DEPARTMENT OF LEATHER TECHNOLOGY

ANNA UNIVERSITY, CHENNAI

B. TECH. LEATHER TECHNOLOGY (PART TIME)

VISION:

To become a premier centre of learning and research in leather and allied technologies.

MISSION:

MD1 **:** To provide quality education in the area of leather technology with high professional values.

MD2 **:** To share and disseminate expertise to provide solutions for the problems faced by the leather industry.

MD3 **:** To build an expertise based capsule of delivering technology to leather and allied sectors.

MD4 **:** To provide a learning ambience for innovators, researchers and technologists.

ANNA UNIVERSITY, CHENNAI

UNIVERSITY DEPARTMENTS

REGULATIONS - 2023

CHOICE BASED CREDIT SYSTEM

B. TECH. LEATHER TECHNOLOGY (PART-TIME)

1. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

Bachelor of Leather Technology curriculum is designed to prepare the undergraduates

I.	To demonstrate core competency in basic mathematics, scientific and engineering fundamental to design , formulate, analyse and solve the problems of leather and allied sectors.
II.	To pursue lifelong multidisciplinary learning as professional engineers, researchers and scientists and effectively communicate technical information.
III.	To practice values and exhibit leadership qualities and team spirit to promote entrepreneurship and indigenization.
IV.	To nurture among students, the ability to work in teams, in professional and social environments.
V.	To develop a global outlook to students to appreciate diversity in the world and in intellectual pursuits and the desire and ability to have continuous learning in life

2. PROGRAMME OUTCOMES (POs):

PO's	Graduate Attribute
1	**Engineering knowledge:** Apply knowledge of mathematics, science and engineering fundamentals and an engineering specification to the solution of complex engineering problems.
2	**Problem analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural science and engineering.
3	**Design/development of solutions:** Design system for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety and the cultural, societal and environmental considerations.
4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusion.
5	**Modern tool usage:** Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6	**The Engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental context and demonstrate the knowledge of and need for sustainability development.
8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	**Individual and team work:** Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary settings.
10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations and give

	and receive clear instruction.
11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technology change.

3. PROGRAM SPECIFIC OUTCOMES (PSOs):

After completion of Leather Technology program, students will gain core competency skills in domain and the graduates will have the ability to,

PSO1 **:** Understand and apply the foundational knowledge to make a successful career in leather and leather products sector.

PSO2 **:** Identify the problems of the leather sector and provide solutions.

PSO3 **:** To manage leather sector towards its sustainable development.

. MAPPING OF COURSE OUTCOME AND PROGRAMME OUTCOME:

		Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
YEAR I	SEMESTER I	English for Communication	2.2	2.4	2.2	2.4	1.8	2.4	2.4	2.4	2.6	3	1.8	2.8	-	-	-
		Engineering Chemistry	2	1	1	1	2	-	-	-	-	-	-	-			
		Theory of Skin Proteins and Pre-Tanning	3	2	1	2	1	1	3	2	2	1	-	2	2	3	3
		Programming in C	1	2.4	2.8	2	0.2	0.2	-	-	-	0.4			0.4	1	
	SEMESTER II	Leather Manufacture I	3	2	-	-	2	-	1	1	-	1	-	1	1	-	2
		Theory of Inorganic Tannages	3	3	3	-	1	2	2	1	2	1	-	1	1	2	1
		Principles of Unit Processes and	3	1	1	1	1	1	1	2	1	1	1	2	-	3	3
		Probability and Statistics	2	2	1	2.8	1	–	–	–	–	–	1.4	1.4	1	-	-
		Environmental Science and Sustainability	-	2	3	-	-	-	3	3	-	-	-	-	2	-	-
YEAR II	SEMESTER III	Leather Manufacture II	3	3	1	1	3	2	2	2	2	1	2	1	1	3	1
		Theory of Organic Tannages	3	3	2	2	3	1	1	-	-	1	1	2	2	2	2
		Principles of Testing for Leather	3	2	1	1	2	1	1	1	1	1	-	1	1	3	2
		Instrumental Methods of Analysis	3	2.6	2	2	3	1	1	0	0	1	1	2	2.8	2.2	2.2
		Chemical Testing and Analysis Laboratory	1.2	1.8	0.6	1.8	1.2	0.6	0.6	0.6	1.2	0.6	0	0.6	0.6	1.8	1.2
	SEMESTER IV	Leather Chemicals	3	1	1	0	2	1	2	1	1	1	1	1	1	3	2
		Leather and Leather Products Machineries	2	2	1	0	2	1	1	1	1	1	1	1	1	3	2
		Professional Elective I															
		Professional Elective II															
		Physical Testing and Analysis Laboratory	2	3	1	3	2	1	1	1	2	1	1	1	1	3	2

		Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
YEAR III	SEMESTER V	Theory of Leather Finishing	3	2	1	0	2	1	1	1	1	1	0	2	1	3	2
		Biotechnology for Leather	3	1	1	1	2	1	3	2	1	1	0	1	1	3	2
		Finishing Techniques	3	2	1	0	2	1	1	1	1	1	0	2	1	3	2
		Professional Elective III															
		Finishing Practice Laboratory	1.8	1.8	0.6	1.2	1.2	0.6	0.6	0.6	1.2	0.6	0.6	1.2	0.6	1.8	1.2
	SEMESTER VI	Industrial Engineering	3	1	1	1	2	1	3	2	1	1	0	1	1	3	2
		Supply Chain Management	1	1	2	1.2	1.8	2	1	2	3	1	1	2	1	2	3
		Footwear Technology	2.8	1.6	1.6	0.8	0.8	0.6	1.8	1	1	1.6	0.2	2	1.4	3	2.2
		Safety in Leather Industries	2	1	1	1	1.8	2	3	2	1	1	1	2	1	3	2
		Professional Elective IV															
YEAR IV	SEMESTER VII	Leather Goods and Garments Technology	3	2.4	1.8	1.2	1.4	1	1.2	1	0.8	1.4	1.8	2	3	0	0
		Eco-labelling for Leather Sector	2	1	1	1	1.8	2	3	2	1	1	1	2	1	3	2
		Reduce, Reuse and Recycle	2	1	1	1	1.8	2	3	2	1	1	1	2	1	3	2
		Total Quality Management	1.2	1.4	2.2	1.6	1.8	1.8	1.2	2.2	3	1.4	1.4	2.2	1.2	2	3
		Professional Elective V															
	SEMESTER VIII	Quality Assurance for Leather	2	1	1	1	1.8	2	3	2	1	1	1	2	1	3	2
		Professional Elective VI															
		Human Values and Ethics	0.2	-	1	-	-	2	3	1.8	-	1.2	-	2	-	-	1
		Project Work	3	3	3	3	2	2.2	1	2	3	3	3	3	2	2	3

1' = Low; '2' = Medium; '3' = High

ANNA UNIVERSITY, CHENNAI
UNIVERSITY DEPARTMENTS
REGULATIONS – 2023
B. TECH. LEATHER TECHNOLOGY (PART TIME)
CHOICE BASED CREDIT SYSTEM
I TO VIII SEMESTER (PART TIME) CURRICULUM

SEMESTER I

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	PTHS3101	English for Communication	HSMC	3	0	0	3	3
2.	PTCY3151	Engineering Chemistry	PCC	3	0	0	3	3
3.	PTLT3101	Theory of Skin Proteins and Pre-Tanning Processes	PCC	3	0	0	3	3
4.	PTGE3153	Programming in C	ESC	2	0	4	6	4
			TOTAL	**11**	**0**	**4**	**15**	**13**

SEMESTER II

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	PTLT3201	Leather Manufacture I	PCC	3	0	0	3	3
2.	PTLT3202	Theory of Inorganic Tannages	PCC	3	0	0	3	3
3.	PTLT3203	Principles of Unit Processes and Operations	PCC	3	0	0	3	3
4.	PTMA3352	Probability and Statistics	BSC	3	1	0	4	4
5.	PTCY3251	Environmental Science and Sustainability	BSC	2	0	0	2	2
			TOTAL	**14**	**1**	**0**	**15**	**15**

SEMESTER III

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	PTLT3301	Leather Manufacture II	PCC	3	0	0	3	3
2.	PTLT3302	Theory of Organic Tannages	PCC	3	0	0	3	3
3.	PTLT3303	Principles of Testing for Leather	PCC	3	0	0	3	3
4.	PTLT3304	Instrumental Methods of Analysis	PCC	3	0	0	3	3
PRACTICAL								
5.	PTLT3311	Chemical Testing and Analysis Laboratory	PCC	0	0	3	3	1.5
			TOTAL	**12**	**0**	**3**	**15**	**13.5**

SEMESTER IV

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	PTLT3401	Leather Chemicals	PCC	3	0	0	3	3
2.	PTLT3402	Leather and Leather Products Machineries	PCC	3	0	0	3	3
3.		Professional Elective I	PEC	3	0	0	3	3
4.		Professional Elective II	PEC	3	0	0	3	3
PRACTICAL								
5.	PTLT3411	Physical Testing and Analysis Laboratory	PCC	0	0	3	3	1.5
			TOTAL	**12**	**0**	**3**	**15**	**13.5**

SEMESTER V

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	PTLT3501	Theory of Leather Finishing	PCC	3	0	0	3	3
2.	PTLT3502	Biotechnology for Leather	PCC	3	0	0	3	3
3.	PTLT3503	Finishing Techniques	PCC	3	0	0	3	3
4.		Professional Elective III	PEC	3	0	0	3	3
PRACTICAL								
5.	PTLT3511	Finishing Practice Laboratory	PCC	0	0	4	4	2
			TOTAL	**12**	**0**	**3**	**15**	**14**

SEMESTER VI

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	PTLT3601	Industrial Engineering	PCC	3	0	0	3	3
2.	PTLT3602	Supply Chain Management	PCC	3	0	0	3	3
3.	PTLT3603	Footwear Technology	PCC	3	0	0	3	3
4.	PTLT3604	Safety in Leather Industries	PCC	3	0	0	3	3
5.		Professional Elective IV	PEC	3	0	0	3	3
			TOTAL	**15**	**0**	**0**	**15**	**15**

SEMESTER VII

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	PTLT3701	Leather Goods and Garments Technology	PCC	3	0	0	3	3
2	PTLT3702	Eco-labelling for Leather Sector	PCC	3	0	0	3	3
3	PTLT3703	Reduce, Reuse and Recycle	PCC	3	0	0	3	3
4	PTLT3704	Total Quality Management	HSMC	3	0	0	3	3
5		Professional Elective V	PEC	3	0	0	3	3
			TOTAL	**15**	**0**	**0**	**15**	**15**

SEMESTER VIII

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	PTLT3801	Quality Assurance for Leather	PCC	3	0	0	3	3
2.		Professional Elective VI	PEC	3	0	0	3	3
3.	PTGE3851	Human Values and Ethics	HSMC	2	0	0	2	2
4.	PTLT3811	Project Work	EEC	0	0	6	6	3
			TOTAL	**8**	**0**	**6**	**14**	**11**

TOTAL CREDITS: 110

PROFESSIONAL CORE COURSES (PCC)						
SI. NO.	**COURSE CODE**	**COURSE TITLE**	**L**	**T**	**P**	**C**
1.	PTCY3151	Engineering Chemistry	3	0	0	3
2.	PTLT3101	Theory of Skin Proteins and Pre-Tanning Processes	3	0	0	3
3.	PTLT3201	Leather Manufacture I	3	0	0	3
4.	PTLT3202	Theory of Inorganic Tannages	3	0	0	3
5.	PTLT3203	Principles of Unit Processes and Operations	3	0	0	3
6.	PTLT3301	Leather Manufacture II	3	0	0	3
7.	PTLT3302	Theory of Organic Tannages	3	0	0	3
8.	PTLT3303	Principles of Testing for Leather	3	0	0	3
9.	PTLT3304	Instrumental Methods of Analysis	3	0	0	3
10.	PTLT3401	Leather Chemicals	3	0	0	3
11.	PTLT3402	Leather and Leather Products Machineries	3	0	0	3
12.	PTLT3501	Theory of Leather Finishing	3	0	0	3
13.	PTLT3502	Biotechnology for Leather	3	0	0	3
14.	PTLT3503	Finishing Techniques	3	0	0	3
15.	PTLT3601	Industrial Engineering	3	0	0	3
16.	PTLT3602	Supply Chain Management	3	0	0	3
17.	PTLT3603	Footwear Technology	3	0	0	3
18.	PTLT3604	Safety in Leather Industries	3	0	0	3
19.	PTLT3701	Leather Goods and Garments Technology	3	0	0	3
20.	PTLT3702	Eco-labelling for Leather Sector	3	0	0	3
21.	PTLT3703	Reduce, Reuse and Recycle	3	0	0	3
22.	PTLT3801	Quality Assurance for Leather	3	0	0	3
23.	PTLT3311	Chemical Testing and Analysis Laboratory	0	0	3	1.5
24.	PTLT3411	Physical Testing and Analysis Lab	0	0	3	1.5
25.	PTLT3511	Finishing Practice Laboratory	0	0	3	1.5
					Total credits	**70.5**

BASIC SCIENCE COURSE(BSC)						
SI. NO.	**COURSE CODE**	**COURSE TITLE**	**L**	**T**	**P**	**C**
1.	PTMA3352	Probability and Statistics	3	1	0	4
2.	PTCY3251	Environmental Science and Sustainability	2	0	0	2
					Total Credits	**6**

EMPLOYABILITY SCIENCE COURSES (ESC)						
SI. NO.	**COURSE CODE**	**COURSE TITLE**	**L**	**T**	**P**	**C**
1.	PTGE3153	Programming in C	2	0	4	4
					Total Credits	**4**

HUMANITIES AND SOCIAL SCIENCES (HSMC) – MANAGEMENT AND OTHERS						
SI. NO.	**COURSE CODE**	**COURSE TITLE**	**L**	**T**	**P**	**C**
1.	PTHS3101	English for Communication	3	0	0	3
2.	PTMG3701	Total Quality Management	3	0	0	3
3.	PTGE3851	Human Values and Ethics	2	0	0	2
					Total Credits	**8**

EMPLOYABILITY ENHANCEMENT COURSES (EEC)						
SI. NO.	**COURSE CODE**	**COURSE TITLE**	**L**	**T**	**P**	**C**
1.	PTLT3811	Project Work	0	0	6	3
					Total Credits	**3**

PROFESSIONAL ELECTIVE (PEC)						
S NO	**COURSE CODE**	**COURSE TITLE**	**L**	**T**	**P**	**C**
1.	PTLT3001	Computer Applications for Apparel and Goods	3	0	0	3
2.	PTLT3002	Automation in Garment and Goods Manufacture	3	0	0	3
3.	PTLT3003	Product Merchandising in Garments and Goods Industry	3	0	0	3
4.	PTLT3004	Garments and Goods Market Trends and Fashion Forecasting	3	0	0	3
5.	PTLT3005	Testing and Statistics for Garments and Goods	3	0	0	3
6.	PTLT3006	Machineries for Apparels and Goods Manufacture	3	0	0	3
7.	PTLT3007	Computer Applications for Footwear	3	0	0	3
8.	PTLT3008	Automation in Footwear Manufacture	3	0	0	3
9.	PTLT3009	Product Merchandising in Footwear Industry	3	0	0	3
10.	PTLT3010	Footwear Market Trends and Fashion Forecasting	3	0	0	3
11.	PTLT3011	Principles of Testing for Footwear and Components	3	0	0	3
12.	PTLT3012	Machineries for Footwear Manufacture	3	0	0	3
13.	PTLT3013	Chemistry of Collagen	3	0	0	3
14.	PTLT3014	Biophysics of Collagen	3	0	0	3
15.	PTLT3015	Bioprocess Technologies	3	0	0	3
16.	PTLT3016	Composite Materials	3	0	0	3
17.	PTLT3017	Introduction to ETP and CETP Design	3	0	0	3
18.	PTLT3018	Value Addition to Waste	3	0	0	3
19.	PTLT3019	Quality Assurance for Products	3	0	0	3
20.	PTLT3020	Human Resource Management	3	0	0	3
21.	PTLT3021	Entrepreneurship Development	3	0	0	3

22.	PTLT3022	Organization and Management of Leather Manufacture	3	0	0	3
23.	PTLT3023	Leather and Leather Products Costing	3	0	0	3
24.	PTLT3024	Marketing Management	3	0	0	3
25.	PTLT3025	Foreign Trade	3	0	0	3
26.	PTLT3026	Enterprise Resource Planning	3	0	0	3
27.	PTLT3027	Operational Research	3	0	0	3

B. TECH. LEATHER TECHNOLOGY - PART TIME									
Sl. No.	**Subject Area**	**Credits Per Semester**							**Total Credits**
		I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**
	BSC	3	6						**9**
	HSMC	3						3	2	**8**
	ESC	4								**4**
	PCC	3	9	13.5	7.5	11	12	9	3	**68**
	PEC				6	3	3	3	3	**18**
	EEC								3	**3**
Credits Per Semester		**13**	**15**	**13.5**	**13.5**	**14**	**15**	**15**	**11**	**110**

PTHS3101 ENGLISH FOR COMMUNICATION L T P C
3 0 0 3

COURSE OBJECTIVES:

- To build lexical competency and accuracy that will help learners to use language effectively.
- To comprehend the nuances of spoken and written communication in different contexts.
- To learn and use various language functions required for effective communication.
- To read and write different types of texts and comprehend their connotative and denotative meanings.
- To enhance students' listening skills by using different types of audio materials and help them extract necessary information from those materials.

UNIT I BASICS OF COMMUNICATION 9

Listening – Telephone conversation & Writing message, gap filling; **Reading** – Telephone message, bio-note; **Writing** – Personal profile; **Grammar** – Simple present tense, Present continuous tense, Asking questions (wh-questions); **Vocabulary** – One-word substitution, Synonyms.

UNIT II NARRATION 9

Listening – Travel podcast / Watching a travel documentary; **Reading** – An excerpt from a travelogue, Newspaper Report; **Writing** – Narrative (Event, personal experience etc.); **Grammar** – Subject – verb agreement, Simple past, Past continuous Tenses; Vocabulary – Antonyms, Word formation (Prefix and Suffix).

UNIT III DESCRIPTION 9

Listening – Conversation, Radio/TV advertisement; **Reading** – A tourist brochure and planning an itinerary, descriptive article / excerpt from literature; **Writing** – Definitions, Descriptive writing, Checklists; **Grammar** – Future tense, Perfect tenses, Preposition; Vocabulary – Adjectives and Adverbs.

UNIT IV CLASSIFICATION 9

Listening – Announcements and filling a table; **Reading** – An article, social media posts and classifying (channel conversion – text to table); **Writing** – Note making, Note taking and Summarizing, a classification paragraph; **Grammar** – Connectives, Transition words; Vocabulary – Contextual vocabulary, Words used both as noun and verb, Classification related words.

UNIT V EXPRESSION OF VIEWS 9

Listening – Debate / Discussion; **Reading** – Formal letters, Letters to Editor, Opinion articles / Blogs; **Writing** – Letter writing/ Email writing (Enquiry / Permission, Letter to Editor); **Grammar** – Question tags, Indirect questions, Yes / No questions; Vocabulary – Compound words, Phrasal verbs.

Assessment

Two Written Assessments: 35% weightage each
Assignment: 30% weightage
Designing a tourist brochure / Writing an opinion article / Making a travel podcast
End Semester Exam: 3-hour written exam

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1. Use grammar and vocabulary suitable for general context.

CO2. Comprehend the nuances of spoken and written communication.

CO3. Use descriptive and analytical words, phrases, and sentence structures in written communication.

CO4. Read different types of texts and comprehend their denotative and connotative meanings.

CO5. Write different types of texts using appropriate formats.

TEXT BOOKS:

1. "English for Engineers and Technologists" Volume I by Orient Blackswan, 2022
2. "English for Science & Technology - I" by Cambridge University Press, 2023

REFERENCES

1. "Interchange" by Jack C.Richards, Fifth Edition, Cambridge University Press, 2017.
2. "English for Academic Correspondence and Socializing" by Adrian Wallwork, Springer, 2011.
3. "The Study Skills Handbook" by Stella Cortrell, Red Globe Press, 2019
4. www.uefap.com

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PSO 2	PSO 3
CO1	1	1	1	1	1	1	1	1	2	3	1	2	-	-	-
CO2	2	3	2	3	2	3	3	3	3	3	2	3	-	-	-
CO3	2	2	2	2	2	2	2	2	2	3	2	3	-	-	-
CO4	3	3	3	3	2	3	3	3	3	3	2	3	-	-	-
CO5	3	3	3	3	2	3	3	3	3	3	2	3	-	-	-
AVg.	2.2	2.4	2.2	2.4	1.8	2.4	2.4	2.4	2.6	3	1.8	2.8	-	-	-

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTCY3151 ENGINEERING CHEMISTRY L T P C
3 0 0 3

COURSE OBJECTIVES:

- To introduce the basic concepts of polymers, their properties and some of the important applications.
- To impart knowledge on the basic principles and preparatory methods of nanomaterials.
- To facilitate the understanding of corrosion science and protecting coatings.
- To familiarize the operating principles and applications of energy conversion, its processes and storage devices.
- To inculcate sound understanding of water quality parameters and water treatment techniques.

UNIT I POLYMER CHEMISTRY 9

Introduction: Functionality-degree of polymerization. Classification of polymers (Source, Structure, Synthesis and Intermolecular forces). Mechanism of free radical addition polymerization. Properties of polymers: Tg, tacticity, molecular weight-

number average, weight average, viscosity average and polydispersity index (Problems). Techniques of polymerization: Bulk, emulsion, solution and suspension. Engineering Plastics: Polyamides, Polycarbonates and Polyurethanes. Compounding and Fabrication Techniques: Injection, Extrusion, Blow and Calendaring.

UNIT II NANOCHEMISTRY 9

Basics-distinction between molecules, nanomaterials and bulk materials; size-dependent properties (optical, electrical, mechanical, magnetic and catalytic). Types –nanoparticle, nanocluster, nanorod, nanowire and nanotube. Preparation of nanomaterials: sol-gel, solvothermal, laser ablation, chemical vapour deposition, electrochemical deposition and electro spinning. Characterization - Scanning Electron Microscope and Transmission Electron Microscope - Principle and instrumentation (block diagram). Applications of nanomaterials - medicine, agriculture, electronics and catalysis.

UNIT III CORROSION SCIENCE 9

Electrochemical cell, redox reaction, electrode potential - oxidation and reduction potential. Measurement and its application Introduction to corrosion - chemical and electrochemical corrosions-mechanism of electrochemical and galvanic corrosions-concentration cell corrosion-passivity-soil, pitting, inter-granular, water line, stress and microbiological corrosions-galvanic series-factors influencing corrosion-measurement of corrosion rate. Corrosion control-material selection and design-electrochemical protection- sacrificial anodic protection and impressed current cathodic protection. Protective coatings-metallic coatings (galvanizing, tinning), organic coatings (paints). Paints: Constituents and functions.

UNIT IV ENERGY SOURCES 9

Batteries - Characteristics - types of batteries – primary battery (dry cell), secondary battery (lead acid, lithium-ion-battery)- emerging batteries – nickel-metal hydride battery, aluminum air battery, batteries for automobiles and satellites - Fuel cells (Types) – H_2-O_2 fuel cell - Supercapacitors-Types and Applications, Renewable Energy: Solar- solar cells, DSSC.

UNIT V WATER TECHNOLOGY 9

Water – sources and impurities – water quality parameters: colour, odour, pH, hardness, alkalinity, TDS, COD, BOD and heavy metals. Boiler feed water – requirement – troubles (scale & sludge, caustic embrittlement, boiler corrosion and priming & foaming. Internal conditioning – phosphate, calgon and carbonate treatment. External conditioning - demineralization. Municipal water treatment (screening, sedimentation, coagulation, filtration and disinfection-ozonolysis, UV treatment, chlorination), Reverse Osmosis.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1. To recognize and apply basic knowledge on different types of polymeric materials, their general preparation methods and applications to futuristic material fabrication needs.

CO2. To identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.

CO3. To recognize and apply basic knowledge on suitable corrosion protection technique for practical problems.

CO4. To recognize different storage devices and apply them for suitable applications in energy sectors.

CO5. To demonstrate the knowledge of water and their quality in using at different industries.

