SEMESTER WISE COURSE STRUCTURE & EVALUATION SCHEME

for

B. TECH. DEGREE PROGRAMME

(Effective from the session 2019-20)

DEPARTMENT OF LEATHER TECHNOLOGY
SCHOOL OF CHEMICAL TECHNOLOGY
HARCOURT BUTLER TECHNICAL UNIVERSITY
KANPUR-208002
UTTAR PRADESH

Department of Chemical Technology-Leather Technology

Vision

The Department of Leather Technology at HBTU aims at being a leader of innovation in the area of Leather to produce quality technologists of world standards to deliver the benefits of the developed technologies to the people.

Mission

The mission of the Department of Chemical Technology- Leather Technology are:

M1: To achieve academic excellence and practical knowledge in the fields of Leather, Leather Application, and allied areas.

M2: To inculcate technical competence in students for formulation, manufacture and application of advanced Leather with eco -friendly and sustainable approach.

M3: To develop state-of-art facilities for testing and consultancy for industry to make the department a center of excellence in the field of Leather at global level.

M4: To develop indigenous and adaptable technologies related to Leather for small scale production and to develop entrepreneurial skills, towards betterment of society.

M5: To cultivate strong ethical values to be a successful professional and to become life - long learners.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1: To produce graduates and post graduates who will be able to meet the requirements and challenges at national & international levels in the field of formulation, manufacture and application of Leather and allied products.

PEO 2: To inculcate in students the fundamental concepts related to Leather Production & applications to enable them to develop novel technologies to meet the global standards of eco-friendliness & sustainability.

PEO 3: To produce technologists with high moral values and professional ethics, who can work with industry hand-in-hand for mutual benefits and to sensitize them for job creation for the society, specially the rural community.

Program Specific Outcomes:

PSO1 **:** To apply practical skills, technical knowledge in major streams such as chemistry, manufacturing, processing, and applications areas of engineering and technology in Leather and allied industries

PSO2 **:** To take-up career in research organizations or to pursue higher studies in Leather technology and interdisciplinary programs with high regard for ethical values, environmental and social issues.

SEMESTER WISE COURSE STRUCTURE & EVALUATION SCHEME

B. TECH. CHEMICAL TECHNOLOGY- LEATHER TECHNOLOGY

Semester-I

Sl. No.	Course Type	Course Title	Subject Code	Credits	Periods			Sessional Marks				ESE	Total Marks
					L	T	P	CT	TA	Lab.	Total		
1	BSC	Engineering Chemistry	BCY 151	4	3	0	2	15	20	15	50	50	100
2	BSC	Mathematics I	BMA 151	4	3	1	0	30	20	-	50	50	100
3	ESC	Electronics & Instrumentation Engineering	EET 151	3	3	0	0	30	20	-	50	50	100
4	ESC	Engineering Graphics	ECE 151	3	0	0	6	30	20	-	50	50	100
5	ESC	Computer Concepts & Programming	ECS 151	4	3	0	2	15	20	15	50	50	100
6	ESC	Workshop Practice	EWS 151	2	0	0	4	--	20	30	50	50	100
7	MC (Non Credit)	Environment & Ecology	ECE 151	0	2	0	0	30	20	-	50	50	100
		Total Credits 20											**600**

Semester-II

Sl. No.	Course Type	Course Title	Subject Code	Credits	Periods			Sessional Marks ESE					Total Marks
					L	T	P	CT	TA	Lab	Total		
1	BSC	Physics	BPH 152	4	3	0	2	15	20	15	50	50	100
2	BSC	Mathematics II	BMA 152	4	3	1	0	30	20	-	50	50	100
3	ESC	Electrical Engineering	EEE 152	4	3	0	2	15	20	15	50	50	100
4	ESC	Engineering Mechanics	EME 152	3	3	0	0	30	20	-	50	50	100
5	HSMC	English Language & Composition	HHS 152	2	2	0	0	30	20	-	50	50	100
6	HSMC	Professional Communication	HHS 152	3	3	0	2	15	20	15	50	50	100
		Total Credits 20											**600**

Semester-III

Sl. No.	Course Type	Course Title	Subject Code	Credits	Periods			Sessional Marks				ESE	Total Marks
					L	T	P	CT	TA	Lab	Total		
1	BSC	Mathematics III	BMA 251	4	3	1	0	30	20	-	50	50	100
2	PCC	Leather Microscopy & Skin Pretannages	TLT 251	4	3	1	0	30	20	-	50	50	100
3	PCC	Leather Microscopy & Skin Pretannages Lab	TLT 253	2	0	0	4	-	20	30	50	50	100
4	ESC	Fluid Mechanics and Mechanical operation	TLT 255	5	3	1	2	15	20	15	50	50	100
5	PCC	Materials & Energy Balance	TLT 257	4	3	1	0	30	20	-	50	50	100
6	HSMC	Organizational Behaviour	HHS 251	3	3	0	0	30	20	-	50	50	100
7	MC (Non Credit)	Cyber Security	ECS 251	0	2	0	0	30	20	-	50	50	100
	Total Credits 22												**600**

Semester IV

Sl. No.	Course Type	Course Title	Subject Code	Credits	Periods			Sessional Marks				ESE	Total Marks
					L	T	P	CT	TA	Lab	Total		
1	BSC	Modern Analytical Techniques	BCY 252	4	3	0	2	15	20	15	50	50	100
2	BSC	Computer Oriented Numerical Methods	BMA 252	4	2	1	2	15	20	15	50	50	100
3	PCC	Analysis of Materials of Leather Manufacture	TLT 254	5	3	1	2	15	20	15	50	50	100
4	ESC	Heat Transfer Operations	TLT 256	3	2	1	0	30	20	-	50	50	100
5	PCC	Chemical Engineering Thermodynamics	TLT 252	3	2	1	0	30	20	-	50	50	100
6	HSMC	Engg Economics & Management	HHS 252	3	3	0	0	30	20	-	50	50	100
7	MC (Non Credit)	Indian Constitution	HHS 256	0	2	0	0	30	20	-	50	50	100
	Total Credits 22												**600**

Semester-V

Sl. No.	Course Type	Course Title	Subject Code	Credits	Periods			Sessional Marks				ESE	Total Marks
					L	T	P	CT	TA	Lab	Total		
1	PCC	Processing of Leather-I	TLT 351	5	3	1	2	15	20	15	50	50	100
2	PCC	Inorganic Tannages	TLT 353	4	3	1	0	30	20	-	50	50	100
3	PCC	Processing of Leather-I Lab	TLT 355	2	0	0	4	-	20	30	50	50	100
4	PCC	Mass Transfer Operations	TLT 357	4	3	1	0	30	20	-	50	50	100
5	PCC	Chemical Reaction Engineering	TLT 359	4	3	1	0	30	20	-	50	50	100
6	OEC (Humanities)	Open Elective Course -I	HHS 351	3	3	0	0	30	20	-	50	50	100
	Total Credits				**22**								**600**

Semester-VI

Sl. No.	Course Type	Course Title	Subject Code	Credits	Periods			Sessional Marks				ESE	Total Marks
					L	T	P	MSE	TA	Lab.	Total		
1	PCC	Processing of Leather-II	TLT 352	3	2	0	2	15	20	15	50	50	100
2	PCC	Organic Tannages	TLT 354	3	2	1	0	30	20	-	50	50	100
3	PCC	Leather Analysis and Quality Control	TLT 356	4	3	0	2	15	20	15	50	50	100
4	PCC	Post Tanning and Finishing Operation	TLT 358	3	2	1	0	30	20	0	50	50	100
5	PCC	Leather Auxialaries Technology	TLT 360	3	3	0	0	30	20	0	50	50	100
6	PCC	Instrumentation & Process Control	TLT 362	3	2	1	0	30	20	-	-	50	100
7	OEC (Maths)	Open Elective Course -II	BMA 352	3	3	0	0	30	20	-	50	50	100
		Total Credits			**22**								**700**

Semester-VII

Sl. No.	Course Type	Course Title	Subject Code	Credits	Periods			Sessional Marks				ESE	Total Marks
					L	T	P	CT	TA	Lab	Total		
1	PCC	Leather Trades Engineering	TLT 451	2	2	0	0	30	20	-	50	50	100
2	PCC	Professional Areas of Leather Technology	TLT 453	3	2	0	2	15	20	15	50	50	100
3	PEC	Programme Elective Course I (Tannery Effluent Treatment OR Leather biotechnology)	TLT 455 OR TLT 457	3	3	0	0	30	20	-	50	50	100
4	PEC	Programme Elective Course II (Footwear Technology OR Animal and Tannery by Products)	TLT 459 OR TLT 461	3	3	0	0	30	20	-	50	50	100
5	OEC (Leather Tech.)	Open Elective Course -III	OLT 491	3	3	0	0	30	20	-	50	50	100
6		Industrial Training	TLT 493	2	0	0	4	-	25	-	25	25	50
7		Seminar	TLT 495	2	0	0	4	-	25	-	25	25	50
8		Project	TLT 497	4	0	0	8	-	50	-	50	50	100
9		Educational Tour			0	0	0						
	Total Credits 22												**700**

Semester-VIII

Sl. No.	Course Type	Course Title	Subject Code	Credits	Periods			Sessional Marks				ESE	Total Marks
					L	T	P	CT	TA	Lab	Total		
1	PEC	*Programme Elective Course III (Computer Aided Leather Product Design OR Footwear materials and Components)	TLT 452 OR TLT 454	4	3	1	0	30	20	-	50	50	100
2	PEC	*Programme Elective Course IV (Process Modeling & Simulation OR computer aided Equipment Design)	TLT 456 OR TLT 458	4	3	1	0	30	20	-	50	50	100
3	OEC (Chemical Engg.)	*Open Elective Course –IV (Transport Phenomena)	OLT 492	4	3	1	0	30	20	-	50	50	100
4		Project	TLT 498	10	0	0	20	-	50	-	50	50	100
		Total Credits 22											**400**

*** Online Courses**

List of Programme Elective Courses

S. No.	PEC Names	Subject Name	Subject Code	C (L-T-P)
1.	Programme Elective Course I	Tannery Effluent Treatment	TLT 455	3 (3-0-0)
		Leather biotechnology	TLT 457	
2.	Programme Elective Course II	Footwear Technology	TLT 459	3 (3-0-0)
		Animal and Tannery by Products)	TLT 461	
3.	Programme Elective Course III	Computer Aided Leather Product Design	TLT 452	4 (3-1-0)
		Footwear materials and Components	TLT 454	

List of Open Elective Courses

S. No.	OEC Names	Subject Name	Subject Code	C (L-T-P)
1.	Open Elective Course II (Humanities)	Entrepreneurship Development	HHS 341	3 (3-0-0)
2.	Open Elective Course II (Maths)	Operations Research	BMA 342	3 (3-0-0)
3.	Open Elective Course III (Leather Technology)	Introduction to Leather Technology	OLT 433	3 (3-0-0)
4.	Open Elective Course IV (Chemical Engg)	Introduction to Footwear Technology	TLT 492	4 (3-1-0)

B. Tech. Chemical Technology - Leather Technology
Semester 1

BCY151 ENGINEERING CHEMISTRY **L T P C**
3 0 2 4

Course outcome
On the successful completion of the course, students will be able to

CO1	Interpret UV-Visible and IR-Spectra	Understand, Analyze
CO2	Describe reaction rates for reactions of various orders	Understand, Apply, Analyze
CO3	Understand different aspects of corrosion and thermodynamic view of electrochemical processes, reversible and irreversible cells	Understand, Apply
CO4	Understand the stereochemistry of molecules and identify organic reactions on the basis of their mechanism	Remember, Apply, Analyze
CO5	Distinguish between different polymeric structures, classify polymers, and analyze the polymerization mechanism and use of polymers in different walks of life. Knowledge of conductivity of polymer, biodegradable polymers and fibre reinforced plastics. Acquire knowledge about water and treatment of municipal water	Understand, Apply, Evaluate, Create

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation put "-".

BCY101 /102	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO12	**PSOs**	
CO1	3	3	1	3	2	-	2	-	-	-	-	3	1	2
CO2	3	3	1	3	2	-	2	-	-	-	-	3	2	2
CO3	3	3	1	3	2	-	2	-	-	-	-	3	1	2
CO4	3	3	1	3	2	-	2	-	-	-	-	3	2	2
CO5	3	3	1	3	2	-	2	-	-	-	-	3	1	2
Average	3	3	1	3	2	-	2	-	-	-	-	3	1.4	2

SYLLABUS

Module I
(i) Bonding: CFT, Electronic Spectra and Ligands (strong and weak field), Phosphorescence and Fluorescence, Jablonski diagram, hydrogen bonding and their effect on physical properties, Metallic bonds, Classification and Applications of Liquid crystals, Band Theory of Solids and superconductors.
(Lectures: 7-8)

(ii) Spectroscopy: Basic Principles, Instrumentation and Applications of UV-VIS and IR Spectroscopy.

(Lectures: 5-6)

Module II

(i) Chemical Kinetics: Second order reactions. Determination of order, Fast and slow reaction, steady state approximation, Temperature effect, Concept of Activated Complex/Transition State: Energy of activation, Potential energy surface, Theories of reaction rate: Collision and Transition State theories in terms of enzyme catalysis. (Lectures: 4-5)

Module III

(i) Electrochemistry: Dry and fuel cells, electrochemical cell, Solar cells, Disensitized cell, Photovoltaic cell. (Lectures: 3-4)

(ii) Environmental Chemistry: Air and Water Pollution, analysis of gaseous effluents oxides of Nitrogen, oxides of Sulphur and H_2S, chemical analysis of effluents liquid streams, BOD, COD, control of pollution, Depletion of ozone layer. (Lectures: 5-6)

Module IV

(ii) Stereochemistry: Stereoisomerism of organic compounds containing one & two chiral centers. Enantiomers & Diastereomers, E-Z nomenclature, R-S configuration, Atropisomerism, and Optical isomerism in Allenes, biphenyl and Spiranes, Circular Dichroism. (Lectures: 5-6)

(i) Reaction Mechanism: Inductive, Electromeric and Mesomeric effects. Study of reaction intermediates (Carbanion, carbocation, carbene, nitrene and benzyne). Mechanism of nucleophilic and electrophilic substitution reactions. Mechanism and application of following reactions:

a) Suzuki-Miyaura Cross coupling reaction
b) Fries and Photo-Fries Rearrangement
c) Wagner- Meerweir Rearrangement
d) Umpolung Reactions
e) Reaction of vision

(Lectures: 4-5)

Module V

(i) Polymers: Introduction and their classifications, types of polymerization, Free radical, anionic and cationic polymerization, Preparation, Rheological properties and uses of some common polymers. Synthetic Polymers (carbon framework, silicon framework, fluorinated polymer), Conducting and Biodegradable polymers. (Lectures: 4-5)

(ii) Water Analysis: Introduction; Hardness of Water- cause, types, units, Disadvantages of using hard water for domestic and industrial purposes, Softening of hard water, Chemical analysis of Water- estimation of free chlorine, total alkalinity, hardness, Numerical based on determination of hardness.

