students to

- Impart practical exposure in pattern developments
- Gain knowledge in leather assortment and cutting operation
- Acquire the ability of upper fabrication
- Impart practical exposure in bottom stock preparation and full shoe manufacture
- Train students on non-leather shoe manufacturing techniques

LIST OF EXCERCISES

1. DESIGN AND PATTERN MAKING 20

Central line drawing – Measurements – Design Insole pattern – Sole pattern – Forming – slotted, Fabric, Tape & Vacuum Method. Men's shoe standard and preparation (Derby, Oxford, Mocassins, Ankle boots, long boots etc.) Ladies & Children's standard and section preparation.

2. CUTTING AND CLICKING 15

Leather Assortment — Grading — cuttability etc. Layout preparation on paper &leather. Leather consumption calculation; parallelogram and other methods. Hand and Machine cutting Fabric and other sheet materials.

3. UPPER FABRICATION 20

Assessment on cut components, practice in sewing machine – pedal control without thread – Thread –synthetic – leather, practice on pre-closing operation – skiving - splitting-folding, practice on fabrication of – derby - oxford - slip on, practical exposure on upper inspection and assessment practice.

4. BOTTOM STOCK PREPARATION, LASTING AND FINISHING 15

Insole cutting - Sole cutting and cutting other sections/components. Leather/Rubber Sole preparation - Heel attaching - Heel treatment - Edge Treatment - Finishing.

Insole attachment - base strap lasting – vamp lasting – full strap lasting (Manual practice), handdrafting – practice on lasting machine – practice on fabrication of different styles of footwear - shoe dressing and finishing

5. NON-LEATHER SHOE MANUFACTURING TECHNIQUES 20

Preparation of strobel sewn upper, usage of polymer materials, practice on injection of molten material, solidification process into the cavity/ mould and health and safety practices concerning DIM process, PU pouring, completion of injection moulded footwear.

TOTAL: 90 PERIODS

COURSE OUTCOME

At the end of the course, the students are expected to

CO1 Be in a position to develop patterns of different style of footwear.

CO2 Have practical knowledge on cutting and clicking process.

CO3 Have practical experience in upper fabrication.

CO4 Prepare the bottom stock, to fabricate upper and lasting and finishing process.

CO5 Gain skill set to handle non-leather shoe manufacturing techniques.

REFERENCES:

1. Bordoli, B., “The Boot and Shoe Maker”, (4 volumes) The Gresham Publishing Co. Ltd., London,4th edition, 1966.
2. Katz, R.J., “Footwear: Shoes and Socks You can make Yourself” Reinhold, New York, 1979.
3. “Manual of shoe designing”, CLRI Publications, 1999.