TEXT BOOKS:

1. Jain P. C. & Monica Jain., “Engineering Chemistry”, 17th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2015.

2. Sivasankar B., “Engineering Chemistry”, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2012.
3. Dara S.S., “A Text book of Engineering Chemistry”, Chand Publications, 2004.

REFERENCES:

1. Schdeva M.V., “Basics of Nano Chemistry”, Anmol Publications Pvt Ltd, 2011.
2. Friedrich Emich, “Engineering Chemistry”, Medtech, 2014.
3. Gowariker V.R., Viswanathan N.V. and Jayadev Sreedhar, “Polymer Science” New AGE International Publishers, 2009.

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	2									
CO2	2	1		2	2							
CO3	2	2	1	1	2							
CO4	2		2		2							
CO5	3	2	2	1	1							
Avg	2	1	1	1	2	-	-	-	-	-	-	-

- 1’ = Low; ‘2’ = Medium; ‘3’ = High

PTLT3101 THEORY OF SKIN PROTEINS AND PRE- TANNING PROCESSES **L T P C 3 0 0 3**

COURSE OBJECTIVE: To understand the basic structure and function of skin and its components and to understand the various pre-tanning processes/operations.

UNIT I STRUCTURE, FUNCTION AND COMPONENTS OF SKIN 9

Organization of skin components in different animals; Structure and function of epidermis, dermis, cutaneous and subcutaneous tissues; hair; fat tissue; nerve; erectorpilli muscle; sweat glands; Various constituents of hides and skins; Fibrous and non-fibrous proteins in skin; Structure and properties of complex carbohydrates and proteoglycons; Structure and properties of fatty acids; Structure, function and properties of amino acids.

UNIT II COLLAGEN: STRUCTURE, FUNCTION, THERMAL TRANSITION AND DEGRADATION 9

Structure of collagen; Types of collagen; Tropocollagen molecules; Sub-units of collagen; Kinetics of fibril formation; Electron microscopy of the collagen fibre; Biosynthesis; Denaturation temperature; Mechanism of denaturation process; Thermal shrinkage; Factors influencing melting transition; Degradation of collagen – collagenase and mechanism of action.

UNIT III PRESERVATION AND PRE-TANNING PROCESSES 9

Principles of preservation of hides and skins **-** Defects due to parasitic diseases of livestock that affect leather quality.

Chemistry and principles of different pre-tanning processes - Soaking, liming, deliming, bating, pickling, depickling and degreasing.

UNIT IV CLEANER PROCESSING IN BEAMHOUSE PRACTICES 9

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

UNIT V PRACTICE AND QUALITY CONTROL 9

Different methods of pre-tanning processes as applied to light, heavy and industrial leathers. Process control in pre-tanning operations.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1. Illustrate various structural components and functions of skin/hide.

CO2. Apply the molecular structure of collagen and its supramolecular assemblies and their characteristics.

CO3. List out the various steps in preservation and pre-tanning process.

CO4. Explain the various cleaner pre-tanning processes.

CO5. Elaborate the quality control requirements of pre-tanning process.

TEXT BOOKS AND REFERENCES:

1. Lehninger A.L., Nelson D.L., Cox M.M., “Principles of Biochemistry", CBS Publications,1993.
2. Gustavson, K.H., `The Chemistry and Reactivity of Collagen', Academic Press, New York, 1958.
3. Flaherty, O., William Roddy, T. Robert, M. Lollar, `The Chemistry and Technology of Leather', Vol.1 Preparation for Tannage, E Robert Krieger Publishing Company, New York, 1978.
4. Bienkiewicz, K., "Physical Chemistry of Leather Manufacture", Krieger, Florida, 1982.
5. Voet D., Voet G., “Biochemistry ", Second Edition, John Wiley and Sons, 1994.
6. Stryer L., “Biochemistry ", Fourth Edition, 1994.
7. Darnell J., Lodish H., Baltimore D., “Molecular Cell Biology ", Freeman W.H., 1990.
8. “Microbes and Enzymes - -Basics and Applied”, R. Puvanakrishnan, Former Sc.G. and Head, Dept. of Biotechnology, CLRI.

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO 3
CO1	3	2	1	-	1	-	1	-	-	1	-	2	-	3	1
CO2	3	2	1	-	-	-	-	-	-	1	-	2	-	3	1
CO3	3	2	1	1	1	1	3	1	1	1	-	2	1	3	2
CO4	3	2	1	2	1	3	3	2	2	1	-	2	2	3	3
CO5	3	2	1	2	1	1	3	2	2	1	-	2	2	3	3

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTGE3153 PROGRAMMING IN C L T P C
2 0 4 4

UNIT I - BASICS OF C PROGRAMMING 6+12

Introduction to programming paradigms –- Structure of C program - C programming: Data Types - Constants - Keywords - Operators: Precedence and Associativity - Expressions - Input/Output statements, Assignment statements - Decision making statements - Switch statement.

PRACTICALS:

- Designing programs with algorithms/flowchart
- Programs for i/o operations with different data types
- Programs using various operators
- Programs using decision making and branching statements

UNIT II – LOOP CONTROL STATEMENTS AND ARRAYS 6+12

Iteration statements: For, while, Do-while statements, nested loops, break & continue statements - Introduction to Arrays: Declaration, Initialization - One dimensional array -Two dimensional arrays – Searching and sorting in Arrays – Strings – string handling functions - array of strings

PRACTICALS:

- Programs using for, while, do-while loops and nested loops.
- Programs using arrays and operations on arrays.
- Programs implementing searching and sorting using arrays
- Programs implementing string operations on arrays

UNIT Ill - FUNCTIONS AND POINTERS 6+12

Modular programming - Function prototype, function definition, function call, Built-in functions – Recursion – Recursive functions - Pointers - Pointer increment, Pointer arithmetic - Parameter passing: Pass by value, Pass by reference, pointer and arrays, dynamic memory allocation with *malloc/calloc*

PRACTICALS:

- Programs using functions
- Programs using recursion
- Programs using pointers & strings with pointers
- Programs using Dynamic Memory Allocation

UNIT IV - STRUCTURES AND UNION 6+12

Storage class, Structure and union, Features of structures, Declaration and initialization of structures, array of structures, Pointer to structure, structure and functions, typedef , bit fields , enumerated data types, Union.

PRACTICALS:

- Programs using Structures
- Programs using Unions
- Programs using pointers to structures and self-referential structures

UNIT V – MACROS AND FILE PROCESSING 6+12

Preprocessor directives – Simple and Conditional macros with and without parameters - Files - Types of file processing: Sequential and Random access – File operations – read, write & seek.

PRACTICALS:

- Programs using pre-processor directives & macros
- Programs to handle file operations

- Programs to handle file with structure

COURSE OUTCOMES:

Upon completion of the course, the students will be able to

CO1: Write simple C programs using basic constructs.
CO2: Design searching and sorting algorithms using arrays and strings.
CO3: Implement modular applications using Functions and pointers.
CO4: Develop and execute applications using structures and Unions.
CO5: Solve real world problem using files.

Total Hours: 90 (30+60)

TEXT BOOKS:

1. Kernighan, B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2015.
2. Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020.

REFERENCE BOOKS:

1. Pradip Dey, Manas Ghosh, "Computer Fundamentals and Programming in C", Second Edition, Oxford University Press, 2013.
2. Ashok N Kamthane, Programming in C, Pearson, Third Edition, 2020
3. Reema Thareja, "Programming in C", Oxford University Press, Second Edition, 2016.
4. Paul Deitel and Harvey Deitel, "C How to Program with an Introduction to C++", Eighth edition, Pearson Education, 2018.
5. Byron S. Gottfried, "Schaum's Outline of Theory and Problems of Programming with C'" McGraw-Hill Education, 1996.
6. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", 1st Edition, Pearson Education, 2013.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	POS	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	3	1	2	2	1	-	-	-	2	-	3
2	3		3	3	1	1	-	-	-	-	-	-
3	3	3	3	3	2	-	-	-	3	-	-	-
4	3	3	3	3	2	-	-	-	3	-	3	3
5	3	3	3	3	3	2	-	-	-	-	3	3
Avg	1	2.4	2.8	2	0.2	0.2	-	-	-	0.4	0.4	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

SEMESTER II

PTLT3201 LEATHER MANUFACTURE I L T P C
3 0 0 3

COURSE OBJECTIVE:

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

UNIT I PRODUCT BRIEF OF LEATHERS FROM HIDES 9

Product brief of various light and heavy leather manufacture from hides. Raw material availability. Usage of imported hides in leather manufacturing.

UNIT II PROCESS TECHNOLOGY FOR LEATHERS FROM HIDES 9

Process details to achieve the specifications for the following leathers: Full chrome/Semi chrome/Chrome retan - uppers, suedes, nubuck, lining, nappa, shrunken grain, upholstery, burnishable, printed leathers; Upgradation technologies; Rectification of defects in hides.

UNIT III LIGHT LEATHER MANUFACTURE FROM HIDES 9

Property requirement of upper, garment and other light leathers such as industrial gloves from hides; Process design considerations; Choice of raw material; International standards requirements for the light leathers from hides.

UNIT IV HEAVY LEATHER MANUFACTURE FROM HIDES 9

Property requirement of sole, harness, saddle and other industrial leathers from hides; Process design considerations; Choice of raw material; Traditional and modern methods; International standards required for the heavy leathers. Heavy lather for strategic sector.

UNIT V SPORTS GOODS LEATHERS 9

Different types of raw materials used, physical and chemical properties required and process details to achieve the specifications for the following sports goods leathers: Leathers for football, volley ball, hockey ball and cricket ball. Glove leathers for wicket keepers and boxing.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be in the position to,

CO1. Compare and classify the basic product brief of light and heavy leather manufacture from hides.

CO2. Analyse the property requirement and process design of heavy leather.

CO3. Evaluate the property requirement and process design of light leather.

CO4. Perceive in depth knowledge in process technology for leather from hides.

CO5. Compile the physical and chemical properties of raw materials used in sports goods leathers.

TEXT BOOKS AND REFERENCES:

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

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO 3
CO1	1	-	-	1	2	1	2	1	1	1	1	2	1	3	2
CO2	3	2	1	1	2	-	2	1	-	1	1	2	-	3	2
CO3	3	2	1	1	1	1	2	1	1	-	1	2	1	2	1
CO4	3	-	1	-	1	1	1	1	1	1	1	1	1	3	2

CO5	3	2	-	-	2	-	1	1	-	1	-	1	1	-	2
Avg	2.6	1.2	0.6	0.6	1.6	0.6	1.6	1	0.6	0.8	0.8	1.6	0.8	2.2	1.8

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTLT3202 THEORY INORGANIC TANNAGES L T P C
3 0 0 3

COURSE OBJECTIVE:

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

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

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

UNIT II AQUEOUS CHEMISTRY OF CHROMIUM 8

Electronic configuration and its implications, common oxidation states of chromium, redox stabilities of chromium (VI) and chromium (III) salts, redox potentials and their interconversion, protolysis, kinetic inertness of chromium (III), basicity, olation, oxolation and polymerisation, Stiasny's series, Mc Clandish precipitation point.

UNIT III FACTORS CONTROLLING CHROME TANNING 8

Principles of analytical and instrumental methods employed in analysis of various chrome Single and double bath chrome tannages and their relative merits and demerits, preparation of basic chromium sulphate (BCS) salt, reaction parameters influencing composition of BCS, kinetics of chrome tanning, diffusion and complexation, effects of float volume, pH, basicity, masking, temperature, drum speed, ageing chrome tanned substrates.

UNIT IV MECHANISM OF CHROME TANNAGE 9

Theories of chrome tanning; absorption, coating, electrostatic and hydrogen bond interactions and coordinative forces involved in chrome tanning, indirect evidence for chrome binding sites in protein, hydrothermal stability of chrome-collagen compound.

UNIT V OTHER INORGANIC TANNAGES 10

Aqueous chemistry of aluminium (III), zirconium (IV), titanium (IV) and iron(III) and its relevance to mineral tanning, chemistry of silicates and phosphates and their tanning mechanisms, mechanism of inorganic tannages and their relevance to combination tanning.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be in the position to,

CO1.Understand the basics of coordination chemistry involved in inorganic tanning.
CO2.Understand the aqueous chemistry of inorganic tannages.
CO3.Comprehend the chemistry of chromium and factors controlling chrome tanning.
CO4.Have knowledge on mechanism of chrome tanning.
CO5.Understand the mechanism of various inorganic tannages.

TEXT BOOKS AND REFERENCES:

1. Fred O Flaherty, Roddy, T.W. and Lollar, R.M. `The Chemistry and Technology of Leather', Vol.III, Type of tannages, Rober E.Krieger Publishing Co.,New York, 1977.
2. Gustavson, K.H. `Chemistry of Tanning Processes' Academic Press, New York, 1956.
3. Bienkiewicz `Physical Chemistry of Leather Manufacture' Krieger, Florida 1982.
4. Covington A D, 'Tanning Chemistry' RSC Publishing, Cambridge, UK, 2009.
5. Howes, F.N. "Vegetable tanning materials", Butterworth. London, 1953.
6. Haslam, E. "The biochemistry of Plants", Vol.7. Academic Press, 1981, Chapter 18, "Vegetable tannins". "A survey of modern vegetable tannages". Tanning extracts Producers Federation, Switzerland, 1975.
7. Humphreyes, G.H.W. and Jones, C.R. "The manufacture of sole and other heavy leathers". Pergamon Press, 1966. Chapter 5, "Vegetable tannin materials and syntans".
8. Vegetable and Synthetic Tanning agents, Sundara Rao, V.S., et al – The Leather Industry, (ed. by Sadulla, S) Kothari Desk book series, H.C. Kothari Group (Publications Division), Madras, p.71, 1995.

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	P O 10	PO 11	PO 12	PS O1	PS O2	PS O 3
CO1	3	1	-	-	1	-	1	1	-	1	-	1	1	3	1
CO2	3	3	1	-	1	1	3	1	2	1	-	1	1	2	2
CO3	3	2	1	-	1	2	2	1	1	1	-	1	1	3	2
CO4	3	1	-	-	1	-	2	1	-	1	-	1	1	3	2
CO5	3	3	3	-	1	2	2	1	2	1	-	1	1	2	1
Avg	3	2	1	0	1	1	2	1	1	1	0	1	1	2.6	1.6

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTLT3203 PRINCIPLES OF UNIT PROCESSES AND OPERATIONS L T P C
3 0 0 3

COURSE OBJECTIVE: To Impart Basic and Applied Knowledge on Unit Process and Operation Involved in the Leather and Leather Chemicals Manufacture as well as Preparedness for future developments and Environmental compliances for Sustainable development.

UNIT I GENERAL UNIT PROCESS PRINCIPLES AND CONCEPTS WITH RELEVANCE TO LEATHER AND LEATHER CHEMICALS MANUFACTURE 5

General Principles of Unit Operations and Unit Processes in Leather and Leather Chemicals Processing: Definition of Unit Operation and Unit process; Various Aspects and Parameters; Reactions types with Solis-Liquid-Gases; Development of process flow sheets – BIS Symbols, flow diagrams with reference to Leather & Leather chemical industrial design and processes; Process control and safety; Leather Drying Methods and Principles, Pollution abatement.

UNIT II PRINCIPLES OF UNIT OPERATIONS: METERING OF FLUIDS, HEAT TRANSFER AND MASS TRANSFER 15

Fundamentals of Heat Transfer, Heat transfer equipment, Heat exchangers, Evaporators and Condensers and Simple Design Calculations.
Diffusion: Binary diffusion, concept of mass transfer coefficients and interface mass transfer and stage wise contact.
Distillation: Principle of distillation, Application of distillation in leather chemicals and auxiliaries processing.
Extraction: Extraction principles, Leaching and Extraction equipments. General theory and Practice.
Drying: Drying characteristics, Theory and mechanism of drying, estimation of drying rate, design and performance of industrial dryers for leather.
Humidification: Humidity charts, methods of humidification and dehumidification; Equipments and their design aspects; Humidity control in leather processing.

UNIT III MECHANICAL SEPARATIONS 8
Size reduction: Theory and equipment; application in leather chemical processing.
Clarification: Principles of clarification, Liquid-Liquid, Liquid-solid and Liquid-gas separations, Application in leather processing and effluent treatment Mixing: Basic theory and application in leather and leather chemical processing.

UNIT IV PRINCIPLES OF UNIT PROCESSES 11
General Principles of Esterification, Hydrolysis, Oxidation, Reduction, Hydrogenation. Halogenation, Polymerization, Nitration, Sulphation and Sulphonation, Condensation Reaction, Diazotization and Coupling.
Tanning agents: Vegetable tannins and Vegetable tannin extracts – Raw Materials, Vegetable tannin extracts Manufacture, Process Flow diagram, Concepts, Parameters and Application in Leather Manufacture. Basic Chromium Sulphate (BCS) Manufacture – BCS tanning agent concept, Chrome ores, BCS preparations, Unit Process Reactions and Process Flow diagram. Aluminium, Titanium, Iron and Zirconium, Tanning salts Preparation with Unit Process Reaction for leather processing.
Oils, Fats and Detergents Industries: Fatliquor Manufacture: Preparation of Fatliquor from oils/fats and imparting charge characteristics; Anionic, Cationic and Non-ionic fatliquors and Leather auxiliaries. Raw materials; Process Flow diagram. Oils and fats; their nature and products derived from oils and fats, Fatty Acids and Alcohols, waxes and fatliquors.
Syntan Manufacture: General Concepts of Syntans; Phenol-Aldehyde Condensation Reaction and Product as Anionic Syntan. Process Flow diagram.
Dyes and Dyes Intermediates: Concept of Color, Chromophores, Auxochromes, Raw materials; Diazotization and Coupling reaction for the Manufacture Dyes and Dyes Intermediates. Process Flow diagram.
Surface coating agents for Leather Finishing: Synthetic Binders, Lacquers and Pigments: Binders based on acrylics, polyamides, polyesters, polyurethanes, polypropylene. Lacquers and Pigments.
Recent Developments Leather and Leather Chemicals Manufacture for sustainable development: Recent developments like REACH, UN's SDG's, Eco-Lables, Chemicals/ Process Safety Standards and Compliances; and their implications on leather & leather chemicals for sustainable development; Alternate eco-benign leather chemicals and auxiliaries for leather manufacture.

UNIT V WATER AND INORGANIC CHEMICALS 6
Treatment of water for domestic and industrial purposes – Soda-Lime, Ion-Exchange, Zeolite processes, Manufacture of Sodium chloride, Sodium sulphide, Sodium sulphite and Bisulphite, Sodium carbonate, Caustic soda, Lime, Sulphuric and Hydrochloric acids.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1. Explain the basic concepts of unit operations and unit processes in leather and leather chemicals processing.

CO2. Make use of the concept of material and energy balances and fluid dynamics mass and heat transfer in various unit operations such as distillation, extraction, drying and humidification.

CO3. Examine the size reduction and separation and mixing techniques technology of organic and inorganic chemicals involved in the processing of leather and leather chemicals.

CO4. Interpret the principle of various unit processes in leather chemical processing.

CO5. Elaborate About the use of water and manufacture of inorganic chemicals used in leather manufacture.

TEXT BOOKS AND REFERENCES:

1. McCabe. W.L and Smith, J.C., Unit Operations in Chemical Engineering, McGraw Hill, Fourth Ed., 1993.
2. Treybal, R.E., Mass Transfer Operations, McGraw Hill Book Company, Third Ed. 1981.
3. Coulson, J.M., and Richardson, J.F., Chemical Engineering, Vol.I and II Third Ed. Pergamon press, 1978.
4. Welty, J.R., Wilson, R.E., and Wicks, C.E. Fundamentals of momentum, Heat and Mass Transfer, Third Ed., John Wiley, 1984.
5. Perry, J.H., Chemical Engineers Handbook, McGraw Hill, New York, Sixth Ed., 1984.
6. Shreve, R.N., Austin, G.T., Shreve's Chemical Process Industries, McGraw-Hill Book company, 1984.
7. Groggins, P.H., Unit Processes in Organic synthesis, McGraw-Hill Book company, 5th Edition, 2004.
8. Dutta, S.S., An introduction to the principles of leather manufacture, ILTA.
9. Thorstensen, T.C., Practical Leather Technology, Krieger Publications, 1993.

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	1	1	1	1	1	1	2	1	1	1	2	1	3	1
CO2	3	2	1	1	1	2	1	2	1	1	1	2	2	3	1
CO3	3	-	1	1	1	1	1	2	1	1	1	2	2	3	2
CO4	3	1	1	1	1	-	1	2	1	1	1	2	-	3	3
CO5	3	1	1	1	1	1	1	2	1	1	1	2	-	3	3
Avg	3	1	1	1	1	1	1	2	1	1	1	2	1	3	2

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTMA3352 PROBABILITY AND STATISTICS L T P C

3 1 0 4

UNIT I ONE-DIMENSIONAL RANDOM VARIABLES (9+3)

Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Functions of a random variable.

UNIT II TWO-DIMENSIONAL RANDOM VARIABLES (9+3)

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III ESTIMATION THEORY (9+3)

Sampling distributions – Characteristics of good estimators – Method of Moments – Maximum Likelihood Estimation – Interval estimates for mean, variance and proportions.

UNIT IV TESTS OF SIGNIFICANCE (9+3)

Type I and Type II errors – Tests for single mean, proportion, Difference of means (large and small samples) – Tests for single variance and equality of variances – χ^2 test for goodness of fit – Independence of attributes.

UNIT V DESIGN OF EXPERIMENTS (9+3)

Completely Randomized Design – Randomized Block Design – Latin Square Design – 2^2 factorial design.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

On completion of the course, the students will be able to:

CO1: To analyze the performance in terms of probabilities and distributions achieved by the determined solutions.

CO2: To be familiar with some of the commonly encountered two dimensional random variables and be equipped for a possible extension to multivariate analysis.

CO3: To apply the basic principles of the estimation theory to practical situations.

CO4: To demonstrate the knowledge of large / small sample theory in statistical inference.

CO5: To obtain a better understanding of the importance of the methods in modern industrial processes.

TEXT BOOKS:

1. Irwin Miller and Marylees Miller "John E. Freund's Mathematical Statistics with applications", Pearson India Education, Asia, 8th Edition, 2014.
2. Devore, J.L. "Probability and Statistics for Engineering and the Sciences", Cengage Learning, 8th Edition, 2011.

REFERENCES:

1. Milton, J.S. and Arnold, J.C. "Introduction to Probability and Statistics", Tata McGraw Hill, New Delhi, 4th Edition, 3rd Reprint, 2008.
2. Ross, S.M. "Introduction to Probability and Statistics for Engineers and Scientists", Elsevier, New Delhi, 5th Edition, 2014.
3. Spiegel, M.R., Schiller, J., Srinivasan, R.A. and Goswami, D. "Schaum's Outline of Theory and Problems for Probability and Statistics", McGraw Hill Education, 3rd Edition, Reprint, 2017.
4. Walpole, R.E., Myers R.H., Myres S.L., and Ye, K. "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 9th Edition, 2011.

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO 3
CO1	2	2	1	2	1	–	–	–	–	–	1	1	1	-	-
CO2	2	2	1	3	1	–	–	–	–	–	1	1	1	-	-
CO3	2	2	1	3	1	–	–	–	–	–	2	2	1	-	-
CO4	2	2	1	3	1	–	–	–	–	–	1	1	1	-	-
CO5	2	2	1	3	1	–	–	–	–	–	2	2	1	-	-
Avg	2	2	1	2.8	1	–	–	–	–	–	1.4	1.4	1	-	-

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTCY3251 ENVIRONMENTAL SCIENCE AND SUSTAINABILITY L T P C
2 0 0 2

UNIT I ENVIRONMENT AND BIODIVERSITY 6

Definition, scope and importance of environment – need for public awareness. Eco-system and Energy flow– ecological succession. Types of biodiversity: genetic, species and ecosystem diversity– values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ.

UNIT II ENVIRONMENTAL POLLUTION 6

Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollutions. Solid, Hazardous and E-Waste management. Case studies on Occupational Health and Safety Management system (OHASMS). Environmental protection, Environmental protection acts.

UNIT III RENEWABLE SOURCES OF ENERGY 6

Energy management and conservation, New Energy Sources: Need of new sources. Different types new energy sources. Applications of- Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy.