(Lectures: 4-5)

List of Experiments:

1. Determination of alkalinity in given water sample.
   a. Sodium Carbonate & Sodium Bicarbonate
   b. Sodium Carbonate & Sodium Hydroxide
2. Determination of temporary and permanent hardness in water sample using EDTA as standard solution.
3. Determination of Chloride content of water by Mohr's Method.
4. Determination of Chlorine content in Bleaching powder.
5. Determination of strength of supplied Ferrous Ammonium Sulphate (FAS) solution in using external, internal indicators.
6. Determination of viscosity of a given liquid by Ostwald's viscometer.
7. Determination of surface tension of a given liquid by Stalagmometer.
8. pH determination of given sample.
9. Determination of iron content of water by Mohr's Method.
10. Determination of Dissociation constant of weak acids by conductometric Titration.

Reference Books:

1. Advance Organic Chemistry by Jerry March, Third Edition Wiley Eastern Limited, New Delhi.
2. Organic Chemistry by Morrision & Boyd, Allyn and Bacon, Inc. Boston.
3. Physical Chemistry by Puri, Sharma & Pathania, Peter Atkins & Julio de Paula, Arun Bahl, B.S. Bahl & G.D.Tuli.
4. Textbook of Physical Chemistry by S. Glasstone, Macmillan and Co. Ltd., London.
5. Chemical Kinetics and Reaction Dynamics by Puri, Sharma & Pathania.
6. Principles of Polymerization by George Odian.
7. Polymer Science by V. R. Gowarikar, N. V. Vishwanathan and J. Shridhar, Wiley Eastern Ltd., New Delhi.
8. Principles of Instrumental Analysis by Douglas and Skoog, Saunder College Publishing Co., New York.
9. Engineering Chemistry by Jain & Jain, Dhanpat Rai Publication Co., New Delhi.
10. Application of Absorption Spectroscopy of Organic Compounds by John R. Dyer, Prentice Hall of India Pvt. Ltd., New Delhi.
11. Spectroscopy of Organic Compounds by P.S. Kalsi, Y.R. Sharma.

BMA 151 MATHEMATICS –I

L	T	P	C
3	1	0	4

OBJECTIVE: The objective of this course is to educate the students about:

- the convergence of infinite series, improper integrals and differential calculus.
- partial differentiation, multiple integrals and Beta, Gamma functions.
- vector calculus, matrices, linear algebra and optimization techniques.

Course Outcome

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

CO1	find nth derivative, determine the expansion of functions and find convergence of series and improper integrals.	Understand, Apply
CO2	find partial differentiation and evaluate area and volume using multiple integrals.	Apply, Evaluate
CO3	convert line integrals to surface integrals and volume integrals, determine potential functions for irrotational force fields.	Apply, Evaluate
CO4	solve linear system of equations and determine the eigen vectors of the matrix.	Apply, Analyze Evaluate,
CO5	learn concept of optimization and optimization techniques.	Apply, Analyze, Evaluate,

Detailed Syllabus:

Unit I- Functions of One Real Variable:

Successive differentiation, Leibnitz theorem, Mean value theorems, sequences and series, Expansion of functions, Improper integrals and their convergence.

Unit II- Functions of Several Real Variables:

Limit, Continuity, Partial differentiation, Total differential and approximations, Jacobian, Euler's theorem Expansion of functions, Beta and Gamma Functions, Multiple integral, Change of order, Change of variables, Applications to area, volume, mass, surface area etc. Dirichlet's Integral & applications.

Unit III- Vector Calculus:

Point functions, differentiation, Gradient, Directional derivative, Divergence and Curl of a vector and their physical interpretations, Solenoidal & irrotational fields, Integration, Line, Surface and Volume integrals Green's. Stoke's and Gauss Divergence theorems (without proof) and applications.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSOs**	
CO1	3	3	2	1	2	-	-	1	-	1	-	3	**1**	**2**
CO2	3	3	2	1	2	-	-	1	-	1	-	3	2	1
CO3	3	3	2	1	2	-	-	1	-	1	-	3	2	1
CO4	3	3	2	1	2	-	-	1	-	1	-	3	2	2
CO5	3	3	2	1	2	-	-	1	-	1	-	3	2	2
Average	3	3	2	1	2	-	-	1	-	1	-	3	1.8	1.6

Unit IV- Matrices and Linear Algebra:

Vector space and subspace, linear dependence, dimensions and basis, Linear transformation and its matrix representation, Elementary transformations, Echelon form, rank & nullity, Consistency of linear system of equations and their solutions, characteristic equation, Cayley Hamilton theorem, Real and complex eigenvalues and eigenvectors, diagonalisation, quadratic forms, complex, orthogonal, and unitary matrices, Application to Cryptography, discrete, Compartmental models and system stability.

Unit V- Optimization:

Engineering applications of optimization, statement and classification of optimization problems, Optimization techniques, single variable optimization, multi variable optimization

with no constraint, with equality and inequality constraints, Linear Programming Problems, Graphical method and Simplex method.

Books Recommended:

1. R.K. Jain & S. R. K. lyengar; Advanced Engineering Mathematics, Narosa Publishing House 2002.

2. Erwin Kreyszig: Advanced Engineering Mathematics. John Wiley & Sons 8th Edition.

3. Dennis G. Zill & Michael R Cullen; Advanced Engineering Mathematics, Jones & Bartlett Publishers, 2nd Edition.

4. S.S. Rao; Optimization: Theory & application Wiley Eastern Limited.

5. T.M. Apostol, calculus, Vol. I, 2nd ed., Wiley 1967.

6. T.M. Apostol, Calculus, Vol. II, 2nd ed**.,** Wiley 1969.

7. Gilbert Strang, Linear Algebra & its applications, Nelson Engineering 2007.

8. Calculus & Analytic Geometry, Thomas and Finny.

EET 151 Electronics & Instrumentation Engineering

L	T	P	C
3	0	0	3

OUTCOMES:
Upon Completion of the course the students will be able to:

1. To understand the basic concept of diodes, transistor, and Operational Amplifier.
2. To apply the knowledge in the calculation of the parameters of the diode, transistor, and Operational Amplifier.
3. To design the simple digital circuits.
4. Having the basic knowledge of measurement and applying it in the transducer.
5. To apply the knowledge of measurement with the help of electronic instruments and displaying it on electronic devices.

Syllabus

P-N Junction Diode, V-I Characteristics, Diode Application as Rectifier (Half Wave & Full Wave), Zener Diode and its Applications.
Introduction to Bipolar Junction Transistor, Operational Amplifier and FET: Applications, demo, explanation, Applications
Boolean Algebra, Logic Gates, Concept of Universal Gate, Minimization using K map, Number system
Basic Combinational Circuits: Adder, Subtractor.
Sequential Circuits: Flip-Flops, Registers.
Functional Elements of Instruments, Classification & Characteristics, Types of Errors, Active and Passive Transducers and their Characteristics
Display Devices: Seven Segment Display, Alphanumeric Display, LCD, LED, Plasma, Projectors.
Electronic Ammeter and Voltmeter, Digital Multi-meter, Digital Storage Oscilloscope (DSO)

Text Books:

1. Malvino, A.P. / "Electronics Principles" / Tata McGraw-Hill.
2. Boylestad, Robert &Nashelsky, Louis / "Electronic Devices & Circuit Theory" / Prentice Hall of India.
3. H.S. Kalsi / "Electronic Instrumentation" / Tata McGraw-Hill
4. Malvino& Leach / "Digital Principles & Applications" / Tata McGraw-Hill.

Reference Books:

1. Sedra, Adel S., Smith, Kenneth C. / "Microelectronic Circuits"/ Oxford University Press.
2. Sawhney AK/ "Electrical and electronic Measurement and Instrumentation"/ DhanpatRai& sons.
3. Lectures of NPTEL

ECE 151ENGINEERING GRAPHICS (ECE 151/152)

L	T	P	C
0	0	6	3

Syllabus

Unit-I

Lettering and Dimensioning: Introduction, lettering practice, Elements of dimensioning - systems of dimensioning.

Geometric Constructions: Free hand sketching, Conic sections, Special curves.

Engineering Scales

Unit-II

Projection of Points: First and Third Angle Projections; Projection of points.

Projection of Lines: Projection of straight lines (First angle projection only); Projection of lines inclined to one plane and both planes, true length and true inclinations.

Unit-III

Projection of Solids and Section of Solids

Projection of solids: Classification of solids, Projection of solids in simple position, Projection of solids inclined to one plane. Sections of Solids: Right regular solids and auxiliary views for the true shape of the sections.

Unit-IV

Development of Surfaces

Development of surfaces for various regular solids.

Isometric Projection and Perspective Projection

Isometric Projection: Isometric scales, Isometric projections of simple and combination of solids;

Perspective Projection: Orthographic representation of a perspective views – Plane figures and simple solids - Visual ray method.

Unit-V

Orthographic Projection

Conversion of pictorial view into orthographic Projection.

Introduction to auto CAD

References:

1. K. Venugopal and V. Prabhu Raja, “Engineering Graphics”, New AGE International Publishers, 2015.
2. N. D. Bhatt, Engineering Drawing, Charotar Publishing House.
3. K.V.Natarajan, A Text book of Engineering Graphics, Dhanalakshmi Publishers, 2012.
4. K.L.Narayana, P. Kannaiah & K.Venkata Reddy New Age International Publishers.

ECS 151 COMPUTER CONCEPTS & PROGRAMMING

L	T	P	C
3	0	2	4

Course Outcomes:

1. Identify the parts of the computer system and explain the functioning of its componentsalongwith the process of problem solving. (Remember, Understand)
2. Design an algorithmic solution for a given problem and translate it into a program. (Design)
3. Understand different operating systems, related concepts and their functions. (Understand)
4. Use the appropriate control statements to solve the given problem. (Apply)
5. Implement different Operations on arrays and use functions to solve the given problem. (Apply)
6. Understand pointers, structures and unions &Implement file Operations in C programming. (Understand, Apply)

		PO												PSO	
CO	**Statement**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1		3	3	2	1	2	-	-	1	-	1	-	3	**1**	**2**
CO2		3	3	2	1	2	-	-	1	-	1	-	3	2	1
CO3		3	3	2	1	2	-	-	1	-	1	-	3	2	1
CO4		3	3	2	1	2	-	-	1	-	1	-	3	2	2
CO5		3	3	2	1	2	-	-	1	-	1	-	3	2	2
CO6		3	3	2	1	2	-	-	1	-	1	-	3	2	1
Average		3	3	2	1	2			1		1		3	1.8	1.3

Course Content:

Unit-1:

Introduction to Computers: Computer hardware Components, peripherals and their functions, Number Systems and conversion methods, Concept of an algorithm; termination and correctness. Algorithms to programs: specification, top-down development and stepwise refinement, Introduction to programming environment, use of high level programming

language for the systematic developmentof programs. Introduction to the design and implementation of correct, efficient and maintainable programs, Structured Programming, Trace an algorithm to depict the logic.

Unit-2:

Basic operating System Concepts: Introduction of MS-DOS, WINDOWS, and LINUX Operating Systems, Functional Knowledge of these operating systems, Introduction of basic commands of LINUX and Editors, Managing Files and Directories in LINUX, Programming Environment in LINUX, Writing and executing programs in LINUX.

Unit-3:

Programming in C: History, Introduction to C Programming Languages, Structure of C programs, compilation and execution of C programs, Debugging Techniques, Data Types and Sizes, Declaration of variables, Modifiers, Identifiers and keywords, Symbolic constants, Storage classes (automatic, external, register and static), Enumerations, command line parameters, Macros, The C Preprocessor.

Unit-4:

Operators: Unary operators, Arithmetic & logical operators, Bit wise operators, Assignment operators and expressions, Conditional expressions, Precedence and order of evaluation. Control statements: if-else, switch, break, and continue, the comma operator, goto statement. Loops: for, while, do-while. Functions: built-in and user-defined, function declaration, definition and function call, and parameter passing: call by value, call by reference, recursive functions, Multi-file programs. Arrays: linear arrays, multidimensional arrays, passing arrays to functions, Arrays and strings.

Unit-5:

Structure and Union: definition and differences, self-referential structure. Pointers: value at (*) and address of (&) operator, pointer to pointer, Dynamic Memory Allocation, calloc and malloc functions, array of pointers, function of pointers, structures and pointers. File Handling in C: opening and closing a data file, creating a data file, read and write functions, unformatted data files.

Lab Work:

1. Write C program to find largest of three integers.
2. Write C program to check whether the given string is palindrome or not.
3. Write C program to find whether the given integer is
   (i). a prime number
   (ii). an Armstrong number.
4. Write C program for Pascal triangle.
5. Write C program to find sum and average of n integer using linear array.
6. Write C program to perform addition, multiplication, transpose on matrices.
7. Write C program to find Fibonacci series of iterative method using user-defined function.
8. Write C program to find factorial of n by recursion using user-defined functions.
9. Write C program to perform following operations by using user defined functions:
   (i) Concatenation
   (ii) Reverse
   (iii) String Matching
10. Write C program to find sum of n terms of series: n – n*2/2! + n*3/3! - n*4/4! + ...
11. Write C program to interchange two values using
    (i). Call by value.
    (ii). Call by reference.
12. Write C program to sort the list of integers using dynamic memory allocation.
13. Write C program to display the mark sheet of a student using structure.
14. Write C program to perform following operations on data files:
    (i) Read from data file.
    (ii) Write to data file.
15. Write C program to copy the content of one file to another file using command line argument.

Text and References Books:

1. Kernighan, Ritchie, "The C Programming Language", PHI
2. V. Rajaraman, "Fundamentals of Computers", PHI
3. Peter Norton's, "Introduction to Computers", TMH
4. Gottfried, "Programming in C", Schaum's Series, Tata McGraw Hill
5. YashwantKanitkar, "Working with C", BPB
6. E. Balagurusamy, "Programming in ANSI C", TMH

EWS 151 WORKSHOP PRACTICE

L	T	P	C
0	0	4	2

Objective : The objective of this course is to educate and impart basic knowledge of various hand tools and equipments and their use in different shops, day to day industrial work and domestic life. Students able to understand safety precautions in the workshop. Student acquires skills of application oriented task.

Course Outcome

- Acquire skills in basic engineering practice
- Identify the hand tools and instruments.
- Obtain practical skills in the trades.
- Gain measuring skills.

Course Outcome (CO)		Bloom's Knowledge Level (KL)
At the end of the course the student should be able to :		
CO 1	Study and practice on machine tools and their operations	Understand
CO 2	Practice on manufacturing of components using workshop trades including fitting, carpentry, foundry, black - smithy and welding work	Apply
CO 3	Identify and apply suitable tools for machining processes including plain turning, step turning, taper turning, facing, thread cutting operations	Analyze
CO 4	Understand and practice welding and forging operations	Understand
CO 5	Select the appropriate tools required for specific operation	Understand, Apply
CO 6	Comprehend the proper safety measures required to be taken while using different tools.	Remember, Understand

Note : K1 - Remember, K2 - Understand, K3 - Apply, K4 - Analyze, K5 - Evaluate, K6 – Create

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO(	PO10	PO11	PO12	**PSOs**	
CO1	2	-	-	1	1	1	-	-	-	-	-	1	**1**	**2**
CO2	2	-	-	1	1	1	-	-	-	-	-	1	2	1
CO3	2	-	-	1	1	1	-	-	-	-	-	1	2	1
CO4	2	-	-	1	1	1	-	-	-	-	-	1	2	2
CO5	2	-	-	1	1	1	-	-	-	-	-	1	2	2
Avg.	2	-	-	1	1	1	-	-	-	-	-	1	1.8	1.6

1. Slight (Low) 2. Moderate (Medium) 3. Substantial (High)

Course level Assessment Question :

Course Outcome 1 (CO1)

1. Working principle of lathe machine
2. Parts and operations on lathe machine
3. Tool geometry of single point cutting tool

Course Outcome 2 (CO2)

1. Study and practice of different tools used in Fitting shop, Carpentry shop and Foundry shop.
2. Study and practice of different tools used in Black-smithy shop, Sheet metal shop and Welding shop.