UNIT IV SUSTAINABILITY AND MANAGEMENT 6

Development , GDP ,Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocolsSustainable Development Goals-targets, indicators and intervention areas Climate change- Global, Regional and local environmental issues and possible solutions-case studies. Concept of Carbon Credit, Carbon Footprint. Environmental management in industry-A case study.

UNIT V SUSTAINABILITY PRACTICES 6

Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transports. Sustainable energy: Non-conventional Sources, Energy Cyclescarbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization- Socioeconomical and technological change.

TOTAL : 30 PERIODS

COURSE OUTCOMES:

CO1 To recognize and understand the functions of environment, ecosystems and biodiversity and their conservation.

CO2 To identify the causes, effects of environmental pollution and natural disasters and contribute to the preventive measures in the society.

CO3 To identify and apply the understanding of renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.

CO4 To recognize the different goals of sustainable development and apply them for suitable technological advancement and societal development.

CO5 To demonstrate the knowledge of sustainability practices and identify green materials, energy cycles and the role of sustainable urbanization.

TEXTBOOKS:

1. Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers , 2018.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2016.
3. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
4. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Pearson; 1st edition, 2011.
5. Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, CL Engineering; International edition, 2015.
6. Environment Impact Assessment Guidelines, Notification of Government of India, 2006.
7. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998.

REFERENCES :

1. Daniel J. Sherman, David R. Montgomery, " Environmental Science and Sustainability", W. W. Norton, Incorporated, 2nd edition, 2023.
2. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', B.S Publications, 2010.
3. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publications, Mumbai, 2001.
4. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT. LTD, New Delhi, 2007.
5. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 3rd edition, 2015.
6. Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2013.

CO - PO Mapping

Course Outcome	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO 6	PO7	PO8	PO 9	PO 10	PO 11	P O 12	PS O1	PS O2	PSO 3
CO1							3						2	-	-
CO2		2	3										2	-	-
CO3			2				3						2	-	-
CO4							3	3					2	-	-
CO5			3				2	2					2	-	-
Avg	-	**2**	**3**	-	-	-	**3**	**3**	-	-	-	-	2	-	-

• 1' = Low; '2' = Medium; '3' = High

SEMESTER III

PTLT330	LEATHER MANUFACTURE II	L T P C
1		3 0 0 3

COURSE OBJECTIVE:

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

UNIT I PROPERTIES OF LEATHER 9

Classification of leathers, Definition of various leather properties, Understanding and measurement of properties, Relevance and significance of various leather properties in manufacture and usage for different end application. Raw material availability and significance of imported in skins in light leather manufacture.

UNIT II UPPER AND LINING LEATHERS 9

Shoe upper, lining leathers: Choice of raw materials, relationship between each leather property and process parameter; Rational of preparation of the same.

UNIT III GARMENT AND GLOVE LEATHERS 9

Garment nappa, fine glove leathers: Choice of raw materials, relationship between each leather property and process parameter; Rational of preparation of the same.

UNIT IV OTHER SPECIALITY LEATHERS 9

Chamois, suede garment, glazed kid leathers, Fur on leather etc: Choice of raw materials, relationship between each leather property and process parameter; Rational of preparation of the same.

UNIT V LIGHT LEATHER MANUFACTURE 9

Process of manufacture of leathers such as glazed kid, nappa garment, fine glove, suede garment and lining; Quality control aspects with special reference to light leather manufacture.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1. Summarize the property variations of different leathers.
CO2. Design and Design suitable processing variations that are required to manufacture leather from skin.
CO3. List out the various method to develop specialty leathers from skin.
CO4. Explain and understand the leather property and process parameter.
CO5. Comprehend the quality control aspects of light Leather.

TEXT BOOKS AND REFERENCES:

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

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PSO 2	PSO 3
CO1	3	3	1	1	-	-	-	2	-	1	-	1	0	3	2
CO2	3	3	1	1	2	1	2	2	1	1	1	1	0	3	3
CO3	3	3	1	1	2	1	2	2	1	1	1	1	2	3	1

CO4	3	3	1	1	2	1	2	2	1	1	1	1	2	3	3
CO5	3	3	1	1	3	2	2	2	2	1	2	1	1	3	1
Avg	3	3	1	1	1.8	1	1.6	2	1	1	1	1	1	3	2

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTLT3302 THEORY OF ORGANIC TANNAGES L T P C
3 0 0 3

COURSE OBJECTIVE: At the end of this course, the students will have knowledge on the chemistry of various vegetable and organic tanning agents and the mechanism of their interaction with the skin protein - Collagen.

UNIT I VEGETABLE TANNINS 14

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

UNIT II CONSTITUENTS OF VEGETABLE TANNING MATERIALS 7

Tannins as well as non-tannins, polyphenolic constituents present in popular tanning materials like avaram, konnam, wattle, cutch, babul, myrobalan, etc., and their physicochemical properties and their effect on the physical properties of leathers.

UNIT III MECHANISM AND PRACTICE OF VEGETABLE TANNING 10

Mechanism of reaction of vegetable tannins with collagen. Electrolytic equilibria, diffusion equilibria, fixation and absorption equilibria. General practices in vegetable tanning. Pit tanning and drum tanning. Manufacture of E.I. leathers - Modern practices in E.I. tanning.

UNIT IV OTHER ORGANIC TANNAGES 8

Mechanism of tanning with Aldehyde, Dialdehydes, oil, Sulphonyl chloride, Quinone, oxazolidine, phosphonium and other organic tanning agents; wet white leathers; Synthetic tannins - Classification - properties, uses in leather industry - Mechanism of reaction with collagen.

UNIT V PREPARATION OF VEGETABLE TANNIN EXTRACTS AND SYNTHETIC TANNING AGENTS 6

Methods of preparation of vegetable tannin extracts, spray dried vegetable tannins, synthetic and other organic tannages.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be in the position to,

CO1. Summarize the basic structure and classification of veg tannins.

CO2. Make use of different constituents of veg-tannages to assess the tanning chemistry.

CO3. Comprehend the chemistry of vegetable tannins and mechanism of vegetable and organic tanning.

CO4. Explain the mechanism of various organic tannages.

CO5. Formulate the method of preparation of the veg tannins and syntans.

TEXT BOOKS AND REFERENCES:

1. Howes, F.N. “Vegetable tanning materials”, Butterworth. London, 1953.
2. Rodd, “Chemistry of carbon compounds”, Vol. III-D, Chapter on “Hydrolysable tannins”.
3. Haslam, E. “The biochemistry of Plants”, Vol.7. Academic Press, 1981, Chapter 18, “Vegetable tannins”. “A survey of modern vegetable tannages”. Tanning extracts Producers Federation, Switzerland, 1975.
4. Humphreyes, G.H.W. and Jones, C.R. “The manufacture of sole and other heavy leathers”. Pergamon Press, 1966. Chapter 5, “Vegetable tannin materials and syntans”.
5. O’Flaherty and Roddy,T.W. , Lollar, R.M. “The Chemistry and Technology of Leather”, Vol. II. Krieger Publishing Corpn., New York, 1977.
6. Gustavson, K.H. “Chemistry of Tanning Processes” Academic Press, New York, 1950.
7. Vegetable and Synthetic Tanning agents, Sundara Rao, V.S., et al – The Leather Industry, (ed. Bu Sadulla, S) Kothari Desk book series, H.C. Kothari Group (Publications Division), Madras, p.71, 1995.

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PSO 2	PSO 3
CO1	3	3	2	2	3	1	1	-	-	1	1	2	3	2	2
CO2	3	3	2	2	3	1	1	-	-	1	1	2	3	2	2
CO3	3	2	2	2	3	1	1	-	-	1	1	2	3	2	2
CO4	3	2	2	2	3	1	1	-	-	1	1	2	3	3	3
CO5	3	3	2	2	3	1	1	-	-	1	1	2	2	2	2
Avg	3	2.6	2	2	3	1	1	0	0	1	1	2	2.8	2.2	2.2

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTLT3303 PRINCIPLES OF TESTING FOR LEATHER L T P C
3 0 0 3

COURSE OBJECTIVE: To impart knowledge on analytical methods for the analysis of leather, leather chemicals and process liquors generated during processing of leathers.

UNIT I ANALYSIS OF LEATHER CHEMICALS 10

Principles of analytical methods employed in analysis of pretanning chemicals – Lime, unhairing, deliming and bating agents; Vegetable tanning materials and extracts; Aldehydes; Chrome extracts and liquors; Principles of analytical and instrumental methods employed in analysis of syntans, dyes, oils and fats, fatliquor, finishing auxiliaries. Specifications recommended by standards organizations.

UNIT II ANALYSIS OF PROCESS LIQUORS AND EMISSIONS 8

Principles of analytical methods employed in analysis of pretanning chemicals – Lime, unhairing, deliming and bating agents; Vegetable tanning materials and extracts; Aldehydes; Chrome extracts and liquors; Principles of analytical and instrumental

methods employed in analysis of syntans, dyes, oils and fats, fatliquor, finishing auxiliaries. Specifications recommended by standards organizations.

UNIT III ANALYSIS OF LEATHERS 9

Principles of analytical and instrumental methods employed in analysis of various chrome leathers, vegetable tanned leathers; Specifications recommended by standards organizations. Principles of analytical and instrumental methods employed in analysis of eco-sensitive substances- Pentachlorophenol (PCP), Formaldehyde, Hexavalent chromium [Cr(VI)], azodyes etc., present in finished leathers.

UNIT IV MICROBIOLOGY FOR LEATHER 8

Testing of bacterial action on raw hides and skins and in the different stages of Leather Manufacture. Effect of mould growth during processing of skins/hides, finished leathers, leather goods and during transportation. Testing and prevention of mould growth during processing, storage of finished goods and transportation.

UNIT V PHYSICAL TESTING OF LEATHERS 10

Orientation of fibre structure of skins/hides and leathers using various microscopes; Sampling position for physical testing of leathers. Different physical testing methods - principles involved. Static and Dynamic methods, Non-destructive testing of leathers.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1. Explain the analytical chemistry behind the testing of leather chemicals and leathers.
CO2. Apply the various techniques for analysing leather chemicals, spent process liquors, and pelts/ leathers.
CO3. Classify the quality Standards of various leather chemicals and leather end products.
CO4. Perceive the importance of microbiology testing techniques of leathers.
CO5. Discuss the various physical testing methods of leathers.

TEXT BOOKS AND REFERENCES:

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

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PSO 2	PSO 3
CO1	3	3	1	1	2	1	1	2	1	1	-	1	1	3	2
CO2	3	1	1	1	2	1	1	-	1	1	-	1	1	2	1
CO3	3	2	1	1	2	1	1	1	1	1	-	1	1	2	1
CO4	3	2	1	1	2	1	1	1	1	1	-	1	1	3	2
CO5	3	2	1	1	2	1	1	1	1	1	-	1	1	3	2

Avg	3	2	1	1	2	1	1	1	1	1	-	1	1	3	2

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTLT3304 INSTRUMENTAL METHODS OF ANALYSIS L T P C
3 0 0 3

COURSE OBJECTIVE: To introduce various methods of chemical analysis through sophisticated instruments for accuracy.

UNIT I INTRODUCTION TO SPECTROSCOPICAL METHODS OF ANALYSIS 10

Electromagnetic radiation; Various ranges, Dual properties, Various energy levels, Interaction of photons with matter, absorbance, and transmittance and their relationship, permitted energy levels for the electrons of an atom and simple molecules, classification of instrumental methods based on physical properties. Various transitions in organic and inorganic compounds effected by UV, visible and infrared radiations, various energy level diagrams of saturated, unsaturated and carbonyl compounds, excitation by UV and Visible radiations

UNIT II MOLECULAR SPECTROSCOPY 10

UV-Visible-Spectroscopy- Effects of auxochromes and effects of conjugation on the absorption maxima. Beer-Lambert's Law, Limitations, Deviations (Real, Chemical, Instrumental).

IR spectroscopy: Units & measurement, Range of IR radiation, Principle, Theory- Molecular vibrations, Vibrational Frequency- Hook's Law, Number of Fundamental vibrations, Factors affecting vibrational Frequency, Instrumentation.

1H NMR Spectroscopy- Introduction to NMR; isotope ratios, nuclear spin; chemical shifts, coupling constants and integration; Fourier transform technique. Chemical shifts, coupling constants and correlation with structure and stereochemistry. Long range coupling; magnetic and chemical shift equivalence; first and second order spectra.

UNIT III ATOMIC SPECTROSCOPY 8

Atomic Absorption Spectrophotometry; Principle, Instrumentation and Application, Various interferences observed in AAS (Chemical, radiation and excitation); Flame photometry; Principle, Instrumentation and applications.

UNIT IV POLARIMETRY, REFRACTOMETRY AND THERMAL ANALYSIS 9

Polarimetry and refractometry Principle, instrumentation and Applications. Thermogravimetry: Instrumentation, applications, thermograms of some important compounds; Differential thermal analysis: principle, Instrumentation and applications, Principles and applications of DSC, DTA in leather and leather chemicals.

UNIT V CHROMATOGRAPHIC METHODS 8

Classification of chromatographic methods, column, Thin layer, paper, Gas, GPC, High performance liquid chromatographical methods (principles, mode of separation, instrumentation and technique) for the analysis of leather auxiliaries.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be in the position to,

CO1. Illustrate gain fundamental knowledge about the electromagnetic spectrum and its limitations.

CO2. Develop and understand the underpinning science behind molecular spectroscopy
CO3. List out the various principles of atomic spectroscopy and its application.
CO4. Explain the concept of various physico-chemical analytical methods.
CO5. Elaborate the various chromatographic techniques for leather chemical analysis.

TEXT BOOKS AND REFERENCES:

1. Willard, H.H., Merritt, L.L., Dean J.A., and Settle, F.A., Instrumental methods of analysis, Sixth edition, CBS publishers, 1986.
2. Parikh V.M. Absorption spectroscopy of organic molecules Addisen –Wesley Publishing company, 1994.
3. Skoog D.A. and West D.MM., Fundamentals of Analytical Chemistry, Saunders – college Publishing, 1982.
4. Banwell, G.C., Fundamentals of molecular spectroscopy TMH, 1992.

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PSO 2	PSO 3
CO1	3	3	2	2	3	1	1	-	-	1	1	2	3	2	2
CO2	3	3	2	2	3	1	1	-	-	1	1	2	3	2	2
CO3	3	2	2	2	3	1	1	-	-	1	1	2	3	2	2
CO4	3	2	2	2	3	1	1	-	-	1	1	2	3	3	3
CO5	3	3	2	2	3	1	1	-	-	1	1	2	2	2	2
Avg	3	2.6	2	2	3	1	1	0	0	1	1	2	2.8	2.2	2.2

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTLT3311 CHEMICAL TESTING AND ANALYSIS LABORATORY L T P C
0 0 3 1.5

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

Analysis of Lime

a. Purity of lime
b. Total bases

Analysis of Deliming Agents

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

Analysis of Bate Agent

Enzyme Assay

Analysis of Vegetable Tanning Materials

a. Qualitative analysis
b. Quantitative analysis
c. Acids and salts in vegetable tannin extracts by different methods

Analysis of Chrome tanning agents

a. Moisture
b. Cr2O3 content
c. Acid combined with chromium
d. Basicity: Proctor and Lehigh basicities
e. Degree of olation

Analysis of Syntans
Quantification of phenolic contentand free formaldehyde
Analysis of Oils and fatliquors

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

Chemical Analysis of pelts and leathers

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1. Illustrate the practical experience and understanding on the analysis of various leather chemicals.
CO2. Determine the practical knowledge on pelts/leathers analysis.
CO3. Solve and propose to understand the challenges of eco-sensitive substances and their qualitative and quantitative analytical methods.

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO 6	PO7	PO8	PO 9	PO 10	PO 11	P O 12	PS O1	PS O2	PSO 3
CO1	2	3	1	3	2	1	1	1	2	1	-	1	2	3	3
CO2	2	3	1	3	2	1	1	1	2	1	-	1	-	3	1
CO3	2	3	1	3	2	1	1	1	2	1	-	1	1	3	2
Avg	1.2	1.8	0.6	1.8	1.2	0.6	0.6	0.6	1.2	0.6	0	0.6	0.6	1.8	1.2

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

SEMESTER IV

PTLT3401 LEATHER CHEMICALS L T P C
3 0 0 3

COURSE OBJECTIVE: To impart knowledge on the chemistry and properties of various auxiliaries used in leather processing.

UNIT I INTRODUCTION 8
Leather Auxiliaries – Roles and Functions, Classification of Auxiliaries based on applications and chemistry.
Leather chemicals – Roles and functions, classification of leather chemicals based on application.

UNIT II SYNTANS 10
Syntans – Introduction to raw materials and background to relevant chemistries of production such as sulfonation, condensation, polymerisation etc. Technology for preparation of aromatic sulfonic acid – formaldehyde /urea-formaldehyde and sulfone based syntans. Role of syntan product chemistries in obtaining desired feel in leather. General manufacturing principles of acrylic, PU and other polymeric syntans.

UNIT III FATLIQUORS 9

Physical chemistry of colloids. Chemistry of emulsifying agents. Stability and Efficiency of emulsions. Chemistry of oils and fats – Differences, chemical structure of fatty acids, classification of oils, differences between animal, vegetable and mineral oils. Chemical modification of oils for applications in leather. Differences between natural and synthetic fatliquors. General manufacturing principles of fatliquors.

UNIT IV DYE AND PIGMENTS 10

Theory of colour. Fundamentals of colour matching. Particle size. Relevance of particle size of colour. Chemical constituents of dyes. Classification of dye and introduction to chromophores. Structural features of dyes. General manufacturing principles of dyes.
Pigments – classification, relevance of particle size to colour. Introduction to various types of pigments and their chemistries. General manufacturing principles of pigments. Differences between dyes and pigments.

UNIT V FINISHING CHEMICALS 8

Classification of finishes. Chemistry of film formation and theory of adhesion. Binders – chemical classification, General understanding of polymeric, protein and other types of binders. General understanding of the chemistries of plasticizers, feel modifiers, waxes, slip agents.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course, the students are expected to,
CO1.Classify and explore leather auxiliaries and leather chemicals.
CO2.Acquire indepth knowledge on synthetic tanning agents.
CO3.Comprehend chemistry of oil and oil modification for the leather lubrication.
CO4.Explore the physical chemistry of colloids.
CO5.Analyse the chemistry of finishing chemicals.

TEXT BOOKS AND REFERENCES:

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

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	P O 12	PS O1	PS O2	PSO 3
CO1	3	1	1	-	2	1	3	1	1	1	1	1	-	3	2
CO2	3	1	1	-	3	-	2	1	1	1	2	1	-	3	2
CO3	3	1	1	-	1	2	1	1	1	1	-	1	2	3	2
CO4	3	1	1	-	2	1	2	1	1	1	1	1	2	3	2
CO5	3	1	1	-	2	1	2	1	1	1	1	1	1	3	2
Avg	3	1	1	0	2	1	2	1	1	1	1	1	1	3	2

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTLT3402 LEATHER AND LEATHER PRODUCTS MACHINERIES L T P C
3 0 0 3

COURSE OBJECTIVE: To provide orientation on the machineries used for leather and leather products manufacture.

UNIT I MECHANICAL POWER TRANSMISSION AND FLUID POWER SYSTEMS 9

Machine elements bearing, shafts keys and coupling shaft. Introduction to mechanical power transmission system components- Belts, chains, Gears and Cams. Introduction to Fluid power – Advantages and Applications – Fluid power systems – Types of fluids - Properties of fluids. Pumps, compressor, control valves and actuator used in fluid power system.

UNIT II PRINCIPLES AND OPERATION OF LEATHER PROCESSING MACHINERIES 9

Salient features, purpose and mechanism of working of the various machinery used in beam house, tanning and finishing yards - unhairing, fleshing, scudding, sammying, setting, shaving, staking, buffing, dedusting, glazing machines, finiflex, hydraulic press, curtain coating, roller coating, transfer coating, autospray, driers, measuring machine. latest trends and innovations in leather processing machinery, including the use of automation, robotics, and data analytics for improved efficiency and productivity.

UNIT III PRINCIPLES AND OPERATION OF LEATHER PRODUCT MACHINERIES 9

Salient features and purpose and mechanism of working of the various machinery used in leather product manufacturing – Clicking, Splitting, Skiving, sewing machines – Flat bed, Post bed, Cylinder bed machines, strap cutting machine, lasting machines – Forepart lasting, Heel seat lasting, Side lasting, Post lasting machines, Heat setting, Ponding, Roughing, Heat activator, Sole pressing, Shoe polishing machine. prevailing technological developments and their impact on these machines and their operations.

UNIT IV TRANSPORT SYSTEMS AND AUTOMATION IN LEATHER PRODUCT MANUFATURING 9

Different types of material handling system in leather products industry. Manual, semi-automatic and automatic conveyor. Fundamental of industrial robot application, Introduction to warehouse automation and logistics management. Introduction to collaborative robots (cobots) for leather product assembly and packing. Application of computer/microprocessor based machines for leather products making, Die Less Cutting Systems.

UNIT V LAYOUT AND MAINTENANCE 9

Lay out for a small/medium tannery and leather product unit. Arrangements of machines as per the sequence of operation for standard leather processing/ product making. Preventive maintenance and safety utilizing digital systems and real-time monitoring tools in the use of leather and leather product machineries.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be in the position to,

CO1. Explain the knowledge of mechanical power transmission and fluid power systems.
CO2. Choose and construct the working principles of leather processing machineries.
CO3. Explain the working principles of leather product machineries.
CO4. Evaluate the transport systems and automation in leather product manufacture.
CO5. Elaborate the layout and maintenance of tannery and leather product unit

TEXT BOOKS AND REFERENCES:

1. Walter Landmann, The Machines in the Tannery – A Review of Leather Producing Machinery and Equipment in current use, World Trades Publishing, UK, 2003.
2. T.C.Thorstensen, Practical Leather Technology- Robert E.krieger Publishing Company, Huntington, New york, 1976.
3. Thornton, J.H, "Text book for footwear manufacture", National Trade press, London, 1970.
4. Blakeman, J., "An introduction to applied science for boot and shoe manufacture", The Anglo American Technical Co. Ltd., London, 1924.

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO 6	PO7	PO8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
CO1	2	2	1	-	2	1	1	1	1	2	1	1	2	3	2
CO2	3	2	1	-	1	1	1	1	1	1	1	1	-	3	2
CO3	2	2	1	-	2	1	1	1	1	1	1	1	1	3	1
CO4	1	2	1	-	2	1	1	1	1	-	1	1	1	3	3
CO5	2	2	1	-	3	1	1	1	1	1	1	1	1	3	2
Avg	2	2	1	0	2	1	1	1	1	1	1	1	1	3	2

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTLT3411 PHYSICAL TESTING AND ANALYSIS LABORATORY L T P C
0 0 3 1.5

COURSE OBJECTIVE: To provide practical knowledge on microscopical and microbiological testing of leathers and physical testing of leathers.

MICROSCOPY LAB

a) Setting up of a compound microscope
b) Preparation of microscopical slides by paraffin embedding method and by freezing method
c) Identification of hides and skins from their morphological and histological pattern of Buffalo, Cow, Sheep, Goat, Pig and other species
d) Microscopical assessment of fibre structure during the process - Soaking, liming, pickling and tanning and different finished leathers.

MICROBIOLOGY LAB

a) Preparation of various culture media
b) Staining of bacteria
c) Enumeration of bacteria in hides and skins and in tan liquors
d) Isolation and identification of fungi/mold/yeast in raw hides/skins, leathers and tan liquors
e) Mildew resistance test for leathers
f) Identification of insect and parasitic damages in skins/hides/leathers (Entomology demo only)

PHYSICAL TESTING LAB

Strength Properties

a) Tensile Strength and Elongation at break
b) Tongue tear strength

c) Stitch tear and slit tear strengths

Fastness Properties

a) Rub fastness
b) Light fastness

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1. Summarize the various microscopical analysis/identification of leathers.

CO2. Analyze the various microbiological testing of raw skins/hides, pelts and leathers and various process liquors.