Course Outcome 3 (CO3)

1. Explanation and demonstration of various processes like plain turning and step turning.
2. Explanation and demonstration of various processes like taper turning and facing.
3. Explanation and demonstration of various processes like thread cutting, knurling and chamfering.

Course Outcome 4 (CO4)

1. Classification of different welding processes with the help of flow chart.
2. Explanation and demonstration forging operations.
3. Safety precautions during actual forging and welding.

Course Outcome 5 (CO5)

.1 Selection of proper drilling tool for drilling operation.
2 Selection of proper tap for internal thread cutting operation.
3 Selection of power hacksaw blade, wood cutting cutter , snips, chisels etc.

Course Outcome 6 (CO6)

1. Proper demonstration of safety precautions to be taken for example leather apron, leather hand gloves, welding shield etc.
2. Description of different safety tools and precautions in workshop.

Semester 2

L T P

3 0 2

BPH: 152 PHYSICS (Theory & Lab)

Sessional Marks: 50
End Semester Exam Marks: 50

Course Objectives (COs)

Pre-requisites Basic knowledge of Maths (12^{th} level)

CO 1	To understand and apply principle of conservation of momentum, theory of relativity	**Understand and apply**
CO 2	To understand the basics of quantum mechanics and apply its principles to learn the phenomena that occur at subatomic dimensions.	**Understand and analyze**
CO 3	To understand the Maxwell's equations of electromagnetic theory with aim to apply in communication systems.	**Understand and analyze**
CO 4	To apply the fundamentals of material Science especially dielectric materials, semiconducting materials and nano- materials, to apply them in different areas	**Understand and apply**
CO 5	To understand the statistical behavior of the constituent particles and apply the principles of statistical mechanics and basics of laser	**Apply**

CO – PO Matrix

Course	CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSOs**	
BPH 101/102	CO1	3	3	1	2	1	2						1	**2**	**2**
	CO2	3	3	1	2	1	2						1	2	2
	CO3	3	3	1	2	1	2						1	2	2
	CO4	3	3	1	2	1	2						1	2	2
	CO5	3	3	1	2	1	2						1	2	2
	Average	3	3	1	2	1	2						1	2	2

Syllabus

MODULE- 1 (Lectures: 08)

Introductory Mechanics & Theory of Relativity: Potential energy function $F = -\text{grad}\,(V)$, equipotential surfaces, meaning of gradient, divergence, curl and their physical significance, Conservative and Non-Conservative forces, Curl of a force, Central forces, Examples of Central forces, Conservation of Angular Momentum,.

Inertial and Non- Inertial Frames of reference, Galilean transformation, Michelson Morley Experiment, Lorentz Transformation, Length contraction, Time dilation and Evidences for time dilation, Relativistic velocity addition formula, Relativistic variation of mass with velocity, Evidence of mass variation with velocity, Einstein's Mass energy equivalence, Examples from nuclear physics, Relativistic energy momentum relation.

MODULE -2 (Lectures: 08)

Quantum Mechanics-Schrodinger Equation and its Applications:

Dual Nature of matter & Radiation, Heisenberg's uncertainty Principle and their applications, wave group concept, Davisson Germer experiment, Postulates of quantum mechanics, Significance of wave function, Derivation of Schrodinger equation for time independent and time dependent cases.

Application of Schrodinger wave equation for a free particle, Particle in a box (one dimensional and three dimensional), Simple harmonic oscillator (one dimensional).

MODULE – 3 (Lectures: 08)

Electromagnetic Theory: Ampere's law and Faraday's law of electromagnetic induction, Maxwell's equations, Correction of Ampere's law by Maxwell (concept of displacement current), transformation from integral to differential form, Physical significance of each equation,Poyntingtheorem, Maxwell's equations in free space, velocity of electromagnetic wave, Transverse character of the wave and orthogonality of **E**, **H** and **v** vectors, Maxwell's equation in dielectric medium and velocity of e.m. wave, Comparison with free space, Maxwell's equations in conducting media, Solution of differential equation in this case,penetration depth, its significance.

MODULE – 4 (Lectures: 09)

Materials of Technological Importance:

Dielectric Materials: Electric field in presence of dielectric medium,concept of electric polarization, different types of polarizations, dielectric in a.c. field,concept of dielectric loss and loss energy.

Semiconducting Materials: Concept of energy bands in solids, carrier concentration and conductivity in intrinsic semiconductors and their temperature dependence, carrier concentration and conductivity in extrinsic semiconductors and their temperature dependence, Hall effect in semiconductors, compound semiconductors.

Nano Materials: Basic principles of nanoscience and technology, preparation, structure and properties of fullerene and carbon nanotubes, applications of nanotechnology.

MODULE: 5 (Lectures: 09)

Statistical Mechanics & Lasers: Phase space, the probability of distribution, most probable distribution, Maxwell-Boltzmann Statistics, Applicationsof Maxwell-Boltzmann Statistics, derivation of average velocity, RMS velocity and most probable velocity in the above case, Bose-Einstein Statistics, application to black body radiation, distribution law of energy, Planck's radiation formula and Stefan's law. Fermi – Dirac statics, application in case of free electrons in metals, energy distribution, Fermi energy.

Lasers: Spontaneous and stimulated emission of radiations, Einstein's theory of matter-radiation interaction, Einstein's coefficients and relation between them, Population inversion, components of a laser, different kinds of lasers, Ruby laser, He-Ne laser, properties of laser beams, mono-chromaticity, coherence, directionality, and brightness, applications of lasers

References:

1. Physics, Marcelo Alonso, J. Finn Edwards, Addison Wesley
2. Perspectives of Modern Physics, Arthur Beiser, McGraw Hill
3. Engineering Physics, R. K.Shukla, Pearson Education
4. Electrical Engineering Materials, R.K.Shukla, McGraw Hill
5. Introduction to Electrodynamics, David Griffiths, Cambridge University Press
6. Principles of Engineering Physics, R.K.Shukla, Ira Books
7. Introduction to Solid State Physics, Charles Kittel, Willey

List of Experiments:(Any ten experiments)

1. To determine the energy of band gap of a N-type Ge-semiconductor using four probe method
2. Verification of Stefan's fourth power law for black body radiation, determination of the exponent of the temperature
3. Study of thermoelectricity: Determination of thermo-power of Copper-constantan thermo-couple
4. To study the variation of magnetic field with distance along the axis of current carrying coil and then to estimate the radius of the coil
5. Study of Carrey Foster's bridge: determination of resistance per unit length of the bridge wire and of a given unknown resistance
6. Determination of specific charge (charge to mass ratio; e/m) for electron

7. Study of tangent galvanometer: determination of reduction factor and horizontal component of earth's magnetic field
8. Determination of the wavelength of sodium light using Newton Rings' method
9. To determine the concentration of sugar solution using half shade polarimeter
10. Determination of wavelength of spectral lines of mercury (for violet, green, yellow-1 and yellow-2) using plane transmission grating
11. Determination of charge sensitivity and ballistic constant of a ballistic galvanometer
12. To determine the wavelength of spectral lines of hydrogen & hence to determine the value of Rydberg Constant
13. Draw the V-I characteristic of Light Emitting Diode (LED) and determine the value of Planck's constant

EEE-152 Basic Electrical Engineering

L	T	P	C
3	0	2	4

OBJECTIVE: The objective of this course is to educate the students about:
Various electrical components, connections, DC circuit analysis and basic network theorems applicable to dc network
Single-phase AC fundamentals and its analysis
Three-phase AC circuit connections and analysis under various load conditions
Various measuring instruments with construction, working principle and applications
Basic structure of power system
Concept of magnetic circuits, magnetic coupling and losses occurred in magnetic circuit
Construction and working of single-phase transformers
Basic principle of electrical ac/dc machines with their construction, working principle and applications

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

CO1	An exposure to common electrical components and their ratings.
CO2	Learning of electrical connections by wires of appropriate ratings.
CO3	Learning the usage of common electrical measuring instruments.
CO4	Understanding the basic characteristic of magnetic circuits and transformers
CO5	Understanding the basic characteristic of electrical machines.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1O	PO11	PO12
CO1	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**1**	**1**	**1**	**2**
CO2	**3**	**3**	**1**	**1**	**2**	**2**	**1**	**1**	**2**	**2**	**1**	**1**
CO3	**3**	**3**	**2**	**2**	**2**	**2**	**1**	**2**	**2**	**2**	**1**	**1**
CO4	**3**	**3**	**2**	**2**	**2**	**2**	**1**	**2**	**2**	**2**	**1**	**2**
CO5	**3**	**3**	**2**	**2**	**2**	**2**	**1**	**2**	**2**	**2**	**1**	**2**
Avg.	**3**	**3**	**1.8**	**1.8**	**2**	**2**	**1.2**	**1.8**	**1.8**	**1.8**	**1**	**1.6**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) ifthere is no correlation, put "-'

Syllabus

Module I : DC Circuit Analysis and Network Theorems: (9 hours):

Circuit Concepts: Concepts of Network, Active and Passive elements, voltage and current sources, concept of linearity and linear network, unilateral and bilateral elements. R L and C as linear elements. Source Transformation.

Kirchhoff's Law; loop and nodal methods of analysis; star – delta transformation; Network Theorems: Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem. (Simple Numerical Problems)

Module II: Steady – State Analysis of Single Phase AC Circuits: (8 hours):

AC Fundamentals: Sinusoidal, Square and Triangular waveforms – average and effective values, form and peak factors, concept of phasors, phasor representation of sinusoidally varying voltage and current. Analysis of series, parallel, and series – parallel RLC Circuits: Apparent, Active & Reactive Powers, Power factor, causes and problems of low power factor, power factor improvement. Resonance in Series and Parallel Circuits, Bandwidth and Quality Factor. (Simple Numerical Problems)

Module III:

Three Phase AC Circuits: (3 hours)

Three Phase System – its necessity and advantages, meaning of phase sequence and star and delta connections, balanced supply and balanced load, line and phase voltage / current relations, three phase power and its measurement. (Simple Numerical Problems)

Measuring Instruments: (4 hours):

Types of instruments: Construction and Working Principles of PMMC and Moving Iron type Voltmeter & Ammeters, Single Phase Dynamometer Wattmeter and Induction Type Energy Meter, use of Shunts and Multipliers. (Simple Numerical Problems on Energy Meter, Shunts and Multipliers)

Module IV

Introduction To Power System: (2 hours):

General layout of Electrical Power system and functions of its elements, standard transmission and distribution voltages, concept of grid.

Magnetic Circuit: (3 hours):

Magnetic circuit concepts, analogy between Electric & Magnetic circuits, Magnetic circuits with DC and AC excitations, Magnetic leakage. B-H curve, Hysteresis and Eddy Current looses, Magnetic circuit calculations mutual Coupling.

Single Phase Transformer: (3 hours):

Principle of Operation, Construction, e.m.f. equation, equivalent circuit, Power losses, efficiency, introduction to auto transformer. (Simple Numerical Problems)

Module V (8 hours):

Electrical Machines: Principles of electro mechanical energy conversion.

DC Machines:

Types of dc machines, e.m.f. equation of generator and torque equation of motor, characteristics and applications of dc motors. (Simple Numerical Problems)

Three Phase Induction Motor:

Types, Principle of Operation, Slip – torque Characteristics, applications. (Simple Numerical Problems)

Single Phase Induction Motor:
Principle of Operation and introduction to methods of starting, applications.

Three Phase Synchronous Machines:
Principle of Operation of alternator and synchronous motor and their applications.

Text Books:

1. V. Del Toro, " Principles of Electrical Engineering" Prentice Hall International
2. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
3. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
4. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
5. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
6. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

Reference Books:

1. Edward Hughes, "Electrical Technology" Longman
2. T.K. Nagsarkar & M.S. Sukhija, "Basic Electrical Engineering" Oxford University Press
3. H. Cotton, " Advanced Electrical Technology" Wheeler Publishing
4. W.H. Hayt & J.E. Kennely, "Engineering Circuit Analysis" Mc - Graw Hil

Experiments list.

1. Verification of Kirchhoff's laws.
2. Verification of (1) Superposition Theorem (2) Thevenin's Theorem (3) Maximum Power Transfer Theorem.
3. Measurement of power and power factor in a 1 – Ø ac series inductive circuit and study improvement of power factor using capacitor.
4. Study of phenomenon of resonance in RLC series circuit and obtain the resonant frequency.
5. Measurement of power in 3 – Ø circuit by Two Wattmeter method and determination of its power factor.
6. Determination of parameter of ac 1 – Ø series RLC Circuit.
7. Determination of (1) Voltage Ratio (2) Polarity and (3) Efficiency by load test of a 1 – Ø Transformer.
8. To Study speed control of dc shunt motor using (1) Armature Voltage Control (2) Field Flux Control.
9. Determination of Efficiency of a dc shunt motor by load test.
10. To study running and speed reversal of a 3 – Ø induction motor and record its speed in both direction.
11. To measure energy by a 1 – Ø energy meter and determine error.
12. Department may add any three experiments in the above list.

EME-152: ENGINEERING MECHANICS

L	T	P	C
3	0	0	3

Sessional Marks: 50
End Semester Exam Marks: 50

Objective: To provide the basic fundamentals of forces, moments, stresses and strains.

Prerequisite: Class XII Mathematics & Physics

Course Outcomes (COs)
At the end of this course students should be able to:

CO1	Apply basic principal of mechanics and its application in engineering problems.	Understand,Apply
CO2	Determine resultants and apply conditions of static equilibrium to plane force systems.	Apply
CO3	Identify and evaluate all forces associated with a static framework.	Evaluate
CO4	Analyze and sketch shear force and bending moment diagrams.	Analyze
CO5	Derive and apply stress and strain relationships in single and compound members subject to axial force, bending moment and torsion.	Apply
CO6	Stress analysis for two dimensional stress systems.	Analyze

Course Articulation Matrix (CO-PO Matrix of the selected Courses)

Course	COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSOs	
EME-152	CO1	3	3	3			1	1	1	1	1		1	3	3
EME-152	CO2	3	3	3									1	3	3
EME-152	CO3	3	3	3									1	3	3
EME-152	CO4		3	2	2								1	3	3
EME-152	CO5		3	2	2								1	3	3
EME-152	CO6		3	2	3								1	3	3
														3	**3**

Course Content:

Unit-1:

Two Dimensional Force Systems: Basic concepts, Laws of motion, Principle of Transmissibility of forces, Transfer of a force to parallel position, Resultant of a force system, Simplest Resultant of Two dimensional concurrent and Non-concurrent Force systems, Distributed force system, Free body diagrams, Equilibrium and Equations of Equilibrium, Applications.

Friction: Introduction, Laws of Coulomb Friction, Equilibrium of Bodies involving Dry-friction, Belt friction, Applications.

Unit-2:

Shear force and Bending Moment Diagrams for Statically Determinate Beams.

Trusses: Introduction, Simple Truss and Solution of Simple truss, Method of Joints and Method of Sections.

Unit-3:

Centroid and Moment of Inertia: Centroid of plane, curve, area, volume and composite bodies, Moment of inertia of plane area, Parallel Axes Theorem, Perpendicular axes theorems, Principal Moment Inertia, Mass Moment of Inertia of Circular Ring, Disc, Cylinder, Sphere and Cone about their Axis of Symmetry.

Unit-4:

Simple Stress and Strain: Introduction, Normal and Shear stresses, Stress- Strain Diagrams for ductile and brittle material, Elastic Constants, One Dimensional Loading of members of varying cross-sections, Strain energy.

Compound stress and strains: Introduction, state of plane stress, Principal stress and strain, Mohr's stress circle, Theories of Failure.

Unit-5:

Pure Bending of Beams: Introduction, Simple Bending Theory, Stress in beams of different cross sections.

Torsion: Introduction to Torsion of circular shaft, combined bending & torsion of solid & hollow shafts.

Text and Reference Books:

1. Engineering Mechanics by R.K.Bansal
2. Strength of Materials by R.K. Rajput
1. Engineering Mechanics by Irving H. Shames, Prentice-Hall
2. Mechanics of Materials by E. P. Popov, PHI
3. Strength of Materials by Ryder
4. Mechanics of Material by Gere & Timoshenko
5. Engineering Mechanics by A. Nelson
6. Engineering Mechanics by U.C. Jindal
7. Engineering Mechanics Statics by J. L. Meriam & L.G.Kraige

HHS-152 ENGLISH LANGUAGE AND COMPOSITION

L	T	P
2	0	0

Sessional Marks: 50
End Semester Exam: 50

Course Outcome:

On the successful competition of the course, students will be able to

CO1	Understand the various techniques of writing effectively and write professional statements & organizational communications.	Apply, Understand
CO2	Develop writing skills by applying different strategies on organization system.	Understand and apply
CO3	Will write articles, reports, projects and different organizational proposals differently and efficiently.	Apply, Create
CO4	Write in concise with brevity and coherency all the messages of the organization.	Analyze and Create

Course	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
IHU 101/102	CO1	0	0	0	0	0	0	0	0	2	3	0	1	**1**	**2**
	CO2	0	0	0	0	0	0	0	0	2	3	0	1	1	2
	CO3	0	0	0	0	0	0	0	0	2	3	0	1	1	2
	CO4	0	0	0	0	0	0	0	0	2	3	0	1	1	2
Average										2	3		1	1	2

Syllabus

UNIT I Basic Applied Grammar and Usage:
constituent of a sentence- noun, verb, adjective, preposition, etc.; use of articles, adjectival forms, prepositions, adverbs; verb forms; finite and non-finite verbs, gerund and participles, auxiliary verbs. Tense and mood, Subject- verb concord, pronoun concord

UNIT II Sentence Structure-2:

(i) adverb clause, adjective clause, noun-clause; (ii) negation and interrogation; (iii) passive; (iv) exclamatory; (v) transformations; (vi) tense forms; (vii) varieties of sentences; (viii) placement of modifiers

UNIT III Paragraph Writing:

Structure of Paragraph, Topic Sentence, Construction of Paragraph, Technique of Paragraph writing, Unity, Coherence, Emphasis

UNIT IV Comprehension and Précis Writing

Reading and listening comprehension, improving comprehension skills, précis writing

UNIT V Short Essay Writing

Dimension of essay writing- literary, Scientific, Comparison and Contrast, Narrative, Descriptive, Reflective, Expository, Argumentative and Imaginative

References:

1. Das, B K and A David, 'A Remedial Course in English for Colleges', (Book -1,2,3) Oxford University Press, New Delhi.

2. Sinha, R P, 'Current English Grammar and Usage with Composition', Oxford University Press, New Delhi.

3. Wren, P C & Martin, 'English Grammar and Composition', S Chand & Co Ltd. New Delhi.

4. A. S. Horne, Guide to Pattern and usage in English, Oxford University Press, N.D.

5. M.L. Tickoo& A. E. Subramanian, Intermediate Grammar, usage & composition, Orient Longman

HHS 153/154, HHS-451: PROFESSIONAL COMMUNICATION

Course: B. Tech & MCA	**Branch: All**	**Year / Semester: Ist Year**
Sessional Marks:	**50**	**Credit: 3**
End Semester Exam:	**50**	**LTP: 3 0 2**

Course Outcome:

On the successful competition of the course, students will be able to:

CO1	Understand the basics of technical communication	Apply, Understand
CO2	Developing the skills of variety of the words like synonyms and writing skills.	Understand
CO3	Draft a business letters and resume for to develop for industry.	Apply, Create
CO4	Explore the body language for perfect professional presentation.	Analyze and Create
CO5	To develop the humanistic & scientific approach towards life.	Create
CO6	Present themselves effectively and in a confident manner in the contemporary competitive market.	Apply

CO-PO Matrix

Course	**CO**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSOs**	
HHS 153/154	**CO1**	0	0	0	0	0	0	0	0	2	3	0	1	**1**	**2**
	CO2	0	0	0	0	0	0	0	0	2	3	0	1	2	1
	CO3	0	0	0	0	0	0	0	0	2	3	0	1	2	1
	CO4	0	0	0	0	0	0	0	0	2	3	0	1	2	1
	CO5	0	0	0	0	0	0	0	0	2	3	0	1	2	2
average										2	3		1	1.8	1.4

Syllabus

UNIT I Fundamentals of Technical Communication:
Process of communication, language as a tool of communication, levels of communication , flow of communication, barriers to communication, communication across cultures; Technical Communication: meaning, significance, characteristics, difference between technical and general communication.

UNIT II Elements of Written Communication:
Words and phrases, word formation, synonyms and antonyms, homophones, one word substitution, sentence construction, paragraph construction,

UNIT III Forms of Technical Communication:
(A) business letters, job application letter and resume, business letters: sales & credit letters, letters of enquiry, letters of quotation, order, claim and adjustment letters, official letters: D.O. letters, government letters, letters to authorities, etc. ,
(B) Technical Reports: general format of a report, formal and informal reports, memo report, progress report, status report, survey report, trip report, complaint report, , Joining Report ,laboratory report, research papers, dissertations and theses. E-mail writing
Technical Proposals: purpose, characteristics, types, structure

UNIT IV Presentation Strategies:
Defining the subject, scope and purpose, analysing audience & locale, collecting materials, preparing outlines, organising the contents, visual aids, nuances of delivery, extemporaneous, manuscripts, impromptu, non- verbal strategies.

UNIT V Value-based Text Reading:
(A) Study of the following essays from the text book with emphasis on writing skills:

1. Man and Nature	by J. Bronowski
2. The Language of Literature and Science	by Aldous Huxley
3. The Aims of Science &The Humanities	by Moody E Prior
4. Gods in this Godless Universe	by Bertrand Russell
5. Science and Survival	by Barry Commoner

(B) Readings of selected short stories:

1. The Renunciation	by Rabindranath Tagore
2. The Lament	by Anton P. Chekhov
3. The Barber's Trade Union	by Mulk Raj Anand
4. The Eyes Are Not Here	by Ruskin Bond

Text Books:

1.'Improve Your Writing' ed. By V N Arora and Laxmi Chandra, Oxford University Press, New Delhi
2.'An Anthology of English Short Stories', edited by R P Singh, Oxford University Press.

3.‘Technical Communication- Principles and Practices’ by Meenakshi Raman &Sangeeta Sharma, Oxford University Press, New Delhi.

Reference Books:

1. Effective Technical Communication, by Barun K Mitra, Oxford University Press
2. Business Correspondence & Report Writing by R.C. Sharma & Krishna Mohan, Tata McGraw Hill, N.D.
3. Developing Communication Skills by Krishna Mohan & Meera Banerjee, Macmillan India
4. ‘Technical Communication- Principles and Practices’ by M R S Sharma, Oxford University Press, New Delhi

Semester- 3

BMA 251 MATHEMATICS-III

L	T	P	C
3	1	0	4

OBJECTIVE: The objective of this course is to provide conceptual understanding of:

- various mathematical tools likes Laplace/ Fourier transforms and their applications.
- concepts and principle of complex analysis in solving various real life problems.
- various statistical methods and tests for analyzing experimental data.

Course Outcome

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

CO1	solve boundary value problems using Laplace transform and Fourier transform methods and solve difference equations and BVP_S using z transform.	Apply, Evaluate
CO2	construct conformal mapping between many kinds of domains.	Understand, Apply
CO3	evaluate complex integrals, improper real integrals using various formulae/theorems. find Taylor and Laurents series expansion of complex functions.	Apply, Evaluate
CO4	estimate relationship between two variable using curve fitting, regression and its strength using correlation.	Understand, Apply
CO5	various parametric and nonparametric tests parameter estimation, hypothesis testing and ANOVA.	Understand, Apply

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) *If there is no correlation, put "-"*

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSOs**	
CO1	3	3	3	3	2	1	2	1	1	-	1	3	**2**	**2**
CO2	3	3	3	3	2	1	2	1	1	-	1	3	2	1
CO3	3	3	3	3	2	1	2	1	1	-	1	3	2	1
CO4	3	3	3	3	1	1	-	-	-	-	-	2	2	2
CO5	3	3	3	3	1	2	3	2	2	1	1	2	2	2
Average	3	3	3	3	1.6	1.2	1.8	1	1	.5	.8	2.6	2	1.6

Detailed Syllabus:

Unit – I: Transform Methods:

Fourier integral, conditions of convergence, Fourier sine and cosine integrals, complex form, applications, Fourier transform pairs, existence conditions, operational properties. Applications of Laplace transform and Fourier transform to solve boundary value problems, Discrete and Fast Fourier transforms and its applications.

Development of difference equations as models, operator method, method of undetermined coefficients, Z-transform pairs, ROC. Operational properties, limiting- value theorems, its applications to solve difference equations and BVP, systems of difference equations.

Unit- II: Functions of a Complex Variable and Conformal mapping:

Limit, continuity, differentiability and analyticity, Cauchy-Riemann equations, harmonic functions, complex functions as mappings, liner transformation, inverse transformation, bilinear transformations, conformal mapping, applications.

Unit- III: Integration of Complex Functions:

Contour integrals and evaluations, Cauchy- integral theorem, Cauchy's integral formulae, Liouville's theorem, convergence of power series, Taylor series, Laurent series, zeros and singularities of a complex function, residues and residue theorem, Fundamental theorem of algebra Rouche's theorem, Argument Principle and maximum modules theorem, evaluation of definite and improper integrals.

Unit- IV: Curve- Fitting, Correlation, Regression and Probability:

Curve-fitting, method of least- squares, fitting of straight lines, polynomials, non-linear and exponential curves etc., correlation analysis, linear, non-linear and multi-regression analysis, probability, random variables and probability distributions, expectation, moments and transform methods, Binomial, Poisson and Normal distributions.

Unit- V: Statistical Methods:

Sampling theory (small and large), parameter estimation, confidence intervals, tests of hypotheses and significance; Overview of t-distribution, F-distributions and χ^2-distribution. Z-, t-, F-, and χ^2 tests, goodness of fit test- χ^2 test, analysis of variance, non-parametric tests (Simple application). time series analysis, index numbers, quality control charts.

Books Recommended:

1. Dennis G, Zill & Michael R. Cullen; Advanced Engineering Mathematics, Jones & Bartlett Publishers. 2nd Edition.

2. R.K. Jain & S.R.K. Iyengar; advanced Engineering Mathematics, Narosa Publishing House, 2002.

3 Erwin Kreyszig; Advanced Engineering Mathematics, John Wiley & Sons 8th Edition.

4. R.V. Churchill and J.L. Brown, Complex Variables and Applications, McGraw Hill, 1990.
5. J.N. Kapur and H.C. Saxena, Mathematical Statistics, S.Chand. & Co., 2001.
6. H.C. Saxena, Practical Mathematical Statistics, S. chand & Co., 2000.
7. J.H. Mathews and R.W. Howell, Complex analysis for Mathematics and Engineering, 3rd Ed. Narosa, 1998.

TLT – 255: LEATHER MICROSCOPY AND SKIN PRETANNAGES

L	T	P	C
3	1	0	4

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

- The composition of Hide & Skin and of compound microscope.
- General and physical chemistry of proteins
- Chemical Constituents of hides and skins
- Reactive groups in collagen
- Pre-tanning process

Course Outcome

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

CO1	Understand The composition of Hide & Skin and of compound microscope.	Understand
CO2	Understand the General and physical chemistry of proteins	Understand
CO3	Understand Chemical Constituents of hides and skins	Understand
CO4	Understand the Reactive groups in collagen	Understand
CO5	Understand the Pre-tanning process	Understand
CO6	Apply the Working of compound microscopy.	Apply

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) *If there is no correlation, put "-"*

Course Level Assessment Questions

Course Outcome 1(CO1)

1.Histology of hides and skins-cells,

2.Mechanical and optical part of compound microscope

3.primary structure of collagen

Course Outcome 2(CO2)

CO	PO 1	PO2	PO 3	PO4	PO5	PO6	PO7	PO8	PO 9	PO1 0	PO1 1	PO1 2
CO1	3	_	_	_	_	_	_	_	_	_	_	_
CO2	3	2	_	_	_	_	_	_	_	_	_	_
CO3	3	2	3	_	_	_	_	_	_	_	_	_
CO4	3	2	_	_	_	1	_	_	_	_	_	_
CO5	3	2	2	_	_	1	_	1	_	_	_	_
Aver age	3	2	2.6	2	_	1.3	1	1	2	_	_	1

1.General and physical chemistry of proteins

2. identification and classification of fungi associate with leather processing,

3.Morphology and physiology of fungi

Course Outcome 3(CO3)

1.Chemical Constituents of hides and skins:

2.Other skin proteins.

3.Non proteinous skin components

Course Outcome 4(CO4)

1.Reactive groups in collagen

2. Flaying, curing,

3. defect of hides and skins.

Course Outcome 5(CO5)

1. soaking,

2.liming, deliming, bating, degreasing,

3.pickling and depickling

Course Outcome 6(CO6)

1. Study of optical part of a compound microscope. Setting up of compound microscope
2. Identification of hides and skins of different species from their anatomical structure.
3. Preparation of microscopical slides by paraffin wax and freezing method of different hides and skins.

SYLLABUS

Module-I:

History: Histology of hides and skins-cells, tissues, fibers, muscles, glands, epidermis, dermis etc. histological characteristics of buffalo and cow hides, goat and sheep skins, reptiles skins.

Compound Microscope: Mechanical and optical part of compound microscope, image formed, defects in eye pieces and their rectification etc. different types of microscopes.

Structure of collagen: primary structure of collagen, amino acid composition, X-ray diffraction pattern, the triple helix structure, electron microscopy of the collagen fiber, precipitated form of collagen, Kinetics of fibril formation.

Module-II:

General and physical chemistry of proteins: with special reference to hide proteins, chemical constituents of hides and skins, reaction of proteins with acids, base and salts.

Mycology: Isolation, identification and classification of fungi associate with leather processing, Morphology and physiology of fungi, Mycological problems of leather industry and their prevention.

Module-III:

Chemical Constituents of hides and skins: Variation fibrous and non-fibrous proteins, non-proteinous skin components.