CO3. Demonstrate the various physical testing methods for assessing leathers

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO 6	PO7	PO8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO 3
CO1	2	3	1	3	2	1	1	1	2	1	1	1	2	3	1
CO2	2	3	1	3	2	1	1	1	2	1	1	1	1	3	3
CO3	2	3	1	3	2	1	1	1	2	1	1	1	-	3	2
Avg	2	3	1	3	2	1	1	1	2	1	1	1	1	3	2

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

SEMESTER V

PTLT3501 THEORY OF LEATHER FINISHING L T P C
3 0 0 3

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

UNIT I SURFACE COATING 9

Finishing vs DGFT norms; Updates in the export of finished leathers; Theory of surface coating; Characteristics of various components of coating system; Parameters of the process of coating and its influence on coating characteristics; Testing of coatings.

UNIT II PIGMENTS 9

Classification of pigments; Inorganic, organic, nacreous (pearlescent) and interference pigments - their representation code in the colour index. Different forms of pigments - powders and pastes. Evaluation and control of their brilliance, opacity, particle size, resistance to solvent, heat and light and colour matching.

UNIT III POLYMERIC MATERIALS AND THEIR DISPERSION FORMS 9

General introduction to addition and condensation polymerization; various methods of polymerisations, resins binders - acrylics, vinyls and urethanes, protein binders, cellulose nitrate, cellulose acetate butyrate, - protein binders - lacquers - emulsion and emulsifiers - evaluation and control - solvents and thinners.

UNIT IV PRINCIPLES OF FINISHING, FINISH FORMULATIONS ANDTHEIR APPLICATION 9

Impregnation: Terminology, types of impregnating binders, characteristics, selection of systems for corrected and full grain impregnation, formulations, application methods and precautions

Finishing: Definition, aims, film formation mechanisms, properties of films such as glass transition temperature / minimum film forming temperature, transparency, gloss and resistance to heat, light and solvent. Binder to pigment ratio, plasticizer, wetting agents, role in dispersion and stability - requirements in multiple coat technique – such as clearing coat, sealer coat, base coat, top and feel coat. Single coat composition methods like spraying, curtain coating, roller coating etc. Compact finishing systems and their advantages. Cationic finishes and their relative merits. Foam finish; Eco- friendly finishing - Volatile Organic Compounds (VOC) reductions. Finish formulation for various types of leathers.

UNIT V VARIOUS FINISHING METHODS AND TECHNIQUES 9

Role of equipment like HVLP spray, Roller coats, Continuous embossing machines, Finiflex, etc. Methods such as oil pull-up, waxy, burnishable, antique, grain suede, screen printing, roller printing, tie and dye finishing. Pearl finishing, easy-care and patent finishing, cationic finishing, foam finishing, transfer foil, lamination, transfer coating, texture modification/creation using perforation, scaling, engraving and foil transfer. Finishing of leather products and components. Maintenance of leather products and easy care steps.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On the completion of the course students are expected to,

CO1. Demonstrate the role of various finishing agents and auxiliaries used in leather finishing.

CO2. Inspect the various strategies for finishing different types of leathers.

CO3. Categorize the various upgradation technologies for enhancing value to low grade substrates.

CO4. Perceive the application of different machineries used in leather finishing.

CO5. Discuss the principles of finishing mechanisms.

TEXT BOOKS AND REFERENCES:

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

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO2	PO3	PO 4	PO 5	PO 6	PO7	PO8	PO 9	PO 10	PO 11	P O 12	PS O1	PS O2	PSO 3
CO1	3	1	-	-	2	1	-	1	1	1	-	2	2	3	2
CO2	3	1	-	-	-	-	-	1	1	1	-	2	1	3	2
CO3	3	2	1	-	2	-	1	1	1	1	-	2	-	3	2
CO4	3	3	2	-	3	2	2	1	1	1	-	2	1	3	1
CO5	3	3	2	-	3	2	2	1	1	1	-	2	1	3	3
Avg	3	2	1	0	2	1	1	1	1	1	0	2	1	3	2

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTLT3502	BIOTECHNOLOGY FOR LEATHER	L T P C 3 0 0 3

COURSE OBJECTIVE: To impart knowledge on biotechnological applications in processing of skins into leather.

UNIT I PROTEINS, NUCLEIC ACID AND ENZYMOLOGY 9

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

UNIT II GENETIC ENGINEERING (RECOMBINANT DNA TECHNOLOGY) 10

Principles and methods: Essentials of biotechnology – products of biotechnology, Restriction enzymes, vectors, DNA cloning strategies.

UNIT III ENZYMES FOR LEATHER PROCESSING 10

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

UNIT IV WASTE MANAGEMENT FOR LEATHER 8

General features of the organic and inorganic pollutants of tannery. Stabilization and disposal of organic and chemical wastes and their biological treatment. Possible energy generation from wastes.

UNIT V UTILISATION OF COLLAGENOUS TISSUES FOR BIOMEDICAL AND OTHER APPLICATIONS 8

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1. Explore and understand the biotechnological concepts and its relevance for application in leather processing.

CO2. Acquire in depth knowledge in the principles of genetic engineering.

CO3. Analyse the different types of enzyme used for leather processing.

CO4. Articulate the waste management system for leather industries.

CO5. Acquire breadth of knowledge of collagen application.

TEXT BOOKS AND REFERENCES:

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

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PSO 2	PSO 3
CO1	3	1	1	1	3	1	3	3	1	1	-	1	2	3	1
CO2	3	-	1	1	1	1	3	1	1	1	-	1	-	3	3
CO3	3	2	1	1	2	1	3	2	1	1	-	1	1	3	2
CO4	3	1	1	1	2	1	3	2	1	1	-	1	1	3	2
CO5	3	1	1	1	2	1	3	2	1	1	-	1	1	3	2
Avg	3	1	1	1	2	1	3	2	1	1	0	1	1	3	2

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTLT3503 FINISHING TECHNIQUES L T P C
3 0 0 3

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

UNIT I INTRODUCTION 9

Preparing leather for finishing, grain clearing, wet pigmenting, buffing of grain surface, polishing, glazing, plating, printing and embossing, preparation of finishes,

UNIT II APPLICATION OF FINISHES 9

Pad coating, spray coating, Roller coating, design of Roller coater, curtain coating requirements, behaviour of curtain coating mixtures, drying conditions, fixation,

UNIT III FINISHING FOR DIFFERENT TYPES OF LEATHERS 9

Shoe upper leather, nappa leather, glaze kid leather, nubuck leather, suede leather, patent leather, corrected grain leather, pull-up leather, clothing leather.

UNIT IV NOVEL FINISHING TECHNIQUES 9

Role of newer equipments like auto spray, roller coats, continous embossing machines, finiflex etc., Methods such as oil-pull-up, Waxy burnishable, antique, grain sueded, screen printing, roller coating, pearl finishing easy care and patent finishing.

UNIT V CLEANER FINISHING TECHNIQUES 9

Role of finishing equipment such as HVLP spray, foam finishing, etc. in cleaner perspective. Aqueous finishing concepts and formulation; Other novel finishing techniques to reduce VOC. Cleaner finishing of splits for shoe suede, garment suede, grain finished effect and specialty finishes - processing technologies and finishing techniques especially suited for the purpose. Upgradation of lower ends for better utilization.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On the completion of the course students are expected to,

CO1. Outline the various finishing agents and auxiliaries used in leather finishing.

CO2. Summarize the various application methods of finishing
CO3. Categorize the different types of finished leathers
CO4. Evaluate and assess the various novel finishing techniques
CO5. Discuss and improve the new cleaner finishing techniques

TEXT BOOKS AND REFERENCES:

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

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12	PSO 1	PS O2	PSO 3
CO1	3	1	-	-	2	1	-	1	1	1	-	2	2	3	2
CO2	3	1	-	-	-	-	-	1	1	1	-	2	1	3	2
CO3	3	2	1	-	2	-	1	1	1	1	-	2	-	3	2
CO4	3	3	2	-	3	2	2	1	1	1	-	2	1	3	1
CO5	3	3	2	-	3	2	2	1	1	1	-	2	1	3	3
Avg	3	2	1	0	2	1	1	1	1	1	0	2	1	3	2

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTLT3511 FINISHING PRACTICE LABORATORY L T P C
0 0 4 2

COURSE OBJECTIVE: To provide practical training in various methods of finishing of leathers.

Practical training/demonstration to students in the following areas:

- Modern methods of finishing
- Use of cross linkers, Feel modifiers
- Water repellent finish formulations
- Finishing using Roller coaters, Transfer coating m/c
- Cationic and foam finishing technologies
- Patent finishing using Roller Coaters
- Trouble shooting in finishing
- Finishing of various types of leathers – chrome-free, exotic, upholstery and water-repellent leathers
- Finishing of split leathers
- Finishing of leather components and leather products

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of this course, the students are expected to,
CO1. Illustrate the practical experience in finishing of various types of leathers.
CO2. Analyse the recent technology involved in leather finishing.
CO3. Compile the use of various machinery operation involving in leather finishing.

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	P O 12	PS O1	PS O2	PSO 3
CO1	3	3	1	2	2	1	1	1	2	1	1	2	2	3	3
CO2	3	3	1	2	2	1	1	1	2	1	1	2	1	3	1
CO3	3	3	1	2	2	1	1	1	2	1	1	2	-	3	2
Avg	1.8	1.8	0.6	1.2	1.2	0.6	0.6	0.6	1.2	0.6	0.6	1.2	0.6	1.8	1.2

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

SEMESTER VI

PTLT3601 INDUSTRIAL ENGINEERING L T P C
3 0 0 3

COURSE OBJECTIVE: To design and develop Industrial engineering manufacturing operations.

UNIT I PRODUCT DESIGN AND DEVELOPMENT 9

Principles of product design, tolerance design; Quality and cost considerations; Product life cycle; Standardization, simplification, diversification; Value engineering and analysis; Concurrent engineering; Design for "X".

UNIT II WORK SYSTEM DESIGN 9

Taylor's scientific management, Gilbreths's contributions; Productivity – concepts and measurements; Method study, Micro-motion study, Principles of motion economy; Work measurement – time study, Work sampling, Standard data, PMTS; Ergonomics; Job evaluation and merit rating.

UNIT III FACILITY DESIGN 9

Facility location factors and evaluation of alternate locations; Types of plant layout and their evaluation; Computer aided layout design techniques; Assembly line balancing; Materials handling systems.

UNIT IV OPERATION RESEARCH 9

Linear programming – problem formulation, simplex method, duality and sensitivity analysis; Transportation and assignment models; Integer programming; Constrained and unconstrained nonlinear optimization; Markovian queuing models; Simulation – manufacturing applications.

UNIT V PRODUCTION CONTROL 9

Forecasting techniques – causal and time series models, moving average, exponential smoothing, trend and seasonality; Aggregate production planning; Master production scheduling; MRP, MRP-II and ERP; Routing, scheduling and priority dispatching; Push and pull production systems, concepts of Lean and JIT manufacturing systems; Logistics, distribution, and supply chain management; Inventory – functions, costs, classifications, deterministic inventory models, quantity discount; Perpetual and periodic inventory control systems.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1. Compare and contrast the principles and costing of product design.
CO2. Classify and analyse the work system design and ergonomics.
CO3. Design and develop layout design techniques and material handling.
CO4. Explain operational research and simulation applications.
CO5. Develop forecasting techniques and classification of inventory models.

TEXT BOOKS AND REFERENCES:

1. Tolerance Design: A Handbook for Developing Optimal Specifications, Clyde M Creveling.
2. Design for Six Sigma in Technology and Product Development.
3. The Principles of Scientific Management, Fredrick Winslow Taylor.
4. Handbook of Industrial Engineering by Gavriel Salvendy.

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO2	PO3	PO 4	PO 5	PO 6	PO7	PO8	PO 9	PO 10	PO 11	P O 12	PS O1	PS O2	PSO 3
CO1	3	1	1	1	3	1	3	3	1	1	-	1	2	3	1
CO2	3	-	1	1	1	1	3	1	1	1	-	1	-	3	3
CO3	3	2	1	1	2	1	3	2	1	1	-	1	1	3	2
CO4	3	1	1	1	2	1	3	2	1	1	-	1	1	3	2
CO5	3	1	1	1	2	1	3	2	1	1	-	1	1	3	2
Avg	3	1	1	1	2	1	3	2	1	1	0	1	1	3	2

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTLT3602 SUPPLY CHAIN MANAGEMENT L T P C
3 0 0 3

COURSE OBJECTIVE: Understand the scope and practice of business logistics and supply chain in service oriented firms.

UNIT I INTRODUCTION 9

Business logistics and supply chain – importance, objectives, study approach, strategy – planning, selecting proper channel, performance measuring. Outsourcing-Make vs buy approach – sourcing strategy.

UNIT II MANAGING FLOWS 9

Planning Networks – Decision making under risk – Decision trees – Decision making under uncertainty. Distribution Network Design – Role - Factors Influencing Options, Value Addition. Supply Chain Network optimization models. Logistics information system - Role of IT – Framework for IT adoption.

UNIT III INVENTORY 9

Policy Decisions–objectives-control -Retail Discounting Model, Newsvendor Model; EOQ and EBQ models for uniform and variable demand – With and without shortages -Quantity discount models. Probabilistic inventory models.

UNIT IV TRANSPORTATION 9

Transportation – Drivers, Modes, Measures - Strategies for Transportation – Vehicle Scheduling – Vehicle Routing and Scheduling-Transportations Models (Maximizing and Minimizing)- Initial Basic Feasible Solutions – Test for Optimality – Iteration towards optimality. Assignment Models (Minimizing and Maximizing) – Solution thro' Hungarian Algorithm – Traveling Salesmen models – Crew assignment problems.

UNIT V ORGANISATION AND CONTROL 9

Organisation Structure – need and development. Organizational – Choices, Orientation and positioning. Inter-functional and inter-organisational management – alliances and partnerships. Control – Process framework, system details, information, measurement and interpretation.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1. Acquire basic knowledge on logistics and supply chain management.
CO2. Explore the tools and practices for managing an organisation.
CO3. Analyse the importance and management of the inventory.
CO4. Elucidate the importance of transportation and strategies.
CO5. Elucidate on the organization structure and responsibilities for the supply chain management.

TEXT BOOKS AND REFERENCES:

1. Ronald H. Ballou and Samir K. Srivastava, Business Logistics and Supply Chain Management, Pearson education, Fifth Edition.
2. Janat Shah, Supply Chain Management, Pearson Education, 2008.
3. Sunil Chopra and Peter Meindl, Supply Chain Management-Strategy Planning and Operation, PHI Learning / Pearson Education, 2007.
4. Mohanty R.P and Deshmukh S.G, Supply chain theories and practices, Biztantra. publications, 2007.
5. Leenders, Johnson, Flyn, Fearon, Purchasing and supply management, Tata McGraw Hill, 2010.
6. Vinod V. Sople, Logistics Management-The Supply Chain Imperative, Pearson. 3rd edition, 2012.

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	2	1	2	2	2	2	1	2	3	1	1	2	-	-	3
CO2	-	1	2	1	-	2	1	2	3	1	1	3	-	2	3
CO3	1	1	2	1	3	2	1	2	3	1	1	1	1	2	3
CO4	1	1	2	1	2	2	1	2	3	1	1	2	2	3	3
CO5	1	1	2	1	2	2	1	2	3	1	1	2	2	3	3
Avg	1	1	2	1.2	1.8	2	1	2	3	1	1	2	1	2	3

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTLT3603 FOOTWEAR TECHNOLOGY L T P C
3 0 0 3

COURSE OBJECTIVE: To impart knowledge on the manufacture, evaluation and application of materials and components used in footwear manufacture.

UNIT I DESIGN AND PATTERN DEVELOPMENT 9

Introduction to human foot and Footwear and its importance - Different types of Footwear based on Styles and Designs – Introduction to Last and its importance – Difference between Human foot and Last – Terminologies on the Last and its parts – Preparation of mean forme by using last – Preparation of of upper and lining standards.

UNIT II FOOTWEAR MATERIALS AND COMPONENTS 9

Importance and vital role of leather in footwear and various types lathers used in footwear – Role of non-leather materials in footwear – Various components used in footwear and its specifications - Types Natural and Synthetic outsole materials – Threads and its quality parameters – Shank and its importance in footwear – Classification of Adhesives and its advantages and disadvantages – Adhesive properties and its quality parameters – Importance of inter-lining materials - Toe puff and counter stiffener - Types of Fasteners and grinderies.

UNIT III CUTTING, PRE-CLOSING AND CLOSING 9

Types of upper and lining leathers based on finish and animal origin; Different types of Natural and Synthetic soling materials – Adhesives used in upper and full shoe manufacturing process; threads, shank, insole boards, reinforcement materials, types of fasteners and grinderies.

UNIT IV PRELASTING AND LASTING 9

Principles and methods of Pre-lasting operations: Counter moulding, insole attaching and toe mulling – Lasting operations: Machine lasting (Toe, side & seat lasting) Sole preparation (Halogenation or roughening), sole cementing, Heat activation, Sole attaching process - Health and Safety control measures follows in shoe manufacturing line – Various Shoe dressing techniques – Quality checking parameters for finished shoe.

UNIT V DIFFERENT METHODS OF SHOE CONSTRUCTION 9

Introduction to cemented construction, its advantages and disadvantages – Introduction to Machine sewn or McKay construction, its advantages and disadvantages – Introduction to Californian construction, its advantages and disadvantages – DVP & DIP constructions, its advantages and disadvantages.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1. Explain the basic of footwear design and the process of pattern development.
CO2. Identify various materials and components used in footwear fabrication process.
CO3. Develop skills on cutting process of various footwear materials
CO4. Outline the sequence of preclosing, closing and prelasting operations of basic footwear models.
CO5. Elaborate various footwear constructions.

TEXT BOOKS AND REFERENCES:

1. Cott, N.F., “American Shoe Making”, Shoe Trades Publishing Co., Cambridge.1993.
2. “Shoes and Leather News”, Published by bureau of foreign and domestic commerce, Dept of commerce, US, 1940.
3. B. Venkatappaiah, (1997), “Introduction to modern footwear technology” Chennai. -

GOTETI GRAPHICS.

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PS O1	PS O2	PS O 3
CO1	3	1	1	-	-	-	2	-	-	1	-	2	1	3	2
CO2	3	2	2	-	1	-	-	-	-	2	-	2	1	3	1
CO3	2	1	2	-	1	1	1	1	1	2	1	2	1	3	2
CO4	3	2	2	2	1	1	3	2	2	2	-	2	2	3	3
CO5	3	2	1	2	1	1	3	2	2	1	-	2	2	3	3
Avg	2.8	1.6	1.6	0.8	0.8	0.6	1.8	1	1	1.6	0.2	2	1.4	3	2.2

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTLT3604 SAFETY IN LEATHER INDUSTRIES L T P C
3 0 0 3

COURSE OBJECTIVE: To impart knowledge on Occupational Safety and Hazard aspects in leather manufacture.

UNIT I SAFETY PHILOSOPHY, HAZARD IDENTIFICATION AND ASSESSMENT 9

Legal framework of safety and health in India International conventions and trends; Responsibilities and enforcement mechanism. Need for safety and health (cost/benefit rational; safety, environment and productivity triangle); Role of industrial hygiene, Hazard classification (hazard categories and groups), Hazard identification and assessment (tools and methods).

UNIT II SAFETY IN USE OF HAZARDOUS SUBSTANCES AT WORK 10

Chemical and biological hazards in the work place in the leather industry; Health effects of chemical and biological exposure Hazard information systems on hazardous substances (material safety data sheets, labelling), workplace exposure monitoring and evaluation, hazard prevention and control measures (storage, handling and disposal) in the leather industry.

UNIT III PRODUCTIVE MACHINE SAFETY IN THE LEATHER INDUSTRY, WORK ECOLOGY AND ERGONOMICS 10

Safety hazards of machinery, machine tools and electrical installations ; Hazard prevention and safeguarding of machinery (guards, machine controls, ergonomics) ; Role of preventive maintenance; Safe workstation design and layout, Manual handling of material; Lighting (standards, use of natural and artificial illumination); Climate control (standards, temperature/humidity, improving general ventilation); Noise management (standards, prevention and protection); Safety of factory premises and installations (railings, flooring, safe structures); Welfare measures; Personal protection and hygiene (selection, use, maintenance).

UNIT IV EMERGENCY PREVENTION AND PREPAREDNESS 8

Planning for emergencies; Control of fire and explosion; Dealing with medical emergencies.

UNIT V SAFETY AND HEALTH MANAGEMENT AND PROMOTION 8

Promoting safety and health practices at the workplace (training, safety and warning signs); Role and responsibilities of managers, supervisors and workers.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the students will be in the position to,

CO1. Acquire knowledge on legal framework of safety and health, hazard identification and assessment methods

CO2. Analyse and understand Chemical and biological hazards in the work place.

CO3. Acquire knowledge on machinery safety, work ecology and ergonomics in the leather industry.

CO4. Comprehensive knowledge on emergency prevention and preparedness.

CO5. Acquire knowledge on safety and health management.

TEXT BOOKS AND REFERENCES:

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

COURSE ARTICULATION MATRIX:

Course Outcomes	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	2	-	1	-	2	2	3	2	1	1	1	2	2	3	1
CO2	2	-	1	-	2	2	3	2	1	1	-	2	1	3	3
CO3	3	3	2	3	3	2	3	3	2	1	3	3	-	3	2
CO4	2	2	1	2	2	2	3	2	1	1	1	2	1	3	2
CO5	1	-	-	-	-	2	3	1	–	1	-	1	1	3	2
Avg	2	1	1	1	1.8	2	3	2	1	1	1	2	1	3	2

SEMESTER VII

PTLT3701 LEATHER GOODS AND GARMENTS TECHNOLOGY L T P C

3 0 0 3

COURSE OBJECTIVE: To impart knowledge on making leather goods and garments.

UNIT I OVERVIEW 9

Classification of Leather Goods and Garments; Selection of Materials, grading and assorting of leathers for leather goods and garments; Property requirements for leather and other materials; Accessories for Leather goods and garments - Various types of fasteners, fittings and other accessories. Alternative materials and their adaptability for goods and garments. Operational sequences in leather goods and garments production.

UNIT II OPERATIONS 10

Production planning: Nomenclature used for component identification in various leather garments skirts, jackets, trousers etc and various leather goods – Wallet, hand bags, Executive bags etc. Process scheduling and line balancing.

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

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

Quality: Quality control measures in leather products manufacture.

UNIT III MACHINERY 9

Machinery needs for leather goods and garments manufacture. Various types of sewing machines – flat bed, cylinder bed, post bed and other special sewing machines – different feed mechanisms. Clicking, splitting, skiving, folding, embossing, creasing machines – their working principles operation and maintenance.

UNIT IV DESIGN AND DEVELOPMENT 9

Pattern design and development – measurement/ sizing for various types of garments, pattern design of leather goods and garments, pattern grading for leather garments. CAD applications for leather goods and garments. Fashion and material trends.

UNIT V ORGANISATION AND MANAGEMENT 8

Project Feasibility reports, plant lay out, costing and pricing for leather goods and garments. Analysis of International market trends for goods and garments – EU, USA and other markets. Social auditing of leather goods and garment units - occupational Health and Safety, ISO 9000 and 14000.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On the completion of the course students are expected to,

CO1. Explain the various materials and components for the manufacture of leather goods and garments. CO2. Develop and construct the various operations involved in making of leather good and garments.

CO3. Analyze and examine the working principle, operation and maintenance of different machineries used for making leather goods and garments.

CO4. Evaluate the various design and development of leather goods and garments.

CO5. Imagine and formulate the Organisation and management of leather goods and garments manufacturing unit.

TEXT BOOKS AND REFERENCES:

1. Pattern Making Manual - Womens Garments, ESMOD, Paris, 1991.
2. Fashion Drawing Method, ESMOD, Paris, 1992.
3. Metric Pattern cutting for Menswear, Winifred Aldrich, BSP Professional Books, London, 1990.
4. Grading Manual, ESMOD, Paris, 1994.
5. Skiving Manual, First Edition, 1994 CLRI, Madras.
6. A course manual on leather garment pattern designing.
7. Leather garments making, NIMI publication, 2012.
8. Leather and sports goods – Pattern and Template marker, NIMI Publications, 2011

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	P O 12	PS O1	PS O2	PSO 3
CO1	3	2	1	-	-	-	1	1	-	1	2	2	3	-	-
CO2	3	3	2	2	2	1	1	1	2	2	2	2	3	-	--
CO3	3	2	2	1	2	1	1	1	-	1	1	2	3	-	-
CO4	3	2	2	2	2	1	1	1	-	2	1	2	3	-	-
CO5	3	3	2	1	1	2	2	1	2	1	3	2	3	-	-
Avg	3	2.4	1.8	1.2	1.4	1	1.2	1	0.8	1.4	1.8	2	3	0	0

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTLT3702 ECO-LABELLING FOR LEATHER SECTOR L T P C
3 0 0 3

OBJETIVE: To understand the importance of eco-labelling and practice on implementation of the eco-labelling standards in leather sector.

UNIT I INTRODUCTION TO ECO-LABELLING 8

Eco-labelling, significance of labelling, history of eco-labelling. Benefit of environmental labelling, demerits of labelling. LCA Concepts.

UNIT II TYPES OF ECO-LABELLING 8

Type I – The 'classic' ecolabel, gold standard of eco-labelling; Type II – Self-declaration claims; Type III – Environmental declarations (report cards/information labels).

UNIT III GLOBAL STANDARDS AND FRAMEWORK FOR ECOLABELLING 11

Principles and procedures for developing Type I environmental labelling programmes; Selection of product categories, product environmental criteria and product function characteristics, and for assessing and demonstrating compliance. ISO 1450:2020 Environmental management — Vocabulary; ISO 14020:2022 Environmental statements and programmes for products — Principles and general requirements; ISO 14021:2016 Environmental labels and declarations — Self-declared environmental claims (Type II environmental labelling);ISO 14024:2018 Environmental labels and declarations — Type I environmental labelling — Principles and procedures;ISO 14025:2006 Environmental labels and declarations — Type III environmental declarations — Principles and procedures; ISO 14040:2006 Environmental management — Life cycle assessment — Principles and framework; ISO 14044:2006 Environmental management — Life cycle assessment — Requirements and guidelines

UNIT IV LEATHER SECTOR ECO-LABELLING 8

Impediment in the eco-labelling of leather sector. Technologies for leather sector to achieve environment friendly approaches.

UNIT V CASE STUDY 10

Implementation of eco-labelling standards in leather and leather allied sectors: Eco-labelling of tanneries, Eco labelling of leather products sectors; Leather allied sectors – Eco-labelling of leather allied sectors.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1. Analyse eco-labelling significance in the leather sector.
CO2. Classify the types of eco- labelling.
CO3. Acquire knowledge of ISO 14024:2018.
CO4. Elucidate the requirement for the qualification of leather sector to eco-labelling.
CO5. Explore the implementation of the eco-labelling for leather sector.

TEXT BOOKS AND REFERENCES:

1. Ecolabelling and international trade, Simonetta Zarrilli, Veena Jha, Rene Vossenaar.
2. Green Marketing as a Positive Driver Toward Business Sustainability, Anitha Acharya.

COURSE ARTICULATION MATRIX:

Course Outcomes	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	2	-	1	-	2	2	3	2	1	1	1	2	2	3	1
CO2	2	-	1	-	2	2	3	2	1	1	-	2	1	3	3
CO3	3	3	2	3	3	2	3	3	2	1	3	3	-	3	2
CO4	2	2	1	2	2	2	3	2	1	1	1	2	1	3	2
CO5	1	-	-	-	-	2	3	1	–	1	-	1	1	3	2
Avg	2	1	1	1	1.8	2	3	2	1	1	1	2	1	3	2

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTLT3703 REDUCE, REUSE AND RECYCLE L T P C
3 0 0 3

COURSE OBJECTIVE: To impart knowledge on reduce, reuse and recycle concepts in leather and leather products manufacture

UNIT I INTRODUCTION 10

What is Waste? Waste Management Hierarchy and 3R Principle of Reduce, Reuse and Recycle. Waste minimization – reducing waste generation at source. Principles of Waste Utilization and waste as a resource and recovery from waste. Types of waste (organic, inorganic, hazardous, infectious etc.). Characterization & Classification of waste – agrobased, forest residues, industrial waste (hazardous and non-hazardous), municipal solid waste, plastic waste, biomedical waste, e-waste etc.

Concept of–Zero Waste–Zero Pollution–Zero Landfill. General methods of attaining zero pollution. Economics of zero pollution.

UNIT II WASTE TO ENERGY 8

Introduction to waste production in different sectors such as slaughterhouse, tannery, goods and garments manufacture and footwear. Waste-to-Energy – combustion, gasification, pyrolysis, biomethanation, bio-refineries. Landfill gas generation, collection conversion to fuels for useful energy applications-engine, compressors, burners, lamps etc.

UNIT III WASTE RECYCLING **8**

Waste recycling to recover resources –Slaughter house, tannery, goods and garment and footwear industry

UNIT IV WASTE UTILIZATION **10**

Technologies for Waste Utilization and cleaner production processes in Leather manufacture (Beam house, Tanning, Post tanning and Finishing)

UNIT V CASE STUDIES **9**

Case studies & implementation of waste utilization in different product sectors: Manufacturing process, pollution sources, waste characterization, waste reduction/reuse/recovery and final treatment methods for–Tanning industry; Garment; Goods; Footwear; ETPs

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1. Explain waste as a resource aspect.

CO2. Identify and analyse different waste generation methods in different product sectors.

CO3. Perceive knowledge on waste recycling and develop new products.

CO4. Justify the different methods of waste utilization and cleaner leather processing techniques.

CO5. Elaborate the effect of implementation of RRR in the industry.

TEXT BOOKS AND 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.

COURSE ARTICULATION MATRIX:

Course Outcomes	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
CO1	2	-	1	-	2	2	3	2	1	1	1	2	2	3	1
CO2	2	-	1	-	2	2	3	2	1	1	-	2	1	3	3
CO3	3	3	2	3	3	2	3	3	2	1	3	3	-	3	2
CO4	2	2	1	2	2	2	3	2	1	1	1	2	1	3	2
CO5	1	-	-	-	-	2	3	1	–	1	-	1	1	3	2
Avg	2	1	1	1	1.8	2	3	2	1	1	1	2	1	3	2

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTLT3704	TOTAL QUALITY MANAGEMENT	L T P C
		3 0 0 3

COURSE OBJECTIVES:

- Teach the need for quality, its evolution, basic concepts, contribution of quality gurus, TQM framework, Barriers and Benefits of TQM.
- Explain the TQM Principles for application.
- Define the basics of Six Sigma and apply Traditional tools, New tools, Benchmarking and FMEA.
- Describe Taguchi's Quality Loss Function, Performance Measures and apply Techniques like QFD, TPM, COQ and BPR.
- Illustrate and apply QMS and EMS in any organization.

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality –Definition of TQM-- Basic concepts of TQM –-Gurus of TQM (Brief introduction) -- TQM Framework- Barriers to TQM –Benefits of TQM.

UNIT II TQM PRINCIPLES 9

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

UNIT III TQM TOOLS & TECHNIQUES I 9

The seven traditional tools of quality - New management tools - Six-sigma Process Capability; Bench marking - Reasons to benchmark, Benchmarking process, what to Bench Mark, Understanding Current Performance, Planning, Studying Others, learning from the data, Using the findings, Pitfalls and Criticisms of Benchmarking - FMEA - Intent, Documentation, Stages: Design FMEA and Process FMEA.

UNIT IV TQM TOOLS & TECHNIQUES II 9

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

UNIT V QUALITY MANAGEMENT SYSTEM 9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1. Explain the TQM concepts in a selected enterprise.

CO2. Summarize the TQM principles in a selected enterprise.

CO3. Apply the six sigma, traditional tools, new tools, benchmarking and FMEA as TQM tools in leather manufacturing.

CO4. Analyze Taguchi's Quality Loss Function and Performance Measures on leather manufacturing sector and apply QFD, TPM, COQ and BPR.

CO5. Adapt QMS and EMS in leather based organization.

TEXT BOOKS AND REFERENCES:

1. Dale H.Besterfiled, Carol B.Michna,Glen H. Bester field,MaryB. Sacre, Hemant Urdhwareshe and Rashmi Urdhwareshe, "Total Quality Management", Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression,2013.
2. Joel.E. Ross, "Total Quality Management – Text and Cases", Routledge.,2017.
3. Kiran.D.R, "Total Quality Management: Key concepts and case studies, Butterworth – Heinemann Ltd, 2016.
4. Oakland, J.S. "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, Third Edition, 2003.
5. Suganthi,L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO 6	PO7	PO8	PO 9	PO 10	PO 11	P O 12	PS O1	PS O2	PSO 3
CO1	1	1	2	2	2	2	1	3	3	1	2	2	-	-	3
CO2	-	1	2	1	-	2	1	2	3	2	1	3	2	2	3
CO3	1	1	2	2	3	2	1	2	3	2	1	2	1	2	3
CO4	2	2	3	1	2	1	1	2	3	1	2	2	1	3	3
CO5	2	2	2	2	2	2	2	2	3	1	1	2	2	3	3
Avg	1.2	1.4	2.2	1.6	1.8	1.8	1.2	2.2	3	1.4	1.4	2.2	1.2	2	3

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

SEMESTER VIII

PTLT3801 **QUALITY ASSURANCE FOR LEATHER** **L T P C**
3 0 0 3

COURSE OBJECTIVE: To train the students to understand and implement quality assurance system in the leather manufacturing unit.

UNIT I INTRODUCION TO QUALITY ASSURANCE 8

Definition of quality, fundamentals of statistics and probability, confidence intervals, testing significance, statistical process control techniques, analysis, defect diagnosis and prevention. Quality assurance- Definition, Importance of quality assurance, Quality Assurance vs. Quality Control, Pros and cons of QA, History of ISO and QA, QA standards.

UNIT II RAW MATERIAL QUALITY 9

Importance of raw material quality assessment in leather processing, Pre-tanning raw material assessment, tanning raw material assessment, post tanning raw material assessment, finishing raw material assessment.

UNIT III PROCESS CONTROL IN LEATHER PROCESSING 9

Process flow charts; In-process control check; Responsibilities; Calibration, validation and qualification of the pre-tanning, tanning, post tanning and finishing processes.

UNIT IV INTERMITTENT QUALITY CONTROL 9

Calibration, validation and qualification of the pelt/leather at intermittent stages – Limed pelt, pickled pelt, tanned leather, crust leather, finished leather.

UNIT V CASE STUDY **10**

Implementation of the quality assurance system in the leather manufacturing unit.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1. Comprehend the importance of quality assurance in the leather sector.

CO2. Explore and understand the importance of the quality of raw materials for leather processing.

CO3. Acquire knowledge of the in process control of leather manufacturing.

CO4. Elucidate the qualification of the interment products.

CO5. Explore and analyse the implementation of the quality assurance for leather manufacturing.

TEXT BOOKS AND REFERENCES:

1. A. J. Duncan, “Quality Control and Industrial Statistics”, Homewood, Illinois, Published by Irwin, 1986.
2. “International Organization for Standardization” case postale 56, CH-1211-Geneva – 20, Switzerland.
3. “Bureau of Indian Standards”, New Delhi.
4. Dale H.Besterfiled, Carol B.Michna,Glen H. Bester field,Mary B.Sacre,HemantUrdhwareshe and RashmiUrdhwareshe, “Total Quality Management”, Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression,2013.
5. Joel.E. Ross, “Total Quality Management – Text and Cases”,Routledge.,2017.
6. Kiran.D.R, “Total Quality Management: Key concepts and case studies, Butterworth – Heinemann Ltd, 2016.
7. Oakland, J.S. “TQM – Text with Cases”, Butterworth – Heinemann Ltd., Oxford, Third Edition, 2003.
8. Suganthi,L and Anand Samuel, “Total Quality Management”, Prentice Hall (India) Pvt. Ltd., 2006 .

COURSE ARTICULATION MATRIX:

Course Outcomes	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	2	-	1	-	2	2	3	2	1	1	1	2	2	3	1
CO2	2	-	1	-	2	2	3	2	1	1	-	2	1	3	3
CO3	3	3	2	3	3	2	3	3	2	1	3	3	-	3	2
CO4	2	2	1	2	2	2	3	2	1	1	1	2	1	3	2
CO5	1	-	-	-	-	2	3	1	–	1	-	1	1	3	2
Avg	2	1	1	1	1.8	2	3	2	1	1	1	2	1	3	2

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTGE3851 HUMAN VALUES AND ETHICS **L T P C**

2 0 0 2

COURSE DESCRIPTION

This course aims to provide a broad understanding about the modern values and ethical principles that have evolved and are enshrined in the Constitution of India with regard to the democratic, secular and scientific aspects. The course is designed for undergraduate students so that they could study, understand and apply these values in their day to day life.

COURSE OBJECTIVES:

- To create awareness about values and ethics enshrined in the Constitution of India
- To sensitize students about the democratic values to be upheld in the modern society.
- To inculcate respect for all people irrespective of their religion or other affiliations.
- To instill the scientific temper in the students' minds and develop their critical thinking.
- To promote sense of responsibility and understanding of the duties of citizen.

UNIT I DEMOCRATIC VALUES 6

Understanding Democratic values: Equality, Liberty, Fraternity, Freedom, Justice, Pluralism, Tolerance, Respect for All, Freedom of Expression, Citizen Participation in Governance – World Democracies: French Revolution, American Independence, Indian Freedom Movement.
Reading Text: Excerpts from John Stuart Mills' *On Liberty*

UNIT II SECULAR VALUES 6

Understanding Secular values – Interpretation of secularism in Indian context - Disassociation of state from religion – Acceptance of all faiths – Encouraging non-discriminatory practices.
Reading Text: Excerpt from *Secularism in India: Concept and Practice* by Ram Puniyani

UNIT III SCIENTIFIC VALUES 6

Scientific thinking and method: Inductive and Deductive thinking, Proposing and testing Hypothesis, Validating facts using evidence based approach – Skepticism and Empiricism – Rationalism and Scientific Temper.
Reading Text: Excerpt from *The Scientific Temper* by Antony Michaelis R

UNIT IV SOCIAL ETHICS 6

Application of ethical reasoning to social problems – Gender bias and issues – Gender violence – Social discrimination – Constitutional protection and policies – Inclusive practices.

Reading Text: Excerpt from *21 Lessons for the 21st Century* by Yuval Noah Harari

UNIT V SCIENTIFIC ETHICS 6

Transparency and Fairness in scientific pursuits – Scientific inventions for the betterment of society - Unfair application of scientific inventions – Role and Responsibility of Scientist in the modern society.
Reading Text: Excerpt from *American Prometheus: The Triumph and Tragedy of J.Robert Oppenheimer* by Kai Bird and Martin J. Sherwin.

TOTAL: 30 PERIODS

REFERENCES:

1. The Nonreligious: Understanding Secular People and Societies, Luke W. Galen Oxford University Press, 2016.
2. Secularism: A Dictionary of Atheism, Bullivant, Stephen; Lee, Lois, Oxford University Press, 2016.
3. The Oxford Handbook of Secularism, John R. Shook, Oxford University Press, 2017.
4. The Civic Culture: Political Attitudes and Democracy in Five Nations by Gabriel A. Almond and Sidney Verba, Princeton University Press,
5. Research Methodology for Natural Sciences by Soumitro Banerjee, IISc Press, January 2022

COURSE OUTCOMES

Students will be able to

CO1 : Identify the importance of democratic, secular and scientific values in harmonious functioning of social life
CO2 : Practice democratic and scientific values in both their personal and professional life.
CO3 : Find rational solutions to social problems.
CO4 : Behave in an ethical manner in society
CO5 : Practice critical thinking and the pursuit of truth.

PTLT3811 **PROJECT WORK** **L T P C**
0 0 6 3

COURSE OBJECTIVE: 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. Each student is required to submit a report on the project undertaken by and assigned to him by the Department. The report should be based on the information available in the literature, plan of work, experimental details, data determined in the laboratory/industry, results, discussion of the data presented, conclusion and future work. Proper bibliographic details are necessary in the report.

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

TOTAL: 90 PERIODS

COURSE OUTCOMES:
At the end of this course, the students are expected to,
CO1. Identify a problem and define project objectives.
CO2. Plan and execute the project work.
CO3. Compare data and compile results.
CO4. Analyse and discuss the results.
CO5. Develop the skill to present and communicate the findings effectively.

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO 2	PSO 3
CO1	3	3	3	3	2	3	3	2	3	3	3	3	1	2	3
CO2	3	3	3	3	2	2	1	2	3	3	3	3	1	1	3
CO3	3	3	3	3	2	2	1	2	3	3	3	3	2	2	3
CO4	3	3	3	3	2	2	-	2	3	3	3	3	3	2	3
CO5	3	3	3	3	2	2	-	2	3	3	3	3	3	3	3
Avg	3	3	3	3	2	2.2	1	2	3	3	3	3	2	2	3

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PROFESSIONAL ELECTIVES

PTLT3001 COMPUTER APPLICATIONS FOR APPAREL AND GOODS L T P C
3 0 0 3

COURSE OBJECTIVE: The objective of this course is projecting the use of computer assisted designing techniques for making apparels and goods.

UNIT I COMPUTER APPLICATION IN DESIGNING 7

CAD definition, Fundamentals of CAD – Introduction, general process of design, application of computers for design, Benefits of CAD, Computers & the Fashion Industry, Quick response technology, CAD in Today 's Fashion Industry.

UNIT II HARDWARES IN COMPUTER APPLICATION 11

Introduction, Principles, Capabilities and operation of graphical workstations, central processing units, graphic terminals, input/output devices, interface and storage devices, net-working concepts of LAN and WAN. Digitization: 2D & 3D Coordinate extracting, principles of digital and analog conversion, digital input/output processing systems. CNC devices for computer aided cutting including laser and water jet, computer aided manufacturing.

UNIT III PATTERN ENGINEERING USING CAD 9

Computerized techniques for pattern generation, grading and assessment of apparel and goods patterns, consumption calculations, pattern nesting and costing, stitching etc. through computerized techniques. Data Conversion techniques, DXF.

UNIT IV PROTOTYPE MODELLING 9

Sketching, Manual Designing, Demonstrating – Aesthetic Appearance, Functionality; Digitization; Accessories; Detailing; Prototyping; Compiling Specifications; Sampling; Testing; Final Product.

UNIT V RAPID PROTOTYPING AND PRODUCTION TECHNIQUES 9

Pattern Designing – Measurements – Grading - Plotting/Cutting – Standard Blocks – Enlargements – Components and Accessories – CNC Stitching Process.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course students are expected to,

CO1. Explain the concepts of computer applications in leather goods and garments manufacturing.

CO2. Identify different hardware used for the computational leather goods manufacturing.

CO3. Apply CAD pattern engineering for the leather goods manufacturing.

CO4. Justify the computer application in prototype modelling.

CO5. Examine advanced computational techniques in CAD, rapid prototyping, simulation, 3D printing and robotics.

REFERENCES:

1. Groover, M.P. and Zinimers, M.P., "CAD/CAM, Computer Aided Design and Manufacturing", Prentice Hall of India, 1984.
2. Newman and Sul, S.P., "Introduction to Computer Graphics", Published by Morgan Kaufmann,1995
3. Zandi, "Computer Aided Design and drafting", Published by Delmer,1985.
4. Pratt, W., "Digital Image Processing", 1978.
5. Desai and Abel, "Introduction to FEM".
6. Rapidprototyping; AU – FRG publications, 1984.
7. Buchner, J., "Simulation: QUEST manual": EDS Technologies, Published by Springer, 2003.

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	P O 12	PS O1	PS O2	PSO 3
CO1	3	1	1	1	-	-	-	1	-	-	-	-	-	1	-
CO2	3	2	1	-	1	-	-	1	-	-	3	1	1	3	1
CO3	3	2	1	3	1	1	-	-	-	-	-	-	-	1	2
CO4	3	1	1	-	1	-	-	-	-	1	-	-	-	1	-
CO5	3	1	1	-	-	-	1	2	-	-	-	-	1	-	2
Avg	3	1.4	1	0.8	0.6	0.2	0.2	0.8	0	0.2	0.6	0.2	0.4	1.2	1

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTLT3002 AUTOMATION IN GARMENTS AND GOODS MANUFACTURE L T P C
3 0 0 3

COURSE OBJECTIVE: The objective of this course is to present the students on basic concepts in industrial automation.

UNIT I FUNDAMENTAL CONCEPTS OF INDUSTRIAL AUTOMATION 9

Fundamental concepts in manufacturing and automation, definition of automation, reasons for automating. Types of production and types of automation, automation strategies, levels of automation.

UNIT II MANUFACTURING OPERATIONS 9

Automation in production systems, principles and strategies, Product/Production Relationships, Production concepts and Mathematical models, Manufacturing Economies.

UNIT III NUMERICAL CONTROL AND ROBOTICS 9

NC – CNC – Part programing – DNC – Adaptive Control – Robot Anatomy – Specifications – Industrial Applications.

UNIT IV AUTOMATION FOR APPAREL AND GOODS INDUSTRY 9

Raw Material Maintenance - Designing & Pattern Development – Material Area Calculations – Cutting/Clicking – Texture Mapping – Intelligent Sewing Machines - Online Seam Quality Assessment – Checking – Ironing – Bar Code – Conveyor.

UNIT V PREVENTIVE MAINTENANCE AND SAFETY USING SOFTWARES 9

Apparel and Goods Industry - Preventive maintenance, Safety & Security Maintenance, Hospitality, Data Collection, Data Analyzation, Disaster Prediction, Administration Protocols, Employee Management.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1. Summarize the requirements of automation in manufacturing systems.
CO2. Identify the techniques of machinery automation and shop floor automation.
CO3. Apply basic numeric control used for automation process.
CO4. Design the process of automation in apparel and goods manufacturing process.
CO5. Interpret required preventive maintenance and safety in the apparel and goods industry.

TEXT BOOKS AND REFERENCES:

1. Bolton W, “Mecharonics”, Pearson Education, 1999.
2. Mikell P Groover, “Automation Production Systems and Computer – Integrated Manufacturing”, Pearson Education, New York, USA, 2000.
3. Mikell P Groover, “Industrial Robots – Technology Programmes and Applications”, McGraw Hill, New Delhi, 2001.
4. Steve F Krar, “Computer Numerical Control Simplified”, Industrial Press, 2001.

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PSO 2	PSO 3
CO1	2	–	3	3	–	3	–	–	–	–	–	–	2	–	–
CO2	2	–	3	3	–	3	–	–	–	–	–	–	2	–	–
CO3	2	–	3	3	–	3	–	–	–	–	–	–	2	–	–
CO4	2	–	3	3	–	3	–	–	–	–	–	–	2	–	–
CO5	2	–	3	3	–	3	–	–	–	–	–	–	2	–	–
Avg	3	1.4	1	0.8	0.6	0.2	0.2	0.8	0	0.2	0.6	0.2	0.4	1.2	1

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTLT3003 PRODUCT MERCHANDISING IN GARMENTS AND GOODS INDUSTRY **L T P C 3 0 0 3**

COURSE OBJECTIVE: To impart knowledge on leather products merchandising that relates to the domestic and global leather and leather product merchandising.

UNIT I BASICS OF APPAREL MERCHANDISING **9**

Introduction, Functions and role of Merchandiser, Merchandising Process, Meaning and Need for quality control in Merchandising process.

UNIT II PURCHASING PRINCIPLES AND MANAGEMENT **9**

Purchasing scope and development - Strategic aspects of purchasing - Key purchasing -variables consideration - Purchasing negotiations and competitive – Bidding - Outsourcing -purchasing operation - Buying capital goods and services - Purchasing for resale - Purchasing systems and technology - Evaluation of purchasing performance - Purchasing ethics and legal issues.

UNIT III PRINCIPLES AND PRACTICE OF MERCHANDISING **9**

Merchandising concepts, technology, systems, planning - Merchandise pricing and budgeting, sample handling - Managing merchandise assortments - Developing and - presenting product lines - Introduction to shipping operation.

UNIT IV RETAIL SECTOR OF LEATHER **9**

Overview of retailing; Changing retail environment - Typology of retail buying - Understanding the consumer - Competitive strategies in the retail industry - Retail

location strategy; Store layout and Design - Product planning and selection; Inventory management - Retail pricing; Retail communication - Customer Service.