Other skin proteins: Keratin, Reticulin, elastin- their chemical composition, structure and functions, non-fibrous skin proteins.

Non proteinous skin components: Lipids, carbohydrates vitamins, mineral constituents, Mechanism of Denaturation process, Renaturation of gelatin solution.

Module-IV:

Reactive groups in collagen: Modification of reactive groups of collagen modified proteins, Flaying, curing, defect of hides and skins.

Module-V:

Pre-tanning process: chemistry and principle of different pretanning process- soaking, liming, deliming, bating, degreasing, pickling and depickling process control.

References and suggested readings:

1. Pelczar, Reid, "Microbiology"
2. Staineer, "Microbiology"
3. Seelay, Demark, Microbes in Action"
4. Reed, R, "Science for Students of Leather Technology"
5. "Histology of Hides and Skins-A Monograph," CLRI Publication.
6. Dutta. S.S., "An Introduction to the Principles of Leather Manufacture".
7. Sarkar K.T., "Theory & Practice of Leather Manufacture".
8. Heidemann, “Fundamentals of Leather Manufacture”.

9. Flaherty, Roddy, Lollar, “The Chemistry and Technology of Leather” Vol. I

Course contents and lecture schedule

Module No.	Topic	No. of Lectures
1.	**History**:	
1.1	Histology of hides and skins-cells	01
1.2	tissues, fibers, muscles, glands, epidermis, dermis etc.	02
1.3	histological characteristics of buffalo	02
1.4	cow hides, goat and sheep skins, reptiles skins	02
1.5	**Compound Microscope:**	
1.5.1	Mechanical and optical part of compound microscope, image formed, defects in eye pieces and their rectification etc.	02
1.5.2	different types of microscopes	01
1.6	**Structure of collagen:**	
1.6.1	primary structure of collagen, amino acid composition, X-ray diffraction pattern	02
1.6.2	the triple helix structure, electron microscopy of the collagen fiber	02
1.6.3	precipitated form of collagen, Kinetics of fibril formation	02
2.	**General and physical chemistry of proteins:**	
2.1	with special reference to hide proteins, chemical constituents of hides and skins	02
2.2	reaction of proteins with acids, base and salts	01
2.3	**Mycology:**	
2.3.1	Isolation, identification and classification of fungi associate with leather processing	02
2.3.2	Morphology and physiology of fungi, Mycological problems of leather industry and their prevention	02
3.	**Chemical Constituents of hides and skins:**	
3.1	Variation fibrous and non-fibrous proteins,	01

3.2	non-proteinous skin components	01
3.3	**Other skin proteins:**	02
3.3.1	Keratin, Reticulin, elastin- their chemical composition	02
3.3.2	structure and functions, non-fibrous skin proteins	02
3.4	**Non proteinous skin components:**	
3.4.1	Lipids, carbohydrates vitamins, mineral constituents	02
3.4.2	Mechanism of Denaturation process, Renaturation of gelatin solution	02
4.	**Reactive groups in collagen:**	
4.1	Modification of reactive groups of collagen modified proteins	01
4.2	Flaying, curing, defect of hides and skins	01
5.	**Pre-tanning process:**	
5.1	chemistry and principle of different pretanning process- soaking, liming, deliming	02
5.2	bating, degreasing, pickling and depickling process control.	01
Total hours		**40**

TLT-257: Leather Microscopy & Skin Pretannages Lab

L	T	P	C
0	0	4	2

OBJECTIVE: The objective of this course is t**o** enable the students applications of:

- Microscopy
- Bacteriology
- Raw hides and Skins
- Beam house Operations
- Preparation of chrome liquors and tannig

Course Outcome

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

CO1	Apply the Working of compound microscopy.	Apply
CO2	Preparation of different culture media	Apply
CO3	Identification of raw hides and skins and defects	Apply
CO4	Application of beam house Operations	Apply
CO5	Preparation of chrome liquors and application of tanning	Apply

CO	**PO 1**	**PO2**	**PO 3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**
CO1	3	_	_	_	_	_	_	_	_	_	_	_
CO2	3	2	_	_	_	_	_	_	_	_	_	_
CO3	3	2	3	_	_	_	_	_	_	_	_	_
CO4	3	2	_	_	_	1	_	_	_	_	_	_
CO5	3	2	2	_	_	1	_	1	_	_	_	_
Average	3	2	2.6	2	_	1.3	1	1	2	_	_	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) *If there is no correlation, put "-"*

Course Level Assessment Questions

Course Outcome 1(CO1)
1. Applications of a compound microscope.
2. Identification of hides and skins of different.
3.Preparation of microscopical slide

Course Outcome 2(CO2)
1 Preparation of different culture media.
2. Staining of bacteria.
3. Identification defects

Course Outcome 3(CO3)
1. Identification defects
2. Grading and selection.

Course Outcome 4(CO4)
1. Applicaion of curing and Soaking
2. Applicaion of Liming and Deliming
3. Applicaion of Bating etc.

Course Outcome 5(CO5)
1. Practical training in various machines
2. Application of tanning.

SYLLABUS
Module-I:

Microscopy

1. Study of optical part of a compound microscope. Setting up of compound microscope.

2. Identification of hides and skins of different species from their anatomical structure.

3. Identification of hides and skins of different species from their grain pattern.

4. Assessment of sole leather, Leather board etc.

5. Preparation of microscopical slides by paraffin wax and freezing method of different hides and skins.

Module-II:

Bacteriology

1. Preparation of different culture media.

2. Staining of bacteria.

3. Identification defects caused on hides, skins and leather

4. Assessment of finished leather, heavy leather and light leather

Module-III: Raw hides and Skins

1. Study of raw hides and skins

2. Identification defects

3. Grading and selection.

Module-IV Beam house Operations

Training in the various unit operations such as-

1. curing and Soaking

2. Liming and Deliming

3. Bating etc.

Module-V

1. Practical training in various machines employed in the tannery.

2. Preparation of chrome liquors by different procedures and tanning.

References and suggested readings:

1. Pelczar, Reid, "Microbiology"

2. Staineer, "Microbiology"

3. Seelay, Demark, Microbes in Action"

4. Reed, R, "Science for Students of Leather Technology"

5. Dutta. S.S., "An Introduction to the Principles of Leather Manufacture".

Laboratory Experiments schedule

	Laboratory Experiments	
1	Study of optical part of a compound microscope. Setting up of compound microscope	04
2	Identification of hides and skins of different species from their anatomical structure and grain pattern, Assessment of sole leather, Leather board etc.	08
3	Preparation of microscopical slides by paraffin wax and freezing method of different hides and skins.	08
4	Identification defects caused on hides, skins and leather, Assessment of finished leather, heavy leather and light leather	08
5	Study of raw hides and skins, Identification defects, Grading and selection	04
6	curing and Soaking	08
7	Liming and Deliming	08
8	Bating etc	08
	Practical training in various machines employed in the tannery	04
10	Preparation of chrome liquors by different procedures and tanning.	08

TLT 253 FLUID MECHANICS&MECHANICAL OPERATIONS

L	T	P	C
3	1	2	5

Assessment:

Sessional: 50 marks

End Semester: 50 marks

Course Objective:

To understand basic concept of fluid flow and its application to chemical process industries including pipe flow, fluid machinery and agitation & mixing.

Course outcomes:

CO 1	Understand the need of fluid mechanics for chemical engineers	Understand
CO 2	Understand the basic terms and their concepts of fluid flow	Understand
CO 3	Apply the knowledge to develop a dimensional number for the fluid flow	Apply, Create
CO 4	Understand the fundamentals in characterization and classification of solids	Apply, Analyze
CO 5	Understand the sieving performances using different sieve size	Analyze, Evaluate
CO 6	Calculate the crushing efficiency of different size reduction equipment using crushing laws	Analyze, Evaluate

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSOs**	
CO1	3	3	1	1	-	-	2	-	-	1	-	2	**3**	**2**
CO2	3	3	3	-	-	1	1	-	-	1	-	2	3	3
CO3	3	3	3	3	2	1	1	-	-	1	-	2	3	2
CO4	3	2	1	-	-	2	2	-	-	1	-	2	3	3
CO5	3	3	1	3	1	2	1	-	-	1	-	3	3	2
CO6	3	2	2	2	1	2	1	-	3	1	-	3	3	3

Avg.	3.00	2.67	1.83	1.50	0.67	1.33	1.33	-	0.5	1	-	2.33	3	2.5

Syllabus

Module I (8 hours)

Introduction to process fluid mechanics; Fundamental concepts: Definition of a fluid; Continuum hypothesis; Velocity field; Stress field; Newtonian and non-Newtonian fluids, Fluid statics: pressure variation in a static fluid, hydrostatic forces on submerged surfaces, buoyancy, Manometers. Dimensional analysis and similitude: Buckingham Pi theorem and applications

Module II (8 hours)

Macroscopic Balances: derivation of integral balances for mass, energy and momentum; Derivation of engineering Bernoulli equation with losses, Application of macroscopic balances: Losses in expansion, Force on a reducing bend, Diameter of a free jet; Jet ejector. Flow measurement: Orifice meter, venturi meter, Pitot tube, and Rota meter.

Module III (8 hours)

Differential balances of fluid flow: derivation of continuity and momentum (Navier-Stokes) equations for a Newtonian fluid, Boundary layer theory, Pipe flows and fittings: laminar and turbulent flows; friction factor charts, losses in fittings, Fluid transportation: Valves and Pumps and Compressors.

Module IV (8 hours)

Flow through packed and fluidized beds: Flow through beds of solids, motion of particles through the fluid, Particle settling, Fluidization, minimum fluidization velocity, Mixing and Agitation- power consumption, mixing times, scale up

Module V (8 hours)

Filtration: Governing equations, constant pressure operation, constant flow operation, cycle time, types of filters. Centrifuges and Cyclones: Gravity settling, centrifugal separation, cyclone separations, separation efficiency, pressure loss,

Reference:

1. McCabe and Smith, Unit Operations of Chemical Engineering: McGraw Hill

2. Coulson & Richardson , Chemical Engineering Vol. I: Pergamon, 1979 McGraw hill

3. Gupta, Vijay and S. K. Gupta, “Fluid Mechanics and its Applications”, Wiley Eastern, New Delhi (1984).

4. W.L.Badger and J.T.Banchero, Introduction to Chemical Engineering, TMH (1979)

TTL 251 MATERIAL AND ENERGY BALANCE

L	T	P	C
3	1	0	4

Assessment:
Sessional: 50 marks
End Semester: 50 marks

Course Objective:

To understand and apply the basics of calculations related to material and energy flow in the processes.

Course Outcome

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

CO1	Demonstrate comprehensive understanding of material and energy balance equations for open and closed systems.	Understand, Apply, Remember
CO2	Select appropriate basis and conduct degree of freedom analysis before solving material and energy balance problems.	Apply, Evaluate
CO3	Make elementary flow-sheets and perform material and energy balance calculations without and with chemical reactions, and involving concepts like recycle, bypass and purge.	Analyse, Evaluate
CO4	Perform process calculations utilizing psychometric charts and steam tables.	Understand, Apply, Evaluate
CO5	Apply simultaneous material and energy balance calculations for steady state continuous flow systems and unsteady state systems	Understand, Apply, Evaluate

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSOs**	
CO1	3	3	2	1	-	-	-	-	-	-	1	1	**1**	**3**
CO2	3	3	3	2	-	-	-	-	-	-	-	1	2	3
CO3	3	3	3	3	2	2	1	-	-	1	1	1	2	3
CO4	3	3	2	2	1	-	-	-	-	1	1	1	1	3
CO5	3	3	2	1	-	-	-	-	-	-	1	1	2	3
Avg	3	3	2.4	1.8	0.6	0.4	0.2	-	-	0.4	0.8	1	1.6	3

Syllabus

Module 1 (9 hours)

Dimensions, system of units and their conversions, Mass and volume relations, Basic stoichiometric principles, limiting and excess reactants, Degree of completion, Conversion, selectivity, yield. Ideal gas law, Dalton's Law, Amagat's Law, Introduction to degrees of freedom analysis.

Module 2 (7 hours)

Vapor pressure of liquids and solids, Vapor pressure plot (Cox chart), Vapor pressures of miscible and immiscible liquids and solutions, Raoult's Law and Henry's Law. Humidity and saturation use of humidity charts for engineering calculations.

Module 3 (8 hours)

Material balance without chemical reactions and its application to unit operations like distillation, absorption etc. Material balance with chemical reaction Recycle, bypass and purging.

Module 4 (8 hours)

Heat capacity of gases, liquids and solutions Heat of fusion and vaporization. Steady state energy balance for systems with and without chemical reactions. Calculations and application of heat of reaction combustion, formation, neutralization and solution. Enthalpy-concentration charts. Orsat analysis Calculation of theoretical and actual flame temperatures

Module 5 (8 hours)

Simultaneous material and energy balance. Introduction to Unsteady state material and energy balance.

Suggested Text books

1. Hougen, O.A., Watson, K.M and Ragatz, R.A., " Chemical Process Principles Part-I ",John Wiley and Asia Publishing, 1970.

2. Himmelblau, D.M., “Basic Principles and Calculations in Chemical Engineering" ,sixth Edition, Prentice Hall Inc., 1996.
3. Felder, R.M. & Rousseau, R.W. "Elementary Principles of Chemical Processes ", 3rd edition. JohnWiley. (1999)
4. Bhatt, B.L., VORA, S.M., “Stoichiomentry ", Tata McGraw-Hill, 1976.

Suggested Reference Books

1. Venkataramani, V., Anantharaman, N., Begum, K. M. MeeraSheriffa, “ProcessCalculations” , Second Edition, Prentice Hall of India.
2. Sikdar, D. C., “Chemical Process Calculations”, Prentice Hall of India.

HHS 251 ORGANIZATIONAL BEHAVIOR

Course: IIIrd B. Tech	Branch: CS/IT	Year / Semester: IIIrd Year
Sessional Marks:	**50**	**Credit: 3**
End Semester Exam:	**50**	**LTP: 3 0 0**

Objective:

- To identify organizational objectives, components and models for better results in attaining organizational goals;
- To understand individual behavior dimensions and interpersonal behavior;
- To analyze group, group behaviour, team and team building with its key role in organization;

Course Outcomes (COs)

At the end of this course students should be able to:

CO1	Understand organisation, features, key elements, components, types and OB Models	Understand
CO2	Demonstrate individual behavioural dimensions, learning theories, perceptual process, values & ethics with motivational techniques in stressed situations.	Understand and apply
CO3	Identify mechanism for conducive survival of individual in an organization with interpersonal understanding.	Analyze and apply
CO4	Ascertain group, group behaviour, team building with its key role in organization	Analyze, evaluate and apply
CO5	Demonstrate organisational structure, organisational change, organisational development for achieving higher productivity and accomplishing goals of organisation	Analyze and evaluate

CO-PO Matrix

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSOs**	
CO1	0	0	0	1	0	1	1	1	2	2	1	3	**3**	**3**
CO2	0	0	0	1	0	1	1	3	3	3	1	3	3	3

CO3	0	0	0	1	0	2	1	3	3	3	2	3	3	3
CO4	0	0	0	2	0	2	2	3	3	3	2	3	3	3
CO5	0	0	0	2	0	1	2	2	2	2	2	3	3	3
Average				1.4		1.4	1.4	2.4	2.6	2.6	1.6	3	3	3

Syllabus

Unit 1: Introduction to organizations

What is an organization, components of organization, nature and variety of organizations (in terms of objectives, structure etc.), models of analyzing organizational phenomena, organizational and business variables, organizations in the Indian context, institutions and structures,

Unit 2: Dimensions of Individual Behavior

Individual Behavior, Dimensions of individual behavior: Perceptions, Learning, Motivation, Personality, Commitment, Attitudes, Values & Ethics, Stress Management

Unit 3: Dimensions of Interpersonal Behavior

Transactional Analysis, Interpersonal communication, Listening, Feedback, Counseling,

Unit 4: Group Behavior

Leadership, Communication, Group: Formal Vs Informal Groups, Group Decision making, Team: Team building, team problem solving.

Unit 5: Organizational Dimensions

Organizational Structure: Elements of Organizational Structure, Dimensions of Organizational Structure, Organizational change, Organizational Development, Power, Authority, Politics

Test Books:

1. Luthans Fred., "Organizational Behavior", McGraw Hill, 1998
2. Pareek, Udai, "Understanding Organizational Behavior, Oxford university press

Additional Reference Books:

1. Robbins (4th ed.), "Essentials of organizational behavior", Prentice Hall of India Pv1. Ltd., New Delhi, 1995
2. Keith Davis, "Organisational Behaviour,
3. Hersey and Blanchard (6th ed.). "Management of organizational behavior L utilising human resources", Prentice Hall of India Pv1. Ltd., New Delhi, 1996.
4. Nancy J. Adler, “International Organisational behavior’, Cengage Learning
5. Nelson Quick, ‘Organizational Behaviour Function Learning’ Fifth Edition

ECS 251: CYBER SECURITY

L	T	P	C
0	2	0	0

Course Outcomes:

1. Understand information, information systems, information security, Cyber Security and Security Risk Analysis. (Understand)
2. Understand and apply application security, data security, security technology, security threats from malicious software. (Understand, Apply)
3. Understand the concepts of security threats to e-commerce applications such as electronic payment system, e-Cash, Credit/Debit Cards etc. (Understand)
4. Understand and apply Information Security Governance & Risk Management, Security of IT Assets and Intrusion Detection Systems. (Understand, Apply)
5. Understand various types of Security Policies, Cyber Ethics, IT Act, IPR and Cyber Laws in India. (Understand).

Syllabus

Unit-1:

Introduction to information systems, Types of information systems, Development of Information systems, Introduction to information security, Need for Information security, Threats of Information Systems, Information Assurance, Cyber Security and Security Risk Analysis.

Unit-2

Application security (Database, E-mail and Internet), Data Security Considerations-Backups, Archival Storage and Disposal of Data, Security Technology- Firewall and VPNs, Intrusion Detection, Access Control, Security Threats- Viruses, Worms, Trojan Horse, Bombs, Trapdoors, Spoofs, E-mail viruses, Macro viruses, Malicious Software, Network and Denial of Services Attack, Security Threats to E-Commerce – Electronic Payment System, e-Cash, Credit/Debit Cards, Digital Signature, public Key Cryptography.

Unit-3

Developing Secure Information Systems, Application Development Security, Information Security Governance & Risk Management, Security Architecture & Design, Security Issues in Hardware, Data Storage & Downloadable devices, Physical Security of IT Assets, Access Control, CCTV and intrusion Detection Systems, Backup Security Measures.

Unit-4

Security Policies, why Policies should be developed, WWW Policies, Email Security Policies, Policy Review Process- Corporate policies- Sample Security Policies, Publishing and Notification requirement of the Policies. Information Security Standards- ISO, IT Act, Copyright Act, Patent Law, IPR. Cyber Laws in India: IT Act 2000 Provisions, Intellectual Property Law: Copy Right Law, Software License, Semiconductor Law and Pattern Law.

Text and Reference Books:

1. Charles, P., and Shari Lawrence P fleeger, “Analyzing Computer Security”. Pearson Education India.

2. V.K. Pachghare, “Cryptography and information security”, PHI Learning Pvt. Ltd., Delhi India.
3. Dr Surya Prakash Tripathi, RitendraGoyal, and Praveen Kumar Shukla, "Introduction to Information Security and Cyber Law", Willey Dream tech Press.
4. Schou, Shoemaker, “Information Assurance for the Enterprise”, Tata McGraw Hill.
5. Chander Harish, “Cyber Laws and their Protection”, PHI Learning Private Limited, Delhi, India

Semester- 4

BCY-252 MODERN ANALYTICAL TECHNIQUES

L	T	P	C
3	0	2	4

OBJECTIVE:

The objective of this course is to make the students aware of the modern instrumental techniques, the principles underlying them and their applications in the characterization of materials.

Course outcome

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

CO1	Interpret Raman and IR–Spectra for characterization of materials.	Understand, Apply, Analyze
CO2	Interpret NMR, Mass and ESR–Spectra for characterization of materials.	Understand, Apply, Analyze
CO3	To analyze the conductivity to determine the concentration of solution and i-E characteristics of the samples.	Understand, Apply
CO4	Analytical separation carried out by Chromatography in a multi-component system.	Remember, Apply, Analyze
CO5	Elucidation of the Thermal Stability of different molecules and their Characterization on the basis of their thermal stability and Glass Transition Temperature of Polymers. Determine the specific heat, heat of reaction, Melting point & boiling point. Check the purity of drugs, crystallization and fusion of polymeric materials.	Understand, Apply, Evaluate, Create
CO6	To develop experimental skills to perform, monitor and manipulate the reactions.	Understand, Evaluate, Analyze

Syllabus

Module I

(i) Infrared Spectroscopy: Introduction, Principle, Instrumentation, mechanics of measurements, Selection rules, fundamental vibration modes, Factors influencing the Band Position and intensities, some characteristics frequencies and co-relation of IR spectra with molecular structures, effect of Hydrogen Bonding on vibrational frequencies. (Lectures: 6-7)

(ii) Raman Spectroscopy: Introduction theory of Raman Spectroscopy, Mechanism of Raman and Rayleigh scattering, Rule of Mutual Exclusion, correlation with the molecular structure, difference between Raman and IR spectra, Resonance Raman effect, Application of Raman Spectroscopy. (Lectures: 4-5)

Module II

(i) Nuclear Magnetic Resonance Spectroscopy: Introduction, basic principles, mechanics of measurements, chemical shift, band multiplets, spin-spin splitting, shielding and deshielding effect, spin-spin coupling and coupling constant (J), some characteristics of NMR positions, Application in elucidation of molecular structure, , Elementary idea of NOE, DEPT NMR, C^{13} NMR, P^{31}NMR, F^{19}NMR. (Lectures: 4-5)

(ii) Mass Spectroscopy: Introduction, basic principles, instrumentation, fragmentation patterns, nitrogen rule, Mc Lafferty Rearrangement, interpretation of mass spectra and applications. (Lectures: 3-4)

(iii) ESR (Electron Spin Resonance) - Basic Principles and Magnetic Interactions, Instrumentation and Applications. (Lectures: 2-3)

Module III

(i) Potentiometry and Conductometry: General principles, reference and indicator electrodes, potentiometric and conductometric titrations
(Lectures: 3-4) **Polarography:** Basic principle, dropping mercury electrode (DME), half wave potential, polarographic currents and applications.
(Lectures: 3-4)

Module IV

(i) Chromatographic methods: Introduction to Chromatographic methods: TLC, Column and Gas chromatography, Principles, Instrumentation, GC column, Detectors and stationary phases and applications, hyphenated techniques (GC-MS). (Lectures: 4-5)

Liquid Chromatography LC/HPLC, Column efficiency in LC, Detectors, Instrumentation, Partition/Adsorption/Ion Exchange Chromatography (Lectures: 4-5)

Module V

(i) Thermal Methods of Analysis: Thermogravimetric analysis, differential thermal analysis and differential scanning calorimetry and applications. (Lectures: 4-5)

CHEMISTRY LAB

List of Experiments:

1. Estimation of vitamin C in commercial soft drink / Glucon D.
2. Determine the strength of oxalic acid conductometrically using sodium hydroxide solution.
3. Separation of amino acids by thin layer chromatography.
4. Determination of Rf value of Methyl Orange and Phenolphthalein using paper/ thin layer chromatography.
5. Separation of metal ions by paper/thin layer chromatography.
6. Determine the adsorption isotherm of oxalic acid/acetic acid on activated charcoal and verify the Freundlich adsorption isotherm.
7. Determine the rate constant (K) of hydrolysis of ethyl acetate catalyzed by HCL.
8. Prepare p-nitro acetanilide from acetanilide and find its percentage yield.
9. Determine the viscosity and percentage composition of the given liquid using Ostwald's viscometer.
10. Determine the strength of given glucose solution by titration against Fehling's solution.
11. Evaluation of Dissociation Constant k for a weak acid using conductometry.
12. Elution of chemicals by Column Chromatography.
13. Elution of genomic DNA from plants suspension.
14. Estimation of Phosphoric acid from coca cola.

Reference Books:

1. Instrumental Analysis, Douglas A. Skoog, F. James Holler & Stanley R. Crouch.
2. Instrumental Methods of Analysis, Willard, Merit and Dean.
3. Handbook of Instrumental Techniques for Analytical Chemistry Ronald A. Hites, Indian University, School of Public and Environmental Affairs and Department of Chemistry.
4. Applications of absorption spectroscopy of organic compounds, John R. Dyer.
5. Instrumental Methods Analysis, B. K. Sharma.
6. Text book of Quantitative Inorganic Analysis, A. I. Vogel.
7. Spectroscopy of Organic Compounds by P.S. Kalsi, Y.R. Sharma, Robert M. Silverstein & Francis X. Webster.

BMA 252 COMPUTER ORIENTED NUMERICAL METHODS

L	T	P	C
2	1	2	4

OBJECTIVE: The objective of this course is to provide conceptual understanding of:

- various numerical methods for solving linear and non linear equations.
- various numerical techniques of interpolation, integration and differentiation with their applications.
- various numerical methods to solve IVP_S and BVP_S.
- developing computer programs of numerical methods using C/C^{++} language.

Course Outcome

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

CO1	find roots of nonlinear equations and solve systems of algebraic equations.	Apply, Evaluate
CO2	use interpolation techniques and to find numerical differentiation/ integration of data function.	Apply, Evaluate
CO3	use numerical methods for finding solutions of ordinary differential equations, simultaneous and higher order equations.	Apply, Evaluate
CO4	learn numerical methods for finding solution of initial and boundary value problems, partial differential equations.	Apply, Evaluate
CO5	learn basic concepts of some Finite element methods.	Apply, Evaluate
CO6	developing computer programs of numerical methods using C/C^{++} language.	Apply, Evaluate, Create

1: Slight (Low) 2: Moderate (Medium) 3:Substantial (High) *If there is no correlation, put "-"*

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
CO1	3	2	3	3	1	1	1	-	-	-	-	3
CO2	3	2	3	3	1	1	1	-	-	-	-	3
CO3	3	2	3	3	1	1	1	-	-	-	-	3
CO4	3	2	3	3	1	1	1	-	-	-	-	3
CO5	3	2	3	3	1	1	1	-	-	-	-	3
CO6	3	2	2	2	3	2	1	2	2	2	2	3
Averag e	3	2	2.83	2.83	1.33	1.16	1	.33	.33	.33	.33	3

Syllabus:

UNIT I: Nonlinear Equations and Simultaneous Linear Equations

Roots of nonlinear equation, Methods of solution, Order of convergence of iterative methods, Simple roots: Bisection, False position, secant, Newton-Raphson, Chebyshev, Iteration and multi point iteration methods, Multiple roots: Newton-Raphson and Chebyshev, Complex roots: Newton-Raphson and Muller's method, a system of nonlinear equations: Newton-Raphson and Iteration methods, Polynomial equations: Bairstow's method, convergence analysis of above methods.

Linear systems: Introduction, Direct methods, Operation count, Pivoting, III conditioned linear systems & condition number, Iteration methods: Jacobi, Gauss-Seidel, SOR methods, convergence conditions. Special system of equations: Thomas algorithm. Eigen value problems: Given's and Power methods.

UNIT II: Interpolation, Differentiation and Integration

Curve fitting: Polynomial interpolation, error, Existence and Uniqueness, Truncation error bounds, difference operators, Newton forward and backward difference interpolations, Lagrange, Newton divided difference and Iterated interpolations, stirling and Bessel's interpolations, Spline interpolation, Least squares and Chebyshev approximations. Numerical Differentiation: Methods based on interpolation, Error analysis. Numerical Integration: Methods based on interpolations (Trapezoidal, Simpson's 1/3, simpson's 3/8 rule), Gauss quadrature methods, Romberg integration, Error bounds and estimates.

UNIT III: Numerical Solution of Ordinary Differential Equations

Initial-value problems, Single step methods: Taylor's, Picard's, Euler's, Modified Euler's method and Runge-Kutta method (fourth Order), Error estimates, Multi-step methods: Adam's-Bashforth and Milne's methods, convergence and stability analysis, Simultaneous and Higher order equations: RK Fourth order method.

UNIT IV: Initial & Boundary Value Problems and Iterative Solvers

BVP: Shooting method and Finite difference methods for Ordinary Differential Equations, Solution of Partial differential equation; solution of Laplace, Poisson equations: Standard 5-point and diagonal 5- point formulae, Jacobi method, Gauss Seidel method (Liebmann's iterative method) Relaxation method. Solution of heat equation: Crank – Nicolson method, Solution of wave equation.

UNIT V: Finite Element Method

Basic concepts, variational formulation and functional, base functions, approximations weighted residual methods: Ritz method, Galerkin method, Least squares method, collocation method, Finite element and solution of simple problems and time dependent problems.

NT Lab

Develop Programs of the following techniques in C/C++ Language:

1. To implement iterative methods to solve a nonlinear equation.
2. To implement iterative methods to solve a system of linear equations.
3. To implement Forward, Backward and Central difference interpolation formulae.
4. To implement Newton's divided difference and Lagrange's interpolation formulae.
5. To implement Numerical differentiation.
6. To implement Numerical integration using Trapezoidal, Simpson 1/3 and Simpson 3/8 rules.
7. To implement single step methods to solve initial value problems.
8. To implement multi step methods to solve initial value problems.
9. Solution of Heat equations (Parabolic equations) by finite difference method.
10. Solution of Laplace equations (elliptic equations) by finite difference method.
11. Solution of wave equations (Hyperbolic equations) by finite difference method.

Books Recommended:

1. M.K.Jain, S.R.K. Iyengar & R.K.Jain, Numerical methods for Scientific and Engineering Computation, N age International Publication.
2. S.S Sastry, Intoductory Methods of Numerical Analysis, Eastern Economy Edition.
3. S. Rajasekaran, Numerical Method in Science and Engineering, Wheeler Publishing House.
4. B.S. Grewal, Numerical Method in Engineering & Science, Khanna Publishers.

TLT-252 ANALYSIS OF MATERIALS OF LEATHER MANUFACTURE

L	T	P	C
3	1	2	5

OBJECTIVE: The objective of this course is t**o** enable the students

- To understand principle of analytical method employed in analysis of water.
- To understand Analysis of Various Chemicals and Auxiliaries used in Leather Processing:
- To understand theory of oils, fats, binders & waxes etc.
- To understand Analysis of Tanning Agent.