UNIT V GLOBAL SOURCING STRATEGY 9

Globalization and its influences - The role and importance of global sourcing - Global sourcing process and strategy - Investigation and tendering - Supplier selection and development - Operationalization of global sourcing strategy - Performance Measurement - The benefits and challenges of global sourcing - Coping with custom clearance uncertainties - Sourcing on the Internet - Supplier relationship development - Merchandising language for sourcing.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course, the students will be in the position to understand,

CO1. Explain the basic principles of merchandising.
CO2. Apply the purchasing principles and management for product merchandising.
CO3. Illustrate the fundamentals of procurement and merchandising.
CO4. Justify basic knowledge of retail sector.
CO5. Discuss the global marketing and global sourcing

TEXT BOOKS AND REFERENCES:

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

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO 6	PO7	PO8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO 3
CO1	3	1	-	-	1	1	2	1	1	1	-	2	2	3	2
CO2	2	2	3	-	3	1	1	1	1	1	2	2	2	3	2
CO3	2	2	-	-	3	1	-	1	1	1	-	2	2	3	2
CO4	2	3	2	-	2	1	1	1	1	1	3	2	3	3	3
CO5	3	2	1	-	1	1	1	1	1	1	-	2	3	3	3
Avg	2.4	2	1.2	0	2	1	1	1	1	1	1	2	2.4	3	2.4

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTLT3004 GARMENTS AND GOODS MARKET TRENDS AND FASHION FORECASTING L T P C 3 0 0 3

COURSE OBJECTIVE: The objective of this course is present the students on the fashion trends and their consideration in product development.

UNIT I INTERNATIONAL TRENDS OF GOODS AND GARMENTS MARKET 6

Global Trend Analysis and Product Decision – Social Trends – Technical Trends – Economic Trends – Environmental Trends – Political/Policy Trends – Introduction to Product Development Methodologies and Management.

UNIT II ELEMENTS OF DESIGN AND FASHION CONSIDERATIONS 9

Elements and theories of design, Application of the basic elements of design, Ergonomics and interactive scenario of the design elements, Design Criteria through effect of shape, colour, pattern, texture and decorative materials. Life cycle of fashion.

UNIT III DESIGN METHODOLOGY AND PRODUCT DEVELOPMENT 12

Brain storming method of idea generation, Understanding the consumer need and demand, Concept of space and patterns in nature, Product usage and its categories, Product mix and innovation, Design process for accessories, Types, categories and usage of leather and non-leather Goods and Garments; Market Strategy - Prototype Development - Field test and evaluation - Standard preparation - Second prototype - Final run; Costing.

UNIT IV PRESENTATION TECHNIQUES 8

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

UNIT V FASHION TREND AND FORECAST ANALYSIS 10

Definition and entomology of fashion, trend, style and elements of trend direction, Types of trend direction review process, Development of forecast and understanding of styling, Direction of fashion trends in apparel and goods production and marketing.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1. Summarize on market strategy for developing a new product.
CO2. Identify the factors contributing to the fashion trends in leather goods industry.
CO3. Classify different methods on design and new product development.
CO4. Develop the art portfolios and explain the different presentation techniques.
CO5. Plan the fashion trend and forecasting analysis.

TEXT BOOKS AND REFERENCES:

1. Apparel Product Design and Merchandising Strategies by Cynthia L. Regan. Publisher: Prentice Hall
2. “Apparel International” Published by P.F collier and sons, U.K, 1961.

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PSO 2	PSO 3
CO1	–	2	3	2	3	–	–	–	–	–	–	–	–	–	–
CO2	–	2	3	2	3	–	–	–	–	–	–	–	–	–	–
CO3	–	2	3	2	3	–	–	–	–	–	–	–	–	–	–
CO4	–	2	3	2	3	–	–	–	–	–	–	–	–	–	–
CO5	–	2	3	2	3	–	–	–	–	–	–	–	–	–	–
Avg	–	2	3	2	3	–	–	–	–	–	–	–	–	–	–

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTLT3005 TESTING AND STATISTICS FOR GARMENTS AND GOODS L T P C
3 0 0 3

COURSE OBJECTIVE: The objective of this course is present students on the quality control and management aspects associated with manufacturing apparel and goods.

UNIT I MODELING AND STATISTICAL INFERENCE 9

Modelling Uncertainty: Events and Probabilities – Conditional Probability – Random Variables – Discrete Probability Distributions – Continuous Probability Distribution – Statistical Inference: Data Sampling – Selecting a Sample – Point Estimation – Sampling Distributions – Interval Estimation – Hypothesis Testing.

UNIT II CONCEPTS OF QUALITY 9

Definition of quality, quality control theory, fundamentals of statistics and probability, confidence intervals, testing significance, statistical process control techniques, analysis, defect diagnosis and prevention.

UNIT III TESTING STANDARDIZATION 9

Significance of Testing for assessment of Apparel and Goods Performance; List of testing and their methodology.

UNIT IV QUALITY TESTING IMPROVEMENT 9

Concepts of TQM, TQC, KANBAN, Zero defects, JIT – continuous improvement – HRD in quality management – quality grades, Dr. Deming's 14 points management concept, TQA.

UNIT V QUALITY ASSURANCE SYSTEM 9

Introduction to ISO – 9000 and 14000 and related international /national standards, case study.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course, the students are expected to,
CO1. Outline various statistical methods for leather goods sector.
CO2. Apply the concept of quality.
CO3. Analyze various Testing standards.
CO4. Improve the quality management system.
CO5. Apply ISO-9000 and 14000 for leather product industry.

TEXT BOOKS AND REFERENCES:

1. A. J. Duncan," Quality Control and Industrial Statistics", Homewood, Illinois, Published by Irwin, 1986.
2. "International Organization for Standardization" case postale 56, CH-1211-Geneva – 20, Switzerland.
3. "Bureau of Indian Standards", New Delhi.

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
CO1	–	2	3	–	2	–	–	–	–	–	2	–	2	–	–
CO2	–	2	3	–	2	–	–	–	–	–	2	–	2	–	–
CO3	–	2	3	–	2	–	–	–	–	–	2	–	2	–	–
CO4	–	2	3	–	2	–	–	–	–	–	2	–	2	–	–

CO5	–	2	3	–	2	–	–	–	–	–	2	–	2	–	–
Avg	–	2	3	–	2	–	–	–	–	–	2	–	2	–	–

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTLT3006 MACHINERIES FOR APPARELS AND GOODS MANUFACTURE L T P C
3 0 0 3

COURSE OBJECTIVE: To impart theory and practical knowledge on the working principles, use and maintenance of machineries used in manufacturing apparels and goods.

UNIT I MACHINERIES FOR APPARELS MANUFACTURING 9

Fabric Inspection Machine – Plotter Printing Machine – Cutting Machine – Fusing Machine – Embroidery Machine – Various Sewing Machine – Thread Trimmer Machine – Thread Sucking Machine – Iron Machine – Pull Test Machine – Metal Detector Machine – Barcode Scanning Machine – Heat Seal Joining Machine – Case Label Printing Machine – Moisture Checking Machine – Digital Hygrometer – Air Compressor Machine – Boiler Machine – Generator – Water Pump.

UNIT II MACHINERIES FOR GOODS MANUFACTURING 9

Cutting Machine; Coloring Machine – Vertical Coloring Machine, Box Roller Coloring Machine, Horizontal Coloring Machine; Production – Spray Gluing Machine, Folding Machine, Ultra Sonic Machine, Different Sewing Machines, Thread Burning Tool, Folding Machine, Creasing Machine, Embossing Machine, Screw Driving Machine, Roller Gluing Machine, Roller Pressing Machine, Post Hammering Machine.

UNIT III ADVANCEMENT IN MACHINERIES 10

Dieless cutting, Water jet cutting, CAM for automatic stitching. Different types of material handling system – Manual, semi – automatic and automatic conveyor.

UNIT IV MODULAR MANUFACTURING AND PLANT LAYOUT 11

Productivity improvements: scheduling, simulation, Toyota and lean manufacturing system. Factor affecting plant location and construction of factory building for balancing the production line in apparel and goods industry.

UNIT V PREVENTIVE MAINTENANCE AND SAFETY 6

Preventive maintenance and safety in the use of apparel and goods machinery.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course, the students will be able to understand the working principles of machineries used in apparel and goods manufacture and their use and maintenance.

The students also understand the following,

CO1. Explain various machineries used in apparel and goods manufacture.

CO2. Identify the features and purpose of the various machinery used.

CO3. Interpret the preventive maintenance and safety in the use of apparel and goods machinery.

CO4. Examine the malfunction of various product machineries.

CO5. Design of optimal machinery layout in apparel and goods unit.

TEXT BOOKS AND REFERENCES:

1. G. H. Ryder, M. D. Bennett; “Mechanics of Machines”, Royal Military College of Science, Shrivenham, UK.
2. Dr. Mahmoud Mostafa; “Mechanics of Machinery”, CRC Press Inc.

3. Steve Krar, Mario Rapisarda, Albert F. Check, “Machine Tool and Manufacturing Technology”, S.Chand (G/L) & Company Ltd.

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PSO 2	PSO 3
CO1	2	–	3	3	–	3	–	–	–	–	–	–	2	–	–
CO2	2	–	3	3	–	3	–	–	–	–	–	–	2	–	–
CO3	2	–	3	3	–	3	–	–	–	–	–	–	2	–	–
CO4	2	–	3	3	–	3	–	–	–	–	–	–	2	–	–
CO5	2	–	3	3	–	3	–	–	–	–	–	–	2	–	–
Avg	2	–	3	3	–	3	–	–	–	–	–	–	2	–	–

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTLT3007 COMPUTER APPLICATIONS FOR FOOTWEAR L T P C
3 0 0 3

COURSE OBJECTIVE: The objective of this course is project the use of computer assisted designing techniques for making footwear.

UNIT I INTRODUCTION FOR CAD IN FOOTWEAR MANUFACTURE 9

Starting AutoCAD – AutoCAD screen components – Starting a drawing: Open drawings, create drawings (Start from scratch, use a template & Use a wizard) – Invoking commands in AutoCAD –Drawing lines in AutoCAD – Co-ordinate systems: Absolute co-ordinate system, Relative co-ordinate system – Direct distance method – Saving a drawing: Save & Save As – Closing a drawing – Quitting AutoCAD.

UNIT II CAD FOR PATTERN MAKING 8

Introduction to different types tool bar in footwear cad, draw tools, designing tools, pattern tools, grading tools, editing tools and making marking and other output related tools, ideas about geometric primitives. Create pattern, general elements, attach and detach GP, exchange boundary, exchange axis, pattern properties, attach element detach element and pattern editing.

UNIT III LAST MODELLING 10

Digitization with 3D Scanner; manipulation and optimization of digitized last; use of macros; last comparison; grading wizard; flattening; 3D visualization of last and styles; concept of e-last; introduction to sole and sole mould design.

UNIT IV ADVANCED COMPUTATIONAL TECHNIQUES 8

Principles and practice of foot scanner; conversion of foot dimensions to last model; creation of still files for last manufacture; simulation – concepts and applications; robotics: concepts and applications in footwear manufacture; 3D Printing: concepts and applications in footwear manufacture.

UNIT V COMPUTER AIDED MEASUREMENT AND CONTROL SYSTEMS 10

Role of computers in measurement and control, Elements of computer aided measurement and control, man-machine interface, computer aided process control hardware, process related interfaces, Communication and networking, Industrial communication systems, Data transfer techniques, Computer aided process control software, Computer based data acquisition system, Internet of things (IoT) for plant automation.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course students are expected to,

CO1. Explain the concepts of computer applications in footwear sector.
CO2. Apply CAD for pattern engineering for footwear pattern making.
CO3. Analyze the computer application in sole modelling for footwear.
CO4. Examine the advanced computational techniques in footwear application.
CO5. Recommend the application of computer in measurement and control systems.

TEXT BOOKS AND REFERENCES:

1. Groover, M.P. and Zinimers, M.P., "CAD/CAM, Computer Aided Design and Manufacturing", Prentice Hall of India, 1984.
2. Newman and Sul, S.P., "Introduction to Computer Graphics", Published by Morgan Kaufmann,1995
3. Zandi, "Computer Aided Design and drafting", Published by Delmer,1985.
4. Pratt, W., "Digital Image Processing", 1978.
5. Desai and Abel, "Introduction to FEM".
6. "Step by Step guide to CAD for footwear": CAD Centre, SDDC, CLRI.
7. Rapidprototyping; AU – FRG publications, 1984.
8. Buchner, J., "Simulation: QUEST manual": EDS Technologies, Published by Springer, 2003.
9. Mass Customization and Footwear: Myth, Salvation or Reality? A Comprehensive Analysis Of The Adoption Of The Mass Customization Paradigm In Footwear by Claudio R.Bor, Sergio Dulio;SpringerVerlag, 2007.

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PSO 2	PSO 3
CO1	3	1	1	1	-	-	-	1	-	-	-	-	-	1	-
CO2	3	2	1	-	1	-	-	1	-	-	3	1	1	3	1
CO3	3	2	1	3	1	1	-	-	-	-	-	-	-	1	2
CO4	3	1	1	-	1	-	-	-	-	1	-	-	-	1	-
CO5	3	1	1	-	-	-	1	2	-	-	-	-	1	-	2
Avg	3	1.4	1	0.8	0.6	0.2	0.2	0.8	0	0.2	0.6	0.2	0.4	1.2	1

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTLT3008 AUTOMATION IN FOOTWEAR MANUFACTURE L T P C
3 0 0 3

COURSE OBJECTIVE: The objective of this course is to present the students on basic concepts in industrial automation.

UNIT I INTRODUCTION TO AUTOMATION 9

Automation overview, Requirement of automation systems, Architecture of Industrial Automation system, Introduction of PLC and supervisory control and data acquisition (SCADA). Industrial bus systems: Modbus & Profibus.

UNIT II INTRODUCTION TO MACHINE LEARNING 9

Philosophy of learning in computers, Overview of different forms of learning, Classifications vs. Regression, Evaluation metrics and loss functions in Classification, Evaluation metrics and loss functions in Regression, Applications of AI in Robotics.

UNIT III AUTOMATION COMPONENTS 9

Sensors for temperature, pressure, force, displacement, speed, flow, level, humidity and pH measurement. Actuators, process control valves, power electronics devices DIAC, TRIAC, power MOSFET and IGBT. Introduction of DC and AC servo drives for motion control.

UNIT IV TOTALLY INTEGRATED AUTOMATION 9

Need, components of TIA systems, advantages, Programmable Automation Controllers (PAC), Vertical Integration structure.

UNIT V AUTOMATION FOR FOOTWEAR INDUSTRY 9

Raw Material Maintenance - Designing & Pattern Development – Material Area Calculations – Cutting/Clicking – Pre-Closing – Closing – Lasting – Post Lasting – Finishing – Metal Detecting - Packing.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1. Explain the basics of automation in manufacturing systems.

CO2. Summarize the basic knowledge on machine learning.

CO3. Apply the techniques of machinery automation and shop floor automation in footwear manufacturing.

CO4. Analyze the totally integrated automation system in the manufacturing unit.

CO5. Design the process of automation in footwear manufacturing process.

TEXT BOOKS AND REFERENCES:

1. Bolton W, “Mecharonics”, Pearson Education, 1999.
2. Mikell P Groover, “Automation Production Systems and Computer – Integrated Manufacturing”, Pearson Education, New York, USA, 2000.
3. Mikell P Groover, “Industrial Robots – Technology Programmes and Applications”, McGraw Hill, New Delhi, 2001.
4. Steve F Krar, “Computer Numerical Control Simplified”, Industrial Press, 2001.

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PSO 2	PSO 3
CO1	2	–	3	3	–	3	–	–	–	–	–	–	2	–	–
CO2	2	–	3	3	–	3	–	–	–	–	–	–	2	–	–
CO3	2	–	3	3	–	3	–	–	–	–	–	–	2	–	–
CO4	2	–	3	3	–	3	–	–	–	–	–	–	2	–	–
CO5	2	–	3	3	–	3	–	–	–	–	–	–	2	–	–
Avg	2	–	3	3	–	3	–	–	–	–	–	–	2	–	–

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTLT3009 PRODUCT MERCHANDISING IN FOOTWEAR INDUSTRY L T P C
3 0 0 3

COURSE OBJECTIVE: To impart knowledge on leather products merchandising that relates to the domestic and global leather and leather product merchandising.

UNIT I INTRODUCTION TO MERCHANDISING 9

Merchandising - Terms Pertaining to Merchandising - Requirements of a Purchase Order - Amendment Sheet - Direct Order - Merchant Order - CM Order - CMT Order - Vendor & Sub-Contractor Evaluation Specifications.

UNIT II PRINCIPLES OF MARKETING MANAGEMENT 9

Introduction, Definition, Importance and Scope of Marketing, Philosophies of Marketing Management, Elements of Marketing - Needs, Wants, Demands, Customer, Consumer, Markets and Marketers; Marketing Vs Selling, Consumer Markets and Industrial Markets. Concept of Marketing Management, Marketing – Mix, Functions of Marketing Management, Marketing Organisations, Qualities of Marketing Manager. Marketing Environment, Factors Affecting Marketing Environment, Marketing Information System and Marketing Research, Strategic Marketing Planning.

UNIT III MARKETING MANAGEMENT 9

Functions of a Merchandiser - Types of Samples - Sample Quality and Sample Order - Expediting Procedures - Record Maintenance - Approval, Types of Approvals - Check Points for a Proper Approval - Approving Sewing Operations & Various Processes.

UNIT IV PRACTICE OF MERCHANDISING 9

Time Management - Production Scheduling - Route Card Format - Accessories Follow-Up - Various Processes Follow-Up & Practical Check Points. Pattern Approval - Size Set Approval Procedures - Pre - (Pilot Run Inspection) - Order Execution Procedures.

UNIT V RETAIL MERCHANDISING 9

Fashion Merchandising vs. Retail Merchandising, Job Objectives of Retail Merchandising, Definition of Promotional Merchandising, Visual Merchandising Techniques, Sales Focused Merchandising, Outlet Vs. Retail, SWOT Analysis for Retail. The Advantages of Retail Outlets.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1. Explain the basic principles of merchandising.
CO2. Apply the principles of marketing management.
CO3. Summarize the importance of marketing management.
CO4. Design the fundamentals of structure of procurement and merchandising.
CO5. Outline the basic of retail sector.

TEXT BOOKS AND REFERENCES:

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

Operations Addison Wesley, 2007.
5. Justin Paul – International Business – Prentice Hall of India, 2007 Oded Shenkar Yadong Luo: International Business – John Wiley & Co., 2006.

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	1	-	-	1	1	2	1	1	1	-	2	2	3	2
CO2	2	2	3	-	3	1	1	1	1	1	2	2	2	3	2
CO3	2	2	-	-	3	1	-	1	1	1	-	2	2	3	2
CO4	2	3	2	-	2	1	1	1	1	1	3	2	3	3	3
CO5	3	2	1	-	1	1	1	1	1	1	-	2	3	3	3
Avg	2.4	2	1.2	0	2	1	1	1	1	1	1	2	2.4	3	2.4

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTLT3010 FOOTWEAR MARKET TRENDS AND FASHION FORECASTING L T P C
3 0 0 3

COURSE OBJECTIVE: The objective of this course is present the students on the footwear fashion trends and their consideration in product development.

UNIT I INTERNATIONAL TRENDS OF FOOTWEAR MARKET 6

Historical evaluation of footwear styling. Seasonal influences on fashion, cultural and geographical instances on footwear fashion. Market research and track record.

UNIT II TREND FORECASTING 9

Trend forecasting: Importance of forecasting, Elements of forecasting, Principles of forecasting, Theories explaining forecasting, Steps in forecasting, Major areas of forecasting, Advantages and limitations in forecasting.

UNIT III FASHION FORECASTING 12

Fashion forecasting: Role of fashion forecaster, Long- term forecasting, Short- term forecasting. Direction of fashion change, Forecasting with Trend, Seasonality and Cycles, Time series and Trends, Constant pattern, Linear pattern. Role of internet in fashion forecasting.

UNIT IV FASHION FORECASTING PROCESS 8

Fashion forecasting process: Activities. Market research- Consumer research, Shopping, Sales records, Evaluating the collections- Fashion trends, Trends for target markets, Colour forecasting, textile development and sales forecasting. Fashion services and resources- Collection reports, Trend reports, Consulting services, Fashion editing, Trade publications.

UNIT V COLOUR FORECASTING 10

Colour forecasting: Steps in Colour forecasting - Colour forecast reports. Dimensions of Colour, Colours in Marketing, Consumers and the Psychology of Colours. Forecasting with Colour Cycles, Colour Research, Sources for Colour Ideas and Palettes.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1. Explain the market strategy for developing a new product.
CO2. Identify the factors contributing to market trends in footwear industry.
CO3. Classify the different methods on design and new product development.
CO4. Analyze the fashion forecasting of the footwear.
CO5. Perceive the colour forecasting techniques.

TEXT BOOKS AND REFERENCES:

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

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	P O 12	PS O1	PS O2	PSO 3
CO1	–	2	3	2	3	–	–	–	–	–	–	–	–	–	–
CO2	–	2	3	2	3	–	–	–	–	–	–	–	–	–	–
CO3	–	2	3	2	3	–	–	–	–	–	–	–	–	–	–
CO4	–	2	3	2	3	–	–	–	–	–	–	–	–	–	–
CO5	–	2	3	2	3	–	–	–	–	–	–	–	–	–	–
Avg	–	2	3	2	3	–	–	–	–	–	–	–	–	–	–

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTLT3011 PRINCIPLES OF TESTING FOR FOOTWEAR AND COMPONENTS L T P C 3 0 0 3

COURSE OBJECTIVE: To impart knowledge on Types of Footwear, their components, material characterization – Physical and chemical analytical methods.

UNIT I INTRODUCTION TO LEATHER AND NON-LEATHER FOOTWEAR AND COMPONENTS AND STANDARDS IN TESTING 9

Types of footwear - Boots, Pumps shoes, Slippers, Trainers, Sports footwear, Sandals, Casuals.

Types of Footwear components - Whole shoe, Upper – Vamp, Quarter – Tongue, Toe Puff, Lining – Vamp lining, Quarter lining, Counter stiffeners, Heels and heel grips, shanks, Insole, Insock, Top-piece attachments, Elastics and Velcros, Adhesives, Laces, Metallic components - Buckles, Eyelets, Fasteners, Outsoles.

Types of Footwear Materials - Leathers used in soles, insoles, outsoles, Leather Fiber boards – Cellulose textiles - Synthetic textiles, Polymers and coatings – PVC/PVC Coatings, PU/PU Coatings, Polyesters – Metals - Rubbers, MCR, TPR – Adhesives - Polymeric Foams.

Indian and International Footwear testing standards and specifications and implementations.

UNIT II PHYSICAL TESTING OF FOOTWEAR COMPONENTS – LEATHER AND NON-LEATHER 9

Components and materials specific mechanical tests - Quantitative and Qualitative assessment –Tensile strength, Flex resistance, Upper-outsole bond, Attachment strength, Lastometer, Burst strength, Seam and Stitch tear strength, Sole Slip,

Flexing, Density and Abrasion resistance, Hardness, Color fastness properties, Tests for Zips, Touch and close fasteners, Eyelets and other metallic and non-metallic components testing, Waterproofness and Comfort properties, Safety footwear types and their test methods

UNIT III CHEMICAL TESTING OF FOOTWEAR COMPONENTS - LEATHER 9

Restricted substance list (RSL) - Aromatic amines released from Azo dyes - Chromium (VI) estimation - Polychlorophenols estimation - Formaldehyde estimation- Dimethyl fumarate (DMFu) estimation - Organotin estimation - Phthalate (If Coated leather) estimation - pH value.

UNIT IV CHEMICAL TESTING OF FOOTWEAR COMPONENTS - TEXTILE 9

Aromatic amines released from Azo dyes- Allergenic and carcinogenic disperse dyes Determination-Formaldehyde estimation- Dimethyl fumarate (DMFu) Estimation-Organotin Estimation-Phthalate estimation-pH value.

UNIT V CHEMICAL TESTING OF FOOTWEAR COMPONENTS - POLYMERIC MATERIAL AND METAL COMPONENT 9

Polymeric material: Dimethyl fumarate (DMFu) Estimation-Organotin estimation - Phthalate estimation. Metal component: Nickel, on skin contact.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1. Explain basic on leather and non-leather footwear and footwear components.

CO2. Identify the physical testing standards for the leather and non-leather footwear components.