Course Outcome

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

CO1	Understand principle of analytical method employed in analysis of water.	Understand
CO2	Understand Analysis of Various Chemicals and Auxiliaries used in Leather Processing:	Understand
CO3	Understand basic principles of titration and standards theory of oils, fats, binders & waxes etc.	Understand
CO4	Understand analysis of Liquors of beam House Processes	Understand
CO5	Understand analysis of Tanning Agent.	Understand
CO6	Understand analysis of materials of leather manufacture.	Apply

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	03	02	_	01	02	_	_	_	_	_	_	_
CO2	03	02	_	01	02	_	_	_	_	_	_	_
CO3	03	_	_	_	_	_	_	_	_	_	_	_
CO4	03	02	_	01	02	_	_	_	_	_	_	01
CO5	03	02	_	_	_	_	_	_	_	_	_	_
CO6	03	02	_	_	02	_	_	_	_	_	_	01
Average	3	2	_	1	2	_	_	_	_	_	_	_

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High), *no correlation, "-"*

Course Level Assessment Questions:

Course Outcome 1(CO1)

1. Analytical method employed in analysis of water
2. Effect of hardness of water on various processes in leather manufacture
3. Softening of water.

Course Outcome 2(CO2)

1. Analysis of salt, lime.
2. Analysis of deliming agents.
3. Neutralizing agents.

Course Outcome 3(CO3)

1. Oils and Fats
2. Sulfated oils, soap, fat liquors
3. Auxiliaries like resin binders, wax emulsions etc.

Course Outcome 4(CO4)

1. Analysis of Soak liquor,
2. Analysis of lime liquor.
3. Analysis of pickle liquor.

Course Outcome 5(CO5)

1. Vegetable tanning materials and extracts.
2. Chrome extracts and liquors.
3. Zirconium and Aluminum Tanning agent.

Course Outcome 6(CO6)

1. Analysis of water.
2. Analysis of materials of leather manufacture

SYLLABUS

Module -I:

Analysis of water: Type of water – principle of analytical method employed in analysis of water effect of hardness of water on various processes in leather manufacture softening of water.

Module -II:

Analysis of Various Chemicals and Auxiliaries used in Leather Processing: Salt, Lime, Sodiumsulphate, Almmonium salt, Deliming agents, Bates, Neutralizing agents.

Module -III:

Oils and Fats, sulfated oils, soap, fat liquors and other auxiliaries like resin binders, wax emulsions etc.

Module-IV :

Analysis of Liquors of beam House Processes: Soak liquor, lime liquor and pickle liquor.

Module -V:

Analysis of Tanning Agent: Vegetable tanning materials and extracts, chrome extracts and liquors, zirconium and Aluminum Tanning agent, formaldehyde.

Module -VI:

Water Analysis: Temporary hardness, Permanent hardness, Total hardness, Chloride content, Sulphate content, Iron content, Analysis of common salt, Analysis of lime-available lime, Total bases. Analysis of sodium sulphide, Analysis of used lime liquors-lime, sodium sulphide, salt content. Analysis of deliming agents-analysis of ammonium salts, analysis of organic acids, Analysis of pickle liquor, Analysis of bate, Analysis of oils, moisture, acid value, saponification value, iodine value, unsaponifiables, Analysis of sulphate oils-moisture, pH, acid value, total alkalinity organically combined SO3, Na groups.

References and suggested readings:

1. Sarkar, P. K., "Analysis of Materials of Leather Manufactures"
2. Mahadevan, T. S. K., "A Practical Guide for Chemical Analysis and Physical Testing of Leather"
3. Sarkar K.T. "Theory and practices of Leather Manufacture".
4. "I.S. Standards for Chemical Testing".

Course contents and lecture schedule

Module No.	Topic	No. of Lectures
1.	**Analysis of water:**	
1.1	Type of water	02
1.2	principle of analytical method employed in analysis of water	02
1.3	effect of hardness of water on various processes in leather manufacture	02
1.4	softening of water.	02
2.	**Analysis of Various Chemicals and Auxiliaries used in Leather Processing:**	
2.1	Salt & Lime.	02
2.2	Sodiumsulphate & Almmonium salt.	02
2.3	Deliming agents & Bates,	02

2.4	Neutralizing agents.	02
3.		
3.1	Oils and Fats.	02
3.2	Sulfated oils & soap.	02
3.3	Fat liquors and other auxiliaries like resin binders,	02
3.4	Wax emulsions etc.	02
4.	**Analysis of Liquors of beam House Processes**	
4.1	Soak liquor.	02
4.2	Lime liquor.	02
4.3	Pickle liquor.	02
5.	**Analysis of Tanning Agent:**	
5.1	Vegetable tanning materials and extracts	03
5.2	Chrome extracts and liquors.	03
5.3	Zirconium and Aluminum Tanning agent.	03
5.4	Formaldehyde	01
Total hours		**40**
6.	**Laboratory experiments**	
6.1	Water Analysis: Temporary hardness, Permanent hardness, Total hardness, Chloride content, Sulphate content, Iron content.	06
6.2	Analysis of common salt.	06
6.3	Analysis of lime-available lime, Total bases.	06
6.4	Analysis of sodium sulphide.	06
6.5	Analysis of used lime liquors-lime, sodium sulphide, salt content.	06
6.6	Analysis of deliming agents-analysis of ammonium salts, analysis of organic acids.	06
6.7	Analysis of pickle liquor.	06
6.8	Analysis of bate.	06
6.9	Analysis of oils, moisture, acid value, saponification value, iodine value, unsaponifiables.	06
6.10	Analysis of sulphate oils-moisture, pH, acid value, total alkalinity organically combined SO_3, Na groups.	06
Total hours		**60**
Grand total hours		**100**

TLT 254 HEAT TRANSFER OPERATIONS

L	T	P	C
2	1	0	3

Assessment:

Sessional: 50 marks

End Semester: 50 marks

Course Objective:

To understand the fundamentals of heat transfer mechanisms in fluids and solids and their applications in various heat transfer equipment in process industries.

Course outcomes:

CO 1.	Understand different modes of heat transfer.	Understand
CO 2	Apply the concepts of one-dimensional and multi-dimensional; steady and unsteady state conduction heat transfer, and relevant boundary and initial conditions in problem solving.	Apply, Analyze ,Evaluate
CO 3.	Apply the knowledge of analytical and graphical (temperature charts) techniques in solving specific transient heat conduction problems, including lumped and one-dimensional systems	Apply, Evaluate
CO 4	Understand the concept of temperature-dependent buoyancy which causes natural free convection, and apply the dimensionless Grashof number used in correlations for free convective heat transfer calculations	Understand, Analyze, Evaluate
CO 5.	Understand phase-change phenomena and latent heat of vaporization, including free convective, nucleate and film boiling, as well as dropwise and film condensation	Understand, Analyze

		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSOs**	
CO1		3	2	1	1	-	-	2	-	-	1	-	1	**1**	**2**
CO2		3	3	3	3	2	1	1	-	-	1	-	1	2	2
CO3		3	3	3	3	3	1	1	-	-	1	1	1	1	2
CO4		3	2	3	3	3	2	2	-	-	1	1	1	2	2
CO5		3	3	3	3	1	2	1	-	-	1	1	1	1	2
Avg.		3	2.6	2.6	2.6	1.8	1.2	1.4	-	-	1	0.6	1	1.4	2

Syllabus

Module 1 (6 hours)

Introduction ot heat transfer and general concepts of heat transfer by conduction, convection and radiation, Conduction: Basic concepts of conduction in solids, liquids, gases, steady state temperature fields and one dimensional conduction without heat generation e. g. through plain walls, cylindrical and spherical surfaces, composite layers, Insulation materials, critical and optimal, insulation thickness, Extended surfaces, fins and their applications, Introduction to unsteady state heat transfer.

MODULE 2 (6 hours)

Convection: Fundamentals of convection, Basic concepts and definitions, natural and forced convection, hydrodynamic and thermal boundary layers, laminar and turbulent heat transfer inside tubes, Dimensional analysis, determination of individual and overall heat transfer coefficients, heat transfer in molten metals.

MODULE 3(6 hours)

Radiation: Basic laws of heat transfer by radiation, black body and gray body concepts, view factors, Kirchoff's law, solar radiations, combined heat transfer coefficients by convection and radiation.

MODULE 4(6 hours)

Heat Transfer by phase change: Condensation of pure vapours, film wise and drop wise condensation, eat transfer in boiling liquids, boiling heat transfer coefficients, Evaporation: Elementary principles, types of evaporators, Single and multiple effect evaporators.

MODULE 5(6 hours)

Heat exchangers: Types of heat exchangers, Principal components of a concentric tube & shell-and-tube heat exchangers, baffles, tube and tube distribution, tubes to tube sheet joint, heat exchanger with multiple shell and tube passes, log-mean temperature difference, overall heat transfer coefficient, fouling factors, design of double pipe and shell and tube heat exchangers.

BOOKS:

1. "Heat Transfer principles and applications" Dutta, B. K., PHI

2. "Heat Transfer" Holman J. P, 9th Ed. McGraw Hill.

3. "Process Heat Transfer". Kern D. Q. McGraw Hill Book

4.Heat and Mass Transfer Fundamentals and Applications, Cengel Y. A. and Ghajar A. J., McGraw Hill,5th edition, 2016.

TLT 256 CHEMICAL ENGINEERING THERMODYNAMICS

L	T	P	C
2	1	0	3

Assessment:
Sessional: 50 marks

End Semester: 50 marks

Course Objective:

To understand the theory and applications of classical thermodynamics, thermodynamic properties, equations of state, methods used to describe and predict phase equilibria.

Course outcomes:

CO 1	Understand the basic of thermodynamics and the terminology associated with engineering thermodynamics	Understand
CO 2	Understand the knowledge of contemporary issues related to chemical engineering thermodynamics	Understand
CO 3	Understand and apply the knowledge of phase equilibria in two-component and multi-component systems	Understand, Apply
CO 4	Analyse the thermodynamic properties of substances in gas or liquid state of ideal and real mixture	Apply
CO 5	Understand intermolecular potential and excess property behaviour of multi-component systems	Understand

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSOs**	
CO1	3	2	1	1	-	-	1	-	-	1	-	1	**1**	**2**
CO2	3	1	1	1	-	3	3	-	-	1	-	1	2	2
CO3	3	3	2	2	3	-	-	-	-	1	-	1	1	2
CO4	3	3	3	2	3	1	1	-	-	1	-	1	2	2
CO5	3	2	2	3	2	1	1	-	-	1	-	1	2	2
Avg.	3	2.2	1.8	1.8	1.6	1	1.2	-	-	1	-	1	1.6	2

Syllabus

Module 1 (8 hours)

Basic Concepts & First Law of Thermodynamics: Scope of thermodynamics, System & Surroundings, Properties -Force, Temperature & pressure, Equilibrium, Processes- Reversible & Irreversible, Work, Heat, Energy ,Phase rule, Joule's Experiment, Internal energy, Enthalpy, Heat capacities, Application of first law to closed & open systems.Volumetric properties of pure fluids: PVT behavior of pure substances, Virial equation of state and its application ,ideal gas and cubic equation of state, Generalized correlations for gases and liquids.

Module 2 (6 hours)

Second Law of Thermodynamics: Heat engine and its efficiency, Heat pump, Refrigerator, COP, Second law of Thermodynamics, Kelvin–Planck statement &Clausius Statement, Carnot's cycle and Carnot theorems, Clausius inequality, Entropy balance for open systems, ideal work and lost work, Principle of entropy.

Module 3 (6 hours)

Residual properties, two phase systems: Clapeyron equation, Estimation of thermodynamic properties by using graphs and tables.Solution thermodynamics Theory: Fundamental property relation, Chemical potential and phase equilibria ,Partial properties ,Ideal gas mixture model.

Module 4 (6 hours)F

ugacity and fugacity coefficient for pure species and in solution, Ideal solution model and excess properties.Solution thermodynamics Application: Liquid phase properties from VLE data, Models for the excess Gibbs energy, Property changes of mixing.

Module 5 (4 hours)

Phase Equilibria: Nature of equilibrium, phase rule, VLE qualitative behavior, Simple Models for VLE, VLE by Modified Raoultslaw and VLE from K-value charts.

Reference

1. "Introduction to Chemical Engineering Thermodynamics" by J.M. Smith and H.C. Van Ness, McGraw

Hill International Ltd, 2005.

2. "Chemical Engineering Thermodynamics" by Y.V.C. Rao, Universities Press (India) Ltd. Hyderabad.

3. "Chemical and Process Thermodynamics", Kyle B.G., 3rd ed., Prentice Hall. 1999

4. "Chemical Engineering Thermodynamics", by Narayanan, K.V., Prentice Hall. 2007

HHS 251/252 ENGINEERING ECONOMICS AND MANAGEMENT

L	T	P	C
3	0	0	3

Course: B. Tech.	**Branch:** All Branches	**Year: 2nd Year**
Sessional Marks:	**50**	**Credit: 3**
End Semester Exam:	**50**	**LTP: 3 0 0**

Objective:

- ✓ To provide useful knowledge to engineering students in their professional career particularly in corporate and manufacturing sector.
- ✓ To understand essential economic principles for solving economic problems with suitable policy alternatives.
- ✓ To study and analyze the contemporary market situations, market strategy to manage the business and industry.
- ✓ To understand fundamental of business management and apply management techniques for the benefit of business and society.

Course Outcome (COs)

At the end of this course students should be able to:

CO1	Understand essential economic principles for solving economic problems with suitable policy alternatives	Understand
CO2	Understand and evaluate the production system with different type of cost.	Understand, evaluate
CO3	Study and analyse the market, structure, types and characteristics	Analyze and apply
CO4	Understand fundamentals of management principles and functions	Understand and apply
CO5	Know various forms of business ownership, formation and their relevance	Analyze, evaluate and apply

CO-PO Matrix

Course	CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSOs**	

HHS-201/202	CO1	0	0	0	1	0	2	1	3	1	3	3	3	**1**	**2**
	CO2	1	0	0	0	0	2	1	3	3	3	3	3	2	1
	CO3	0	0	0	1	0	2	2	3	2	3	3	3	1	2
	CO4	0	0	0	0	0	2	2	3	3	3	3	3	1	2
	CO5	0	0	0	0	0	2	3	3	3	2	3	3	3	2
average		0.2	0	0	0.4	0	2	1.8	3	2.4	2.8	3	3	1.6	1.8

Syllabus

UNIT I Introduction to Economics:
Overview: production possibility curve, choices-what, how and for whom, micro- and macro economics, inflation, unemployment, GDP and business cycle; demand and supply, elasticity of demand, consumer surplus and its applications, utility theory.

UNIT II Production and Cost:
Factors of production, production function, law of variable proportion, isoquant analysis, return to scale, economies of scale;
Types of costs: direct and indirect costs, explicit and implicit costs, opportunity cost, economic cost, fixed cost and variable costs, average and marginal costs, short-run and long-run costs, optimal combination of factor-inputs.

UNIT III Market Structure:
Perfectly Competitive Market, Imperfect market: Monopoly, Oligopoly, Monopolistic Market

UNIT IV Fundamentals of Management:
Development of Management Thoughts, Objectives, Functions of Management: Planning, Organising, Directing, Controlling and Coordination.