CO3. Analyze the various chemical testing standards of leather footwear components.

CO4. Appraise various chemical testing standards of textile footwear components.

CO5. Aware of various chemical testing standards of the polymeric and metal based footwear components.

TEXT BOOKS AND REFERENCES:

1. Footwear Materials and Process Technology, A. J. Harvey, Lasra, 1982.
2. Encyclopedia of Polymer Applications Ed. Munmaya Mishra, Chapter: Footwear, S. Gnanasundaram, M. Ranganathan, CRC Press, Taylor & Francis, Pg 1444.
3. Personal Protective Equipment, IS 15298 (PART1).
4. IS 15844: SPORTS FOOTWEAR – SPECIFICATION.

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO 6	PO7	PO8	PO 9	PO 10	PO 11	P O 12	PS O1	PS O2	PSO 3
CO1	–	2	3	–	2	–	–	–	–	–	2	–	2	–	–
CO2	–	2	3	–	2	–	–	–	–	–	2	–	2	–	–
CO3	–	2	3	–	2	–	–	–	–	–	2	–	2	–	–
CO4	–	2	3	–	2	–	–	–	–	–	2	–	2	–	–
CO5	–	2	3	–	2	–	–	–	–	–	2	–	2	–	–
Avg	–	2	3	–	2	–	–	–	–	–	2	–	2	–	–

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTLT3012 MACHINERIES FOR FOOTWEAR MANUFACTURE L T P C
3 0 0 3

COURSE OBJECTIVE: To impart theory and practical knowledge on the working principles, use and maintenance of machineries used in Footwear manufacture.

UNIT I MACHINERIES FOR PRECLOSING 10

-Types of Clicking (Manual, Machine) -- Manual Clicking -- Machine clicking -- Mechanical clicking press -- Hydraulic clicking press -- Hydronic Clicking Press -- Other Modern Clicking Machine [Fixed arm, travelling head, Large beam, Flash Cutter etc] -- Comparison of Manual & Machine clicking -- Some features of the Clicking Machine [voltage, oil tank, swing arm, swing arm hand wheel, operation of the swing arm, cutting operation, hydraulic system, cutting board, day light etc.] Introduction to Die-less cutting system, Operation, and Machine adjustment. Splitting machine, Skiving Machine.

UNIT II MACHINERIES FOR CLOSING 10

Needle: Parts of Needle and their role; Needle Finishes; Needle systems; Needle Size; Classification of Needle on the basis of Needle Point; Cutting Point [P, S, LR, PLR, PCR, D, D1, VR]; Number of Needles; Direction of Needle-bar movements; Material transportation Systems in Stitching machines (Drop Feed, Compound Feed, Unison Feed, Step Feed); Stitching machine Construction; Parts of Stitching Machine and their functions; Types of stitching Machines: - Flat Bed, Post Bed, Cylinder Bed, Variable Stitch, Length Flat Machine, Under Edge Trimmer, Twin Needle flat machine, Zig-Zag Machine; Computerized Stitching Machine. Introduction and Operation.

UNIT III MACHINERIES FOR LASTING 8

Counter Moulding, Insole attaching, Toe puff activator, mulling chamber, thermo-cementing, preforming, Toe lasting, side lasting, seat lasting,

UNIT IV MACHINERIES FOR SOLE ATTACHMENT 8

Heel crowing, heat setter, Hot air blower, roughing machine, Heat Reactivator, Sole Pressing machine, Delasting machine, Polishing machine.

UNIT V MODULAR MANUFACTURING AND PLANT LAYOUT 9

Plant layout for productivity improvements – Scheduling and simulation. Factor affecting plant location and construction of factory building for balancing the production line footwear manufacture.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course, the students will be able to understand the working principles of machineries used in footwear manufacture and their use and maintenance.

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

CO1. Explain the general principles involved in various preclosing machineries used in footwear manufacture.

CO2. Identify the features and purpose of the various closing machineries.

CO3. Summarize the principle involved in lasting machineries.

CO4. Identify the features of the sole attachment machineries.

CO5. Design of optimal machinery layout in footwear unit.

TEXT BOOKS AND REFERENCES:

1. Thornton, J.H, “Text Book of Footwear Manufacture”, National Trade Press Ltd., London, 1970.

2. Blakeman, J., “An Introduction to applied Science for Boot and Shoe Manufacture”, The Anglo American Technical Co.Ltd., London,1924.

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PSO 2	PSO 3
CO1	2	–	3	3	–	3	–	–	–	–	–	–	2	–	–
CO2	2	–	3	3	–	3	–	–	–	–	–	–	2	–	–
CO3	2	–	3	3	–	3	–	–	–	–	–	–	2	–	–
CO4	2	–	3	3	–	3	–	–	–	–	–	–	2	–	–
CO5	2	–	3	3	–	3	–	–	–	–	–	–	2	–	–
Avg	2	–	3	3	–	3	–	–	–	–	–	–	2	–	–

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTLT3013 CHEMISTRY OF COLLAGEN L T P C
3 0 0 3

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

UNIT I HISTOLOGY OF SKIN 9

Histology and fibre packing in Skins. Techniques for study of macro-ultra and microstructural details of skins. Primary, secondary, tertiary and quaternary structure of collagen.

UNIT II MOLECULAR ARCHITECTURE OF COLLAGEN 10

Molecular architecture of collagen. Inter and intra-change forces in the stabilisation and aggregation of collagen molecules. Three dimensional network of collagen fibres in skins and leather matrix.

UNIT III PHYSICO-CHEMICAL PROPERTIES OF COLLAGEN 8

Hydration, fibre swelling and phase transitions in collagen fibres and their role in dimensional stability of skin and leather matrix.

UNIT IV THERMO-MECHANICAL PROPERTIES OF COLLAGEN 9

Molecular mechanisms in relaxation and folding with special reference to native collagen and tanned collagen. Helix to coil transition and effects of thermo-mechanical stress on connective tissue fibres.

UNIT V CROSSLINKING MECHANISM 9

Shrinkage and cross linking phenomena in native, chrome tanned and vegetable tanned collagen. Influence of electromagnetic and high energy radiation on native collagen.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1.Acquire comprehensive knowledge on the chemistry and physics of skin.
CO2.Analyse and understand the molecular of Collagen
CO3.Acquire in depth knowledge on physical and chemical properties of Collagen
CO4. Acquire in depth knowledge on thermo-mechanical properties of collagen.
CO5.Comprehend the electromagnetic and high energy radiation on collagen.

TEXT BOOKS AND REFERENCES:

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

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PSO 2	PSO 3
CO1	3	3	1	1	1	1	2	3	1	1	1	2	3	1	1
CO2	3	3	2	1	1	-	2	2	1	1	1	2	3	1	1
CO3	3	3	1	1	1	1	2	2	1	1	1	2	3	2	1
CO4	3	3	1	1	1	2	2	1	1	1	1	2	3	3	1
CO5	3	3	-	1	1	1	2	2	1	1	1	2	3	3	1
Avg	3	3	1	1	1	1	2	2	1	1	1	2	3	2	1

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTLT3014 BIOPHYSICS OF COLLAGEN L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand hydration of skin protein and its functional sites
- To understand diffusion and transport phenomena in collagenous matrices
- To understand molecular level changes and dimensional changes during various unit processes in leather making
- To relate surface science to leather making.

UNIT I REACTIVITY OF COLLAGEN 8

Macro and microporosity of skin and influence of hydration and water structure on the pore size pattern in skin. Functional sites in protein for interactions with vegetable and pre-tanning materials, Electrophilic and nucleophilic reactions at protein sites.

UNIT II DIFFUSION AND TRANSPORT PHENOMENA 9

Types of transport of fluids into solid matrices. Diffusion and transport phenomena in collagenous matrices. Kinetics and diffusion of tannery materials, dyes; forced diffusion into collagenous matrices.

UNIT III MOLECULAR BEHAVIOUR OF COLLAGEN 10

Molecular level changes in collagen at various process conditions (viz., soaking, liming/dehairing, deliming/bating, pickling, tanning, dyeing and fatliquoring).

UNIT IV MACRO AND MICRO STRUCTURAL BEHAVIOUR OF COLLAGEN 9

Dimensional changes and ultra and micro structural variations of skins during soaking, liming, deliming/bating, pickling, tanning, retanning, fatliquoring and drying as well as finishing with resin and casein.

UNIT V SURFACE SCIENCE FOR LEATHER 9

Surface science application to leather. Surface charge and energy of full chrome and chrome retanned leather. Emulsions in leather processing and the surface charge and potential of leather finish films, adhesion, mechanisms, influence of opacity, refractive index and scattering coefficient of pigments and pigment formulations and factors controlling the stability of leather finish films.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1.Analyse and explore the reactivity of collagen.
CO2.Explore the diffusion and transport phenomena.
CO3.Acquire indepth knowledge on molecular behaviour of collagen.
CO4.Acquire wide knowledge on macro and micro structural behaviour of collagen
CO5. Comprehend the importance of surface science for leather.

TEXT BOOKS AND REFERENCES:

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

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PSO 2	PSO 3
CO1	3	3	1	1	1	1	2	3	1	1	1	2	3	1	1
CO2	3	3	2	1	1	-	2	2	1	1	1	2	3	1	1
CO3	3	3	1	1	1	1	2	2	1	1	1	2	3	2	1
CO4	3	3	1	1	1	2	2	1	1	1	1	2	3	3	1
CO5	3	3	-	1	1	1	2	2	1	1	1	2	3	3	1
Avg	3	3	1	1	1	1	2	2	1	1	1	2	3	2	1

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTLT3015 BIOPROCESS TECHNOLOGIES L T P C
3 0 0 3

COURSE OBJECTIVES:

The course aims to,

- Develop an understanding of the concepts in different fermentation and sterilisation process.
- Study the kinetics involved in growth and sterilisation of micro-organisms.

UNIT I OVERVIEW OF FERMENTATION PROCESSES 6

Overview of fermentation industry, general requirements of fermentation processes, basic configuration of fermenter and ancillaries, main parameters to be monitored and controlled in fermentation processes.

UNIT II RAW MATERIALS AND MEDIA DESIGN FOR FERMENTATION PROCESS 10

Criteria for good medium, medium requirements for fermentation processes, carbon, nitrogen, minerals, vitamins and other complex nutrients, oxygen requirements, medium formulation of optimal growth and product formation, examples of simple and complex media, design of various commercial media for industrial fermentations – medium optimization methods.

UNIT III STERILIZATION KINETICS 6

Thermal death kinetics of microorganisms, batch and continuous heat sterilization of liquid media, filter sterilization of liquid media, air sterilization and design of sterilization equipment - batch and continuous.

UNIT IV METABOLIC STOICHIOMETRY AND ENERGETICS 12

Stoichiometry of cell growth and product formation, elemental balances, degrees of reduction of substrate and biomass, available electron balances, yield coefficients of biomass and product formation, maintenance coefficients energetic analysis of microbial growth and product formation, oxygen consumption and heat evolution in aerobic cultures, thermodynamic efficiency of growth.

UNIT V KINETICS OF MICROBIAL GROWTH AND PRODUCT FORMATION 11

Batch cultivation and continuous cultivation. Simple unstructured models for microbial growth, Monod-model, growth of filamentous organisms, product formation kinetics - Leudeking- Piret models, substrate and product inhibition on cell growth and product formation. Biomass estimation – Direct and Indirect methods.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On the completion of the course students are expected to

CO1. Explore the fundamental configuration of fermenter.
CO2. Develop knowledge on the design and optimization of fermentation process.
CO3. Elucidate various sterilization techniques for the fermentation processes.
CO4. Comprehend the metabolic stoichiometry and energetics of the microbial cell.
CO5. Acquire knowledge on kinetics of the microbial growth and product formation.

TEXT BOOKS AND REFERENCES:

1. Schuler, Michael L. and Fikret Kargi, “Bioprocess Engineering “, Prentice Hall, 1992.
2. Doran, Pauline “of Bioprocess Engineering Principles “. Elsevier, Academic Press 1995
3. Lydersen, Bjorn K. “Bioprocess Engineering Systems, Equipment and Facilities” John Wiley, 1994.
4. Bailey, James E. and David F. Ollis, “Biochemical Engineering Fundamentals”, IInd Edition. McGraw Hill, 1986.
5. Peter F. Stanbury, Stephen J. Hall & A. Whitaker, Principles of Fermentation Technology, Science & Technology Books.
6. Harvey W. Blanch, Douglas S. Clark, Biochemical Engineering, Marcel Dekker, Inc.

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PSO 2	PSO 3
CO1	2	3	3	2	-	-	-	-	-	-	-	3	2	3	1
CO2	2	3	3	2	-	-	-	-	-	-	-	3	-	3	3

CO3	2	3	3	2	-	-	-	-	-	-	-	3	1	3	2
CO4	2	3	3	3	-	2	2	-	-	-	-	3	1	3	2
CO5	3	2	-	2	-	-	-	-	-	-	-	3	1	3	2
Avg	2.2	2.8	2.4	2.2	0	0.4	0.4	0	0	0	0	3	1	3	2

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTLT3016 COMPOSITE MATERIALS L T P C
3 0 0 3

COURSE OBJECTIVE: The Objective of this course is to provide knowledge to the students on various materials other than leather which have the same properties as leather.

UNIT I POLYMER BASED MATERIALS 9

Polyurethane based materials/Pleather – Rubber based materials – Polyethylene based materials – Synthetic Fibers. Manufacturing Methods– Applications – Properties.

UNIT II NATURAL FIBERS BASED MATERIALS 9

Cotton fibers – wool based materials – Jute fibers – Silk fibers – Bamboo fibers – Hemp fibers – Sisal fibers – Palm fibers – Coir Fibers - Rice Husk based materials. Manufacturing Methods – Applications – Properties. Combination Products using natural fibers with leathers - Application in Product sector.

UNIT III BIO BASED MATERIALS 9

Bio-based polymers – Microbial Origin Materials – Microbial Cellulose – Fungal composites. Synthetic biotechnology based artificial skin based approaches.

UNIT IV FRUIT / VEGETABLE BASED MATERIALS 9

Cactus – Pineapple – Mango Leather – Grape Leather – Banana peel Leather – Flower based leather – Apple Leather: Principles – Extraction - Manufacturing Methods– Applications – Properties.

UNIT V RECYCLED MATERIALS 9

Tannery Waste: Buffing dust based materials – Leather trimming based materials – Collagen based materials – Agricultural wastes. Manufacturing Methods - Applications – Properties.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1. Explore various polymers used in developing like leather materials.
CO2. Comprehend the various natural fibers in making sheets.
CO3. Analyse the different biological origin materials.
CO4. Acquire in depth knowledge on various fruit and vegetable sources used to prepare leather like materials.
CO5. Develop various methods for recovering and recycling leather waste materials.

TEXT BOOKS AND REFERENCES:

1. https://www.daryatamin.com/wp-content/uploads/2019/12/Szychers-Handbook-of-Polyurethanes.pdf
2. Alvanas, H. (2021). Polyurethane Fabric: Fabric Made in Traditional Polyurethane: Polyurethane Fabric. (n.p.): Independently Published.
3. Faux Real: Genuine Leather and 200 Years of Inspired Fakes. United States:

University of Pennsylvania Press, Incorporated.
4. Gilroy, D. (2023). Fashion Bags and Accessories: Creative Design and Production. United Kingdom: Quercus Publishing

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO 6	PO7	PO8	PO9	PO 10	PO 11	P O 12	PS O1	PS O2	PSO 3
CO1	3	1	1	1	3	1	3	3	1	1	-	1	2	3	1
CO2	3	-	1	1	1	1	3	1	1	1	-	1	-	3	3
CO3	3	2	1	1	2	1	3	2	1	1	-	1	1	3	2
CO4	3	1	1	1	2	1	3	2	1	1	-	1	1	3	2
CO5	3	1	1	1	2	1	3	2	1	1	-	1	1	3	2
Avg	3	1	1	1	2	1	3	2	1	1	0	1	1	3	2

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTLT3017 INTRODUCTION TO ETP AND CETP DESIGN L T P C
3 0 0 3

COURSE OBJECTIVE: To train students with the skill of designing the ETP/ CETPs for treatment of Tannery Wastewater including Solid Waste Management

UNIT I INTRODUCTION 9

Details of leather processing with water and chemical input, water requirement based on type of process and wastewater generation, need for wastewater treatment, nature of pollutants, characteristics of pollutants, environmental significance of pollutants, standards for discharge of treated effluents, concept of individual Effluent Treatment Plants (ETPs) and Common Effluent Treatment Plants (CETPs), planning for segregation and collection of liquid and solid waste.

UNIT II PHYSICO- CHEMICAL TREATMENT OF WASTEWATER 9

Concept of unit operations and processes, Physical treatment with principle of the process and design criteria- basis for selection of treatment units- screening – flotation, mixing, equalization –sedimentation – filtration – evaporation– incineration, adsorption, membrane separation, stripping and crystallization– recent advances, Preparation of process flow diagram

Chemical treatment with principle of the process and design criteria- basis for selection of treatment units- Coagulation - flocculation–Precipitation –Disinfection, advanced oxidation process –Preparation of process flow diagram

UNIT III BIOLOGICAL WASTEWATER TREATMENT 9

Principles of Biological treatment with process and design criteria – Role of microorganisms in wastewater treatment, Introduction to microbial metabolism – Bacterial growth, Assessment of biodegradability of waste, classification of biological treatment processes, Suspended and attached growth systems, Activated Sludge Process, Membrane Bioreactors, Upflow Anaerobic sludge Blanket (UASB) Reactor,

Waste Stabilization Ponds, basis for selection of treatment units- Preparation of process flow diagram

UNIT IV TERTIARY TREATMENT AND SOLID WASTE MANAGEMENT 9

Principles of Tertiary treatment with process and design criteria – Need and objectives of Tertiary Treatment, removal of residual organics, removal of Colour, polishing treatment, basis for selection of treatment units, sources of solids and solid waste generation, methods of solid waste disposal and treatment, criteria for design of Tertiary Treatment units and solid waste management facilities

UNIT V DESIGN OF ETPS/ CETPS 9

Design concepts for ETPs/ CETPs, freezing of treatment process, arriving the sizes of treatment units, Selection and arriving the capacity of Electro Mechanical items, arriving energy requirement, layout Design, preparation of layout, preparation of Hydraulic Flow Diagram, Preparation of P & I diagram. construction requirements for Civil, mechanical, electrical and instrumentation items, Pre-commissioning activities, O & M of CETPs/ ETPs.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1. Explain the significance of various pollutants present in water, wastewater and develop the kinetics for reactor design.

CO2. Relevant physico-chemical systems for effective water and wastewater treatment.

CO3. Biological Wastewater Treatment.

CO4. Evaluate the various Tertiary Treatment and Solid Waste Management.

CO5. Design of ETP/CETPs.

TEXT BOOKS AND REFERENCES:

1. Metcalf & Eddy, Inc., George Tchobanoglous, Franklin L. Burton and H. David Stensel, Wastewater engineering, treatment and reuse, Fourth Edition, McGraw-Hill, 2017.
2. Lee, C.C. and Shun dar Lin, "Handbook of Environmental Engineering Calculations", McGraw Hill, New York, 1999.
3. Qasim.S.R., Guang Zhu., “Wastewater Treatment and Reuse” – Volume 1& 2 2018.
4. CPHEEO manual – “Manual for sewerage and sewage treatment systems” – Part A,B,C, Ministry of Urban development, New Delhi,2013.
5. CPHEEO manual – “Manual for water supply and treatment” –Ministry of Urban development, New Delhi, 1999.
6. Soli J Arceivala- Wastewater Treatment for Pollution Control – Tata McGraw- Hill Publishing Company Limited, New Delhi

COURSE ARTICULATION MATRIX:

Course Outcomes	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
CO1	2	-	1	-	2	2	3	2	1	1	1	2	2	3	1
CO2	2	-	1	-	2	2	3	2	1	1	-	2	1	3	3
CO3	3	3	2	3	3	2	3	3	2	1	3	3	-	3	2
CO4	2	2	1	2	2	2	3	2	1	1	1	2	1	3	2
CO5	1	-	-	-	-	2	3	1	–	1	-	1	1	3	2
Avg	2	1	1	1	1.8	2	3	2	1	1	1	2	1	3	2

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTLT3018 VALUE ADDITION TO WASTE L T P C
3 0 0 3

COURSE OBJECTIVE: To gain knowledge on the value addition to the by-products produced by the leather sector as a waste to wealth concept.

UNIT 1 INTRODUCTION TO TANNERY WASTE 7
Definition of pollution, Classification of pollutants from leather sector Solid- Liquid- Gaseous

UNIT II TANNERY BYPRODUCTS CHARACTERISTICS 8
Classification of solid wastes from tannery; composition and characteristics – raw trimmings, fleshings, hair wastes, shavings, wetblue/crust/finished leather trimmings, buffing waste.

UNIT III SOLID WASTE DISPOSAL 10
Secured land fill: leachability studies and management of leachates – Biomethanisation of Solid waste: with reference to energy recovery – Thermal incineration – Bacterial compositing – Vermicomposting – Bioremediation-RO reject management.

UNIT IV UTILIZATION OF UNTANNED SOLID WASTE 10
Technologies for utilization of raw trimmings – High end collagen products, glue, gelatin; Fleshing waste – Glue, energy recovery; Hair waste – Composite, keratin hydrolysate.

UNIT V UTILIZATION OF TANNED SOLID WASTE 10
Chrome and vegetable tanned shavings – leather board, protein fillers; utilization of crust/finished leather trimmings.

TOTAL: 45 PERIODS

OUTCOME:
On Completion of the course, the student is expected to be able to,
CO1. Acquire the knowledge of the waste produced in leather sector.
CO2. Explore the characteristics of tannery by-products.
CO3. Elucidate the solid waste disposal methods practiced in industries
CO4. Acquire knowledge on the untanned waste utilization.
CO5. Elucidate the tanned waste utilization methods.

REFERENCES:

1. Arceivala S.J. "Waste water treatment and disposal" Marcel Dekkar Inc., New York, 1981.
2. Besselievie, B.E. and Schwartz, M. "The Treatment of Industrial wastes", 2nd edn., McGraw Hill.
3. McCarty, P., Parkin, G.F. and Sawyer, C.N., "Chemistry for Environmental Engineering 4th Edition", McGraw Hill, 1994.

COURSE ARTICULATION MATRIX:

Course Outcomes	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
CO1	2	-	1	-	2	2	3	2	1	1	1	2	2	3	1
CO2	2	-	1	-	2	2	3	2	1	1	-	2	1	3	3
CO3	3	3	2	3	3	2	3	3	2	1	3	3	-	3	2
CO4	2	2	1	2	2	2	3	2	1	1	1	2	1	3	2
CO5	1	-	-	-	-	2	3	1	–	1	-	1	1	3	2
Avg	2	1	1	1	1.8	2	3	2	1	1	1	2	1	3	2

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTLT3019 QUALITY ASSURANCE FOR PRODUCT L T P C
3 0 0 3

COURSE OBJECTIVE: To train the students to understand and implement quality assurance system in the leather product manufacturing unit.

UNIT I QUALITY ASSURANCE AND ITS METHODS 8

Quality assurance, Importance of quality assurance for product manufacturing; Quality assurance Methods - Failure testing, Statistical process control, Total quality management.

UNIT II TOOLS FOR QUALITY ASSURANCE 9

Seven basic tools of quality - Stratification, histogram, check sheet, cause and effect diagram, pareto chart, scatter diagram, control chart; Quality assurance in software.

UNIT III PROCESS CONTROL IN LEATHER PRODUCT MANUFACTURING 9

Process flow charts; In-process control check; Responsibilities; Calibration, validation and qualification of the manufacturing processes; Calibration, validation and qualification of the leather products at intermittent stages.

UNIT IV QUALITY CONTROL 9

Quality control theory; Quality assurance and quality control; Importance of quality control; Responsibilities; Quality control of the final product Calibration, validation and qualification involved in quality control of the final product.

UNIT V CASE STUDY 10

Implementation of the quality assurance system in the leather product manufacturing unit.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1. Explore the importance of quality assurance and the methods of quality assurance.
CO2. Classify the tools of the quality assurance.
CO3. Acquire knowledge of the in process control of leather product manufacturing.
CO4. Elucidate the qualification of the final products.
CO5. Explore the implementation of the quality assurance for leather product manufacturing.

TEXT BOOKS AND REFERENCES:

1. A. J. Duncan, “Quality Control and Industrial Statistics”, Homewood, Illinois, Published by Irwin, 1986.
2. “International Organization for Standardization” case postale 56, CH-1211-Geneva – 20, Switzerland.
3. “Bureau of Indian Standards”, New Delhi.
4. Dale H.Besterfiled, Carol B.Michna,Glen H. Bester field,MaryB.Sacre,HemantUrdhwareshe and RashmiUrdhwareshe, “Total Quality Management”, Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression,2013.
5. Joel.E. Ross, “Total Quality Management – Text and Cases”,Routledge.,2017.
6. Kiran.D.R, “Total Quality Management: Key concepts and case studies, Butterworth – Heinemann Ltd, 2016.
7. Oakland, J.S. “TQM – Text with Cases”, Butterworth – Heinemann Ltd., Oxford, Third Edition, 2003.
8. Suganthi,L and Anand Samuel, “Total Quality Management”, Prentice Hall (India) Pvt. Ltd., 2006 .

COURSE ARTICULATION MATRIX:

Course Outcomes	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	2	-	1	-	2	2	3	2	1	1	1	2	2	3	1
CO2	2	-	1	-	2	2	3	2	1	1	-	2	1	3	3
CO3	3	3	2	3	3	2	3	3	2	1	3	3	-	3	2
CO4	2	2	1	2	2	2	3	2	1	1	1	2	1	3	2
CO5	1	-	-	-	-	2	3	1	–	1	-	1	1	3	2
Avg	2	1	1	1	1.8	2	3	2	1	1	1	2	1	3	2

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTLT3020 HUMAN RESOURCE MANAGEMENT L T P C
3 0 0 3

COURSE OBJECTIVE: To impart human resource management skills to the students.

UNIT I MANAGEMENT AND GENERAL EMPLOYMENT PRACTICES 9

HRM and HRD – Concept and Need; Motivation, Leadership, Employee involvement vs engagement, Employee empowerment; Performance management, Performance and potential appraisals; HR Accounting and HR Audit; Workplace ethics and behaviour, Healthy work-life balance and stress management; International HRM and cross-cultural diversity management.

UNIT II STRUCTURE, STAFFING, CULTURE AND CLIMATE 9

Organizational design, Human Resource Planning; Job design, Job Analysis - Job description and job specification; Equal Employment Opportunity; Recruitment, Selection, Placement, Induction and Socialization; Organizational culture – Creating and sustaining culture, Concept and determinants of Organizational climate; Employee retention; Organizational exit.

UNIT III HUMAN RESOURCE DEVELOPMENT 9

HRD role clusters: Analysis/Assessment roles- Evaluator, Needs analyst, Researcher Development roles - Evaluator, HRD materials developer, Program designer.
Strategic roles – HRD manager, Marketer, Organization – Change agent, Individual – Career development advisor, Instructor/Facilitator, Administrator.
Types of competencies and Competency development; Training and Development; Organizational Development for conflict management and change management; Career Planning and Development, Succession planning.
Contemporary issues: Strategic talent management, Knowledge management and learning organizations, Intellectual capital management, HR Outsourcing, HR Benchmarking, HR Information System.

UNIT IV EMPLOYEE COMPENSATION 9

Job evaluation, Pay Structures, Competency based and Performance based pay systems, Benefit programs, Pay delivery administration.

UNIT V HEALTH, SAFETY, SECURITY AND LABOUR RELATIONS 9

Introduction to occupational Safety-Employee assistance programs, safety management and approaches, theft, fraud, investigations, corrections; Labour laws in India, unfair labour practices, collective bargaining.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On the completion of course students are expected to

CO1. Acquire knowledge on human resource management and development of general employment practices.

CO2. Design organizational structure, staffing, culture and climate.

CO3. Acquire in-depth knowledge on HRD role clusters, developmental interventions from HRD perspective and contemporary issues.

CO4. Elucidate employee compensation and compensation administration.

CO5. Analyse occupational health, safety, security, labour laws and labour relations.

TEXT BOOKS AND REFERENCES:

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

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PSO 2	PSO 3
CO1	1	1	2	2	2	2	1	3	3	1	2	2	-	-	3
CO2	-	1	2	1	-	2	1	2	3	2	1	3	2	2	3
CO3	1	1	2	2	3	2	1	2	3	2	1	2	1	2	3
CO4	2	2	3	1	2	1	1	2	3	1	2	2	1	3	3
CO5	2	2	2	2	2	2	2	2	3	1	1	2	2	3	3
Avg	1.2	1.4	2.2	1.6	1.8	1.8	1.2	2.2	3	1.4	1.4	2.2	1.2	2	3

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTLT3021 ENTREPRENEURSHIP DEVELOPMENT L T P C
3 0 0 3

COURSE OBJECTIVE: This course aims to provide necessary knowledge and attitude to understand and appreciate the process of starting and developing a new venture.

UNIT I QUALITY OF ENTREPRENEURS 8

Entrepreneurs – Mindset, character, motivation. Types of entrepreneurs. Competencies - creativity, innovation, risk taking, resilience, leadership, communication, negotiation and networking; Design thinking for entrepreneurs. Myths about entrepreneurs; benefits and drawbacks of entrepreneurship. Managerial concerns specific to growing ventures; Reasons for a venture failure. Successful first-generation entrepreneurs in leather sector – case study.

UNIT II PLANNING AND DEVELOPMENT 8

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

UNIT III FINANCIAL MANAGEMENT 10

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

UNIT IV ORGANIZATIONAL MANAGEMENT 9

Building Team – creating growth oriented organizational culture. Employee motivation, retention strategies. Organizational structure with clear roles, responsibilities, authorities and accountabilities. Attracting talent with ESOP and other incentives and benefits. Training and development to enhance the quality of operators, supervisors and managers of the tannery.

UNIT V BUSINESS DEVELOPMENT STRATEGIES 10

Building Business – Market plan, market research, competitive analysis, formulating competitive marketing strategy. Segmenting, Targeting and Positioning of the brand. Formulating marketing mix – 4 Ps of Product Marketing and 7 Ps of Service Marketing. Personal selling, advertising and sales promotion, managing a sales team. Distribution and CRM Strategy. New Product development. E-commerce fundamentals; strategy for expansion. Franchising - benefits and drawbacks of franchising. Global marketing – overseas marketing strategies; export documentation. Mergers and Acquisitions – synergy and valuation. Intellectual Property - patterns, trademarks, copy rights and trade secrets to grow the business in leather sector.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1. Acquire conceptual and theoretical knowledge about entrepreneurs and entrepreneurship

CO2. Design and development of Business Plan.

CO3. Acquire basic knowledge in financial management.

CO4. Explore the various organizational management aspects to attract, retain and develop talented workforce.

CO5. Acquire knowledge on business development strategies.

TEXT BOOKS AND REFERENCES:

1. Entrepreneurship - D.F. Kuratko and T.V.Rao – Cengage Learning -2012 ; ISBN – 978-81315- 1716-1.
2. Entrepreneurial Development – Dr. S.S. Khanna - S. Chand -2012 ISBN – 81- 219-1801-4.
3. Handbook for New Entrepreneurs – P.C. Jain – Entrepreneurship Development Institute of India – 2010; ISBN:13 : 978-0-19-565224-6.
4. Essentials of Entrepreneurship and Small Business Management – Thomas W. Zimmerer, Norman M. Scarborough – PHI Learning Ltd New Delhi. ISBN : 978 – 81-203-3911-8.
5. http://smallb.in/entrepreneurship - A SIDBI initiative.
6. http://business.gov.in/ - Business Knowledge Resources for SMEs.
7. http://www.dcmsme.gov.in/ - Development Commissionaire (MSME) Ministry of Small Micro Medium Industries.

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PSO 2	PSO 3
CO1	-	1	2	2	-	2	1	2	3	3	2	2	2	1	3
CO2	2	2	2	2	2	2	1	2	3	1	1	2	-	3	3
CO3	-	1	2	1	-	2	1	2	3	1	3	3	-	2	3
CO4	1	1	2	1	2		1		3		1		1	2	3
CO5	1	1	2	1	3	2	1	2	3	1	1	2	2	3	3
Avg	0.8	1.2	2	1.4	1.4	1.6	1	1.6	3	1.2	1.6	1.8	1	2.2	3

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTLT3022 ORGANIZATION AND MANAGEMENT OF LEATHER MANAUFACTURE L T P C 3 0 0 3

COURSE OBJECTIVE: To provide skills and knowledge on organization and management for leather sector.

UNIT I RAW MATERIAL RESOURCE MANAGEMENT 10

Basic Resource – Livestock: Management systems - Population distribution and trends in India and World – Relative importance - Supply of meat animals – Projections for future. Raw materials – Hides and skins: Meat consumption pattern – Slaughter and mortality rates – Availability of hides and skins in India and world – Storage and grading systems – Pricing and other marketing factors - Major markets and sources of supply from India and world – Scenarios for future.

UNIT II INDUSTRY MANAGEMENT 10

Social relevance and historical growth of leather sector. Processing Industry – Tanning: Structure of the Industry in India and the World – Capacity, Production, Environmental management - Exclusive complexes and CETPs – Sustainability challenges. Fabrication Industries – Products: Structure and Distribution of Product industries in India and World - Pattern of Leather utilization – Capacity, Production, Employment pattern - Components of design and fashion.

UNIT III DOMESTIC TRADE MANAGEMENT 8

Domestic Trade – India: Production and Consumption pattern of Footwear in India – Market demand for Leather and Synthetic (non- leather) footwear - Market for Leather goods, garments, gloves and other leather articles in India – Import of Footwear and Products into India – Emerging market scenario in India. Export Trade – India: Export and Import policy - Export trends of leather and products – major markets for India - Importance of Brands, Fashion, Certification issues – Priorities for Future.

UNIT IV INTERNATIONAL TRADE MANAGEMENT 7

International Trade – Global: Major exporting and importing countries in the world – Significance of African region in the world market - Changes in the pattern of demand at global level - Role of Market network, Brands and Fashion– Impact of E-Commerce.

Ecological and Social labelling /certification systems - Traceability, Ethical, Resource conservation issues – Role of WTO - Future challenges for leather trade.

UNIT V DEVELOPMENT STRATEGY 10

Planning and Trade Promotion strategies – India: Planning of Material, Manpower, Financial resources – Potential for non- conventional raw-material resources and product categories – Role of various Organisations – Trade promotion measures – Market surveys and building market intelligence – Measures for India's sustainability in world trade.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1. Elucidate raw material resource management.
CO2. Explore about leather industry in India and world.
CO3. Analyse and understand the domestic trade management in leather.
CO4. Analyse and understand the international trade management in leather.
CO5. Explore industry, trade management and development strategy in leather.

TEXT BOOKS AND REFERENCES:

1. Report of All India Survey on Raw Hides and Skins, CLRI, 1987 and 2004.
2. Report on Capacity Utilisation and Scope for modernization of Indian tanning industry, CLRI, 1990.
3. Report of the Committee on The Development of Leather and Leather Manufactures for Exports (Seetharamaiah Committee Report), Govt of India 1972.
4. Report of the Nationwide Survey on Leather Product Units in India, CLRI, 1997.
5. Thyagarajan, G, Srinivasan, A.V. and Amudeswari, A., "Indian Leather 2010, A technology, Industry and Trade Forecast', CLRI, Madras 1994.
6. Bulletins of India's Foreign Trade in Leather and Leather Products, CLRI.
7. Sadulla, S. The Leather Industry Kothari's Desk Book Series, H.C.Kothari Group (Publications Division), Madras 1995.

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PSO 2	PSO 3
CO1	2	1	1	1	1	3	1	1	2	1	1	1	-	3	3
CO2	1	1	1	-	1	3	1	1	1	1	3	1	-	3	3
CO3	1	1	1	2	1	3	1	1	3	1	2	1	1	3	3
CO4	1	1	1	1	1	3	1	1	2	1	2	1	2	3	3
CO5	-	1	1	1	1	3	1	1	2	1	2	1	2	3	3
Avg	1	1	1	1	1	3	1	1	2	1	2	1	1	3	3

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTLT3023 LEATHER AND LEATHER PRODUCTS COSTING L T P C
3 0 0 3

COURSE OBJECTIVE: To impart knowledge on leather and leather products costing

UNIT I COSTING METHODS 10

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

UNIT II COST ANALYSIS 8

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

UNIT III LEATHER AND LEATHER PRODUCT COSTING 9

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

UNIT IV RISK ANALYSIS OF FOREIGN EXCHANGE 10

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

UNIT V BUDGET MANAGEMENT 8

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1. Acquire basic knowledge on costing.
CO2. Elucidate costing analysis.
CO3. Acquire indepth knowledge on costing of leather and leather products.
CO4. Explore the risk analysis of foreign exchange.
CO5. Elucidate budget management and types.

TEXT BOOKS AND REFERENCES:

1. "Costing in leather processing industry", ICWAI, 2001.
2. Bulijan, J., "Costs of tannery waste treatment", UNIDO, 2005.
3. "World statistical compendium for raw hides and skins, leather and leather footwear", Food and Agriculture Organization of the United Nation, 2016.
4. James C., Van Home., "Financial Management and Policy", Prentice Hall of India Pvt. Ltd, New Delhi, 1980.
5. Thukaram Rao M.E., "Cost and Management Accounting" New Age International, Bangalore, 2004.

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PSO 2	PSO 3
CO1	2	1	-	-	1	2	2	1	1	1	-	2	1	3	-
CO2	2	2	3	-	3	-	1	1	1	1	2	2	1	3	-
CO3	3	2	-	-	3	1	-	1	1	1	-	2	-	3	2
CO4	2	3	2	-	2	1	1	1	1	1	3	2	-	3	3
CO5	3	2	1	-	1	1	1	1	1	1	-	2	3	3	3
Avg	2.4	2	1.2	0	2	1	1	1	1	1	1	2	1	3	1.6

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTLT3024 MARKETING MANAGEMENT L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand the changing business environment
- To identify the indicators of management thoughts and practices
- To understand fundamental premise underlying market driven strategies

UNIT I INTRODUCTION 9

Marketing – Definitions - Conceptual frame work – Marketing environment: Internal and External - Marketing interface with other functional areas – Production, Finance, Human Relations. Management, Information System. Marketing in global environment – Prospects and Challenges.

UNIT II MARKETING STRATEGY 9

Marketing strategy formulations – Key Drivers of Marketing Strategies - Strategies for Industrial. Marketing – Consumer Marketing –– Services marketing – Competitor analysis - Analysis of consumer and industrial markets – Strategic Marketing Mix components.

UNIT III MARKETING MIX DECISIONS 9

Product planning and development – Product life cycle – New product Development and Management – Market Segmentation – Targeting and Positioning – Channel Management - Advertising and sales promotions – Pricing Objectives, Policies and methods.

UNIT IV BUYER BEHAVIOUR 9

Understanding industrial and individual buyer behavior - Influencing factors – Buyer Behaviour. Models – Online buyer behaviour - Building and measuring customer satisfaction – Customer relationships management – Customer acquisition, Retaining, Defection.

UNIT V MARKETING RESEARCH & TRENDS IN MARKETING 9

Marketing Information System – Research Process – Concepts and applications: Product – Advertising – Promotion – Consumer Behaviour – Retail research – Customer driven organizations - Cause related marketing - Ethics in marketing –Online marketing trends.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1. Acquire basic knowledge on the marketing management.
CO2. Explore and analyse different marketing strategies.
CO3. Comprehend decision making skills for a business.
CO4. Articulate the buyers behaviour.
CO5. Elucidate the marketing research methods and trends.

TEXT BOOKS AND REFERENCES:

1. Philip Kortler and Kevin Lane Keller, Marketing Management, PHI 14th Edition, 2012.
2. KS Chandrasekar, “Marketing Management-Text and Cases”, Tata McGrawHill-Vijaynicole, First edition,2010.
3. Paul Baines, Chris Fill and Kelly Page, Marketing, Oxford University Press, 2nd Edition,2011.
4. Lamb, hair, Sharma, Mc Daniel– Marketing – An Innovative approach to learning and teachingA south Asian perspective, Cengage Learning –– 2012.
5. Micheal R.Czinkota & Masaaki Kotabe, Marketing Management, Vikas Thomson Learning, 2000.
6. Duglas,J.Darymple, Marketing Management, John Wiley & Sons, 2008.NAG,

Marketing successfully- A Professional Perspective, Macmillan 2008.
7. Boyd Walker, Marketing Management, McGraw Hill, 2002.
8. Paul Baines, Chriss Fill Kelly Pagb, Marketing, II edition, Asian edition.

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO 3
CO1	2	1	2	2	2	2	1	2	3	1	1	2	-	-	3
CO2	-	1	2	1	-	2	1	2	3	1	1	3	-	2	3
CO3	1	1	2	1	3	2	1	2	3	1	1	1	1	2	3
CO4	1	1	2	1	2	2	1	2	3	1	1	2	2	3	3
CO5	1	1	2	1	2	2	1	2	3	1	1	2	2	3	3
Avg	1	1	2	1.2	1.8	2	1	2	3	1	1	2	1	2	3

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTLT3025 FOREIGN TRADE L T P C
3 0 0 3

COURSE OBJECTIVE: To impart knowledge on international marketing and foreign trade aspects of leather industry.

UNIT I INTRODUCTION 9

Basics of International trade - India's trade policy, International trade and Monetary Systems- Marketing Services in International Trade Pricing and trade cycles- Precautionary measures to prevent fraud in International trade - International Trade Multimodal Transport Operations- Consumer Behavior and Role of international Marketing- Indian Market Analysis.

UNIT II MANAGEMENT OF IMPORT AND EXPORT 9

Introduction-Import to India-An over view, Import and the Customs in India-Importation of Goods, Customs Duty and Exemptions-Valuation of Goods under Customs, Clearance of Imported Goods and Goods in Transit-Warehousing of Goods, Import into India. India's new foreign trade Policy -Legal frame work of foreign trade Policy-Special focus. General provision on Import and Export-Promotional Measures- Duty exemption/ Duty remission scheme EPCG Scheme -EOU/ EHTP/ STP/ BTP- SEZs.

UNIT III DOMESTIC AND IMPORTTRADE MANAGEMENT 10

Marketing concepts and Import-Forms of organization in Import and domestic Trade-Products, Sales forecasting and sales Management-pricing, Promotion, Branding and Advertising. Retail Management - Introduction to Logistics - Parameters of Supply Chain Management - Management of logistics and Supply Chain - Consumer Supply Chain Relationship.

UNIT IV IMPORT POLICY 8

The Customs Tariff Act-Exemptions in Import-by UN and its agencies and their Officials-Import by UN or international organizations for execution of projects in India-Imports by Government Diplomats, Trade representatives etc.-Customs Tariff.

UNIT V MARKETING STRATEGY 9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course, the students are expected to,
CO1. Acquire basic knowledge on international trade.
CO2. Elucidate import export management.
CO3. Elucidate domestic and import trade management.
CO4. Analyse import policy
CO5. Explore marketing strategies.

TEXT BOOKS AND REFERENCES:

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

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PSO 2	PSO 3
CO1	-	-	2	3	3	3	-	3	-	-	-	3	3	2	3
CO2	-	-	2	3	3	3	-	3	-	-	-	3	3	2	3
CO3	-	-	2	3	3	3	-	3	-	-	-	3	3	2	3
CO4	-	-	2	3	3	3	-	3	-	-	-	3	3	2	3
CO5	-	-	2	3	3	3	-	3	-	-	-	3	3	2	3
Avg	-	-	2	3	3	3	-	3	-	-	-	3	3	2	3

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTLT3026 ENTERPRISE RESOURCE PLANNING L T P C
3 0 0 3

COURSE OBJECTIVE: The objective of this course is to teach the principles of ERP technologies involved in enterprise resource and various case studies in the pre and post implementation of ERP's that will enable the students to perform as an efficient entrepreneur.

UNIT I INTRODUCTION 8

What is ERP? - Need of ERP - Advantages of ERP - Growth of ERP.

UNIT II ERP AND RELATED TECHNOLOGIES 9

Business process Reengineering (BPR) - Management Information System (MIS) - Decision Support Systems (DSS) - Executive Support Systems (ESS) - Data Warehousing, Data Mining - Online Analytical Processing (OLTP) - Supply Chain Management (SCM) - Customer Relationship Management (CRM).

UNIT III ERP MODULES AND VENDORS 10

Finance - Production planning, control and maintenance - Sales and Distribution - Human Resource Management (HRM) - Inventory Control System - Quality Management - ERP Market.

UNIT IV ERP IMPLENENTATION LIFE CYCLES 10

Evaluation and selection of ERP package - Project planning - Implementation team training and testing - End user training and Going Live - Post Evaluation and Maintenance.

UNIT V ERP CASE STUDIES 8

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1. Acquire basic knowledge on ERP.
CO2. Explore and analyse various ERP technologies.
CO3. Articulate ERP modules.
CO4. Develop ERP implementation lifecycles.
CO5. Explore the inferences of POST implementation ERP.

TEXT BOOKS AND REFERENCES:

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

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PSO 2	PSO 3
CO1	3	1	1	-	1	-	-	-	-	-	-	-	1	-	-
CO2	3	2	1	1	1	-	-	1	-	-	1	-	1	2	1
CO3	3	2	1	-	-	-	-	-	1	-	-	1	1	2	2
CO4	3	1	1	1	-	-	-	1	1	--	2	-	1	2	3
CO5	3	1	1	2	-	-	-	1	-	-	-	-	1	3	2
Avg	3	1.4	1	0.8	0.4	0	0	0.6	0.4	0	0.6	0.2	1	1.8	1.6

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

PTLT3027 OPERATIONAL RESEARCH L T P C
3 0 0 3

COURSE OBJECTIVE: To understand and gain knowledge on several mathematical and software tools helpful for operational research.

UNIT I MATHEMATICAL PROGRAMMING 12

Introduction, Linear Programming, Solution by simplex method, Duality, Sensitivity analysis, Dual simplex method, Integer Programming, Branch and bound method, Geometric programming and its application.

UNIT II DYNAMIC PROGRAMMING 10

Elements of DP models, Bellman's optimality criteria, Recursion formula, Solution of multistage decision problem by DP method. Application is Heat Exchange Extraction systems.

UNIT III PERT, CPM and GERT 9

Network representation of projects, Critical path calculation, construction of the time-chart and resource leveling, Probability and cost consideration in project scheduling, Project control. Graphical Evaluation and Review Techniques.

UNIT IV ELEMENTS OF QUEUING THEORY 7

Basic elements of the Queuing model, M/M/1 and M/M/C Queues.

UNIT V ELEMENTS OF RELIABILITY THEORY 7

General failure distribution, for components, Exponential failure distributions, General model, Maintained and Non-maintained systems, Safety Analysis.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1. Acquire basic knowledge on the mathematical programming.
CO2. Acquire basic knowledge on the dynamic programming.
CO3. Analyze the methods for the calculation involved in business.
CO4. Elucidate the elements of queuing theory.
CO5. Comprehend reliability theory.

TEXT BOOKS AND REFERENCES:

1. Carter, M. W. and Price, C. C., Operations Research: A Practical Introduction Contributor, CRC Press, 2001.
2. Edgar, T. F., Himmelblau, D. M. and Ladson, L. S., "Optimization of Chemical Processes", 2nd Ed., McGraw Hill, New York, 2003.
3. Hillier, F. S., and Lieberman, G. J., Introduction to Operations Research, McGraw-Hill, 2005.
4. Taha, H. A., "Operations Research, An introduction", 6th Ed., Prentice Hall of India, New Delhi, 2006.

COURSE ARTICULATION MATRIX:

Course Outcome	Program Outcome														
	PO1	PO2	PO3	PO4	PO5	PO 6	PO7	PO8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	1	1	-	1	-	-	-	-	-	-	-	1	-	-
CO2	3	2	1	1	1	-	-	1	-	-	1	-	1	2	1
CO3	3	2	1	-	-	-	-	-	1	-	-	1	1	2	2
CO4	3	1	1	1	-	-	-	1	1	--	2	-	1	2	3
CO5	3	1	1	2	-	-	-	1	-	-	-	-	1	3	2
Avg	3	1.4	1	0.8	0.4	0	0	0.6	0.4	0	0.6	0.2	1	1.8	1.6

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.