UNIT V Business Enterprises-
Business Ownership: Sole Proprietorship, Partnership, Company: Promotion, Formation & Development, Cooperative Firms.

Text Books:

1. **Koutsoyiannis, A**., 'Modern Microeconomics', English Language Book Society, Macmillan.
2. **Joseph, L Massod,** "Essential of Management", Prentice Hall, India.

Additional Reference Books:

1. **Armstrong, Michel**, "A Handbook of Management Techniques", Kogan Page Limited
2. **Babcock, D L and Lucy C Morse**, "Managing Engineering and Technology", third edition, Pearson Education, 2006
3. **Pindyck, R S, Rubinfeld, D L &Mehta** , 'Microeconomics', 6th Edition, Pearson Education India.
4. **Barthwal, R R , Microeconomic Analysis**
5. **Samuelson, Paul A** , 'Economics', 5th edition, McGraw Hill New York.
6. **Henderson, J M and Quadnt, R E** , 'Microeconomic Theory: A Mathematical Approach.', Tata MacGraw Hill, New Delhi,2003
7. **H. Varian,** 'Intermediate Micro Economics'
8. **G. Mankiw,''**Principles of Micro Economics

HHS-256: INDIAN CONSTITUTION

L	T	P	C
0	2	0	0

Course Objectives (COs) At the end of this course students should be able to:

1. Configure the preambles & fundamental rights.
2. Actuate the governance & functioning of constitutional functionaries.
3. Describe the functions of legislative bodies.
4. Decipher the judiciary system & its role in governance.
5. Develop a democratic process through electoral mechanism into system.

Syllabus

UNIT – I

Indian Constitution Sources and Features, Preamble, Fundamental Rights, Fundamental Duties and Directive Principles of State Policy

UNIT-II

Union Executive President, Vice President, Prime Minister, Council of Ministers, State Executives- Governor, Chief Minister and Council of Ministers

UNIT- III

Union Legislature Parliament- Composition and Functions, Speaker of Lok Sabha, Amendment Process, State Legislature- Vidhaan Sabha, Panchaayati Raj, Institutions- History, Basic Features and 73rd Amendment

UNIT- IV

Judiciary Supreme Court, High Courts, Judicial Review and Judicial Activism UNIT-V- Election Commission Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the Welfare of SC/ST/OBC and Women.

Reference Books:

1. Indian Constitution : D.D Basu
2. Indian Administration: Avasthi and Avasti

Additional Reference Books:

1. The Indian Constitution: Corner Stone of a Nation, G. Austin, Oxford University Press.

2. Indian Politics: Contemporary Issues and Concerns, M. P. Singh and RekhaSaxena, Prentice Hall of India, Delhi

SEMESTER- 5

TLT-355 PROCESSING OF LEATHER-I

L	T	P	C
3	1	2	5

OBJECTIVE: The objective of this course is t**o** enable the students

- To understand the manufacturing of various finished & heavy leather.
- To understand the processing of industrial & sports leather.
- To understand the manufacturing of various light leather.
- To understand the manufacturing of water proof leather.
- To understand the uses of splits.

Course Outcome

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

CO1	general practices in vegetable and chrome tanning	Understand
CO2	Understand the processing of industrial & sports leather	Understand
CO3	Understand the manufacturing of various light leather.	Understand
CO4	Understand the manufacturing of water proof leather.	Understand
CO5	Understand the uses & of splits by manufacturing different leathers.	Understand
CO6	Processing of chrome leather from different raw materials and tannages.	Apply

CO	PO1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	_	_	1	_	_	_	_	_	_	_
CO2	3	2	_	_	2	_	_	_	_	_	_	_
CO3	3	2	_	_	2	_	_	_	_	_	_	_
CO4	2	2	_	_	2	_	_	_	_	_	_	_
CO5	3	2	2	2	2	_	3	_	2	_	_	1
CO6	3	2	1	_	_	_	_	_	_	_	_	1
Average	2.8	2	1.5	2	1.8	_	3	_	2	_	_	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) *If there is no correlation, put "*-

Course Level Assessment Questions

Course Outcome 1(CO1)

1. Finished leathers and composition of finishes
2. Vegetable tanned sole leathers, Bag tanning.
3. Belting leathers

Course Outcome 2(CO2)

1. Leather for liquification plants for air, Oil seal, Gas.
2. Sports Goods leather.
3. Hockey ball, Cricket Ball leather.

Course Outcome 3(CO3)

1**.** Softies & nappa leather.
2. Printed Leathers.
3. Upholstery leathers.

Course Outcome 4(CO4)

1. Water proof and water repellent upper leather.
2. Lining leather.
3. Bag leather.

Course Outcome 5(CO5)

1**.** Different types of leathers using chrome splits
2. Formulation and different dyestuffs.
3. Retaining agents.

Course Outcome 6(CO6)

1**.** Wet blue hides and skins and their assortment
2. Lining Leathers from different raw materials and tannages.
3. Chrome and Chrome retain upper leathers.

Syllabus

Module-I:

Finished leathers and composition of finishes, tanned leathers semi finished leathers wet blue-wet white properties, general practices in vegetable and chrome tanning.

Heavy Leathers: Vegetable tanned sole leathers, Bag tanning, different types of finished leathers, Belting leathers, Harness and saddlery leathers, Chrome and waxed soles, picking band leathers. Picker and apron leathers, Hydraulic and pneumatic leather such as hand pump leathers.

Module-II:

Leather for liquification plants for air, Oil seal, Gas, etc. Sports Goods leathers like Football. Rugby ball, Volley ball, Hockey ball, Cricket Ball etc. Gloves leathers for wicket keepers, Batting, Boxing etc.

Module-III:

Light Leather: Full chrome retan, hunting suedes, softies, nappa, and burnishable Upper leathers, Printed, Shrunken grain and upholstery leathers, aircraft automotive leather, crazy horse

Module-IV:

Water proof and water repellent upper leather, Nubuk and white leather. E.I. tanning, dressing of E.I. tanned leathers in to upper, lining, Bag leather, leather for leather goods kattas, bunwar etc. Wet white pickle free leather.

Module-V:

Different types of leathers using chrome splits, Formulation and different dyestuffs, fat liquors, retaining agents.

References and suggested readings:

1.Tuck, D.H., "The Manufacture of Upper Leathers".

2.arkar, K.T., "Theory and Practice of Leather Manufacture".

Course contents and lecture schedule

Module No.	**Topic**	**No. of Lectures**
1.	Heavy Leathers:	
1.1	Finished leathers and composition of finishes,	01
1.2	tanned leathers semi finished leathers wet blue-wet white properties	01
1.3	General practices in vegetable and chrome tanning.	01
1.4	Vegetable tanned sole leathers, Bag tanning,	01
1.5	Different types of finished leathers, Belting leathers, Harness and saddlery leathers	01
1.6	Chrome and waxed soles, picking band leathers	01
1.7	Picker and apron leathers,	01
1.8	Hydraulic and pneumatic leather such as hand pump leathers.	01
2.		
2.1	Leather for liquification plants for air, Oil seal, Gas, etc	02
2.2	Sports Goods leathers like Football. Rugby ball, Volley ball, Hockey ball, Cricket Ball etc.	03
2.3	Gloves leathers for wicket keepers, Batting, Boxing etc.	02
3.	**Light Leather**:	
3.1	Full chrome retan leathers	01
3.2	Hunting suedes leathers	01
3.3	Softies & nappa leathers	02
3.4	Burnishable Upper leathers	01

3.5	Printed & Shrunken grain leathers	02
3.6	Upholstery leathers, aircraft automotive leather, crazy horse	02
4.		
4.1	Water proof and water repellent upper leather,	01
4.2	Nubuk and white leather. E.I. tanning, dressing of E.I. tanned leathers in to upper	02
4.3	Lining leather.	02
4.4	Bag leather.	02
4.5	Leather for leather goods kattas, bunwar, Wet white pickle free leather.etc.	02
5.		
5.1	Different types of leathers using chrome splits,	02
5.2	Formulation and different dyestuffs.	02
5.3	Fat liquors.	02
5.4	Retainning agents.	01
	Total hours	**40**

TLT-359 PROCESSING OF LEATHER-I Lab

L	T	P	C
0	0	4	2

Laboratory Experiments

1. Manufacture of E.I. skins and rips manufacture of vegetable tanned sole leather by rapid tanning method.

2.Manufacture of Chrome and waxed sole leathers manufacture of waterproof sole leathers.

3. Processing of harness and saddlery leather.

4. Wet blue hides and skins and their assortment.

5. Full chrome and Chrome retain upper leathers.

6.Lining Leathers from different raw materials and tannages.

7.Shrunken grain leathers from different raw materials and tannages.

8.Book Binding leather from different raw materials and tannages.

9. Manufacture of aircraft automotive leather.

References and suggested readings:

1.Tuck, D.H., "The Manufacture of Upper Leathers".

2. Sarkar, K.T., "Theory and Practice of Leather Manufacture".

	Laboratory experiments	
1	Manufacture of E.I. skins and rips manufacture of vegetable tanned sole leather by rapid tanning method.	06
2	Processing of harness and saddlery leather.	06
3	Manufacture of Chrome and waxed sole leathers manufacture of waterproof sole leathers.	06
4	Wet blue hides and skins and their assortment.	06
5	Full chrome and Chrome retain upper leathers.	06
6	Lining Leathers from different raw materials and tannages.	06
7	Shrunken grain leathers from different raw materials and tannages.	06
8	Book Binding leather from different raw materials and tannages.	06
	Total hours	**48**

TLT 357: Inorganic Tannage

L	T	P	C
3	1	0	4

OBJECTIVE: The objective of this course is t**o** enable the students understand:

- Behaviour of group elements, chromium, Aluminium, Zirconium, Iron, Titanium, Difference between salts of these elements
- Mechanism of different tanning processes.
- Theory of neutralization processes & Principle and mechanism of Combination Tannage
- Tanning behaviour of group elements
- Basic concepts of Basicity, Masking, Olation, Polymerization & Oxolation.
- Principles of chemistry applied to transition elements

Course Outcome:

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

CO1	Understand behaviour of group elements	Understand
CO2	Understand Chromium complexes and their structures & mechanism of chrome tanning	Understand
CO3	Understand mechanism of tanning of Aluminium, Zirconium.	Understand
CO4	Understand mechanism of tanning of, Iron, Titanium.	Understand
CO5	Unders Principle and mechanism of semi-chrome, chrome retanned and other combination tannages.	Understand

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	_	_	_	_	_	_	_	_	_	_	_
CO2	3	_	_	_	_	_	_	_	_	_	_	_
CO3	3	2	_	_	_	_	_	_	_	_	_	_
CO4	2	2	_	1	_	_	2	_	_	_	_	_
CO5	1	_	2	_	_	_	2	_	2	_	_	1
Average	2.4	2	2	1	_	_	2	_	2	_	_	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) *If there is no correlation, put "-"*

Course Level Assessment Questions:

Course Outcome 1(CO1)

1. Werners co-ordination theory,
2. Behaviour of group elements,
3. Difference between salts.

Course Outcome 2(CO2)

1. Chromium complexes and their structures
2. Olation, oxolation, polymerisation of chrome complexes
3. Variable parameters of chrome tanning.

Course Outcome 3(CO3)

1. Aluminium Tanning
2. Zirconium Tanning
3. Masking principle of masking

Course Outcome 4(CO4)

1. Tanning behaviour of salts of Iron and Titanium .
2. Theory of neutralization processes.
3. Affect of neutralization.

Course Outcome 5(CO5)

1. Principle and mechanism of semi-chrome
2. Chrome retanning.
3. Other combination tannages.

SYLLABUS

Module- I :

Theory & behaviour of group elements:

Werners co-ordination theory, behaviour of group elements, chromium, Aluminium, Zirconium, Iron, Titanium, Difference between salts of these elements.

Module-II :

Chrome Tanning:

Chromium complexes and their structures, study on the phenomena of hydrolysis, olation, oxolation, polymerisation of chrome complexes, masking principle of masking, affect of masking on chrome tannage, Method of chrome tannage, preparation of chrome liquors and powders, influence of reducing agent on nature of chrome complexes mechanism of chrome tanning, variable parameters of chrome tanning.

Module-III :

Aluminium Tanning:

Tanning behaviour of salts of aluminium, study on phenomena of olation, oxolation and masking in aluminium salts, mechanism of aluminium tannage.

Zirconium Tanning:

Tanning behaviour of salts of Zirconium, factors affecting Zirconium Tannage, mechanism of zirconium tannage,

Module-IV:

Tanning behaviour of salts of Iron and Titanium, Tannages involving the use of Sodium silicate and poly phosphates. Metal free tanning, alternative tannage (Aldehyde, polyaldehyde tannage)

Neutralization: Theory of neutralization processes, affect of neutralization.

Module-V:

Combination Tannage:

Principle and mechanism of semi-chrome, chrome retanned and other combination tannages.

References and other readings:

1. Sarkar, K.T., "Theory and Practice of Leather Manufacture".

2. Dutta. S.S., "An Introduction to the Principles of Leather Manufacture".

Course contents and lecture schedule

Module No.	Topic	No. of Lectures
1.	**Theory & behaviour of group elements.**	
1.1	Werners co-ordination theory	02
1.2	Behaviour of group elements, chromium, Aluminium, Zirconium, Iron, Titanium	04
1.3	Difference between salts of these elements.	03
2.	**Chrome Tanning:**	
2.1	Chromium complexes and their structures	02
2.2	Study on the phenomena of hydrolysis, olation, oxolation, polymerisation of chrome complexes	02

2.3	Masking principle of masking, affect of masking on chrome tannage	01
2.4	Method of chrome tannage,	02
2.5	Preparation of chrome liquors and powders	02
2.6	Influence of reducing agent on nature of chrome complexes	01
2.7	Mechanism of chrome tanning	02
2.8	Variable parameters of chrome tanning.	02
3.	**Aluminium Tanning & Zirconium Tanning:**	
3.1	Tanning behaviour of salts of aluminium	01
3.2	Study on phenomena of olation, oxolation and masking in aluminium salts,	01
3.3	Tanning behaviour of salts of Zirconium	01
3.4	Factors affecting Zirconium Tannage	01
3.5	Mechanism of zirconium tannage,	01
4.	**Other Tanning & Neutralization:**	
4.1	Tanning behaviour of salts of Iron and Titanium	02
4.2	Tannages involving the use of Sodium silicate and poly phosphates. Metal free tanning, alternative tannage (Aldehyde, polyaldehyde tannage)	02
4.3	Theory of neutralization processes	02
4.4	Affect of neutralization	02
5.	**Combination Tannage:**	
5.1	Principle and mechanism of semi-chrome	02
5.2	Chrome retanned	02
5.3	Other combination tannages.	02
Total hours		**40**

TLT 351: MASS TRANSFER OPERATION

L	T	P	C
3	1	0	4

Assessment:

Sessional: 50 marks

End Semester: 50 marks

Course Objectives: The purpose of this course is to introduce the undergraduate students with the most important separation equipments in the process industry, and provide proper understanding of unit operations.

Course outcomes:

CO 1	Understand the principles of molecular diffusion and basic laws of mass transfer.	Understand,
CO 2	Ability to determine mass transfer rates using Fick's Law	Apply
CO 3	Estimate diffusion coefficients and apply to practical problems	Apply
CO 4	Ability to determine convective mass transfer rates	Apply
CO 5	Analyze the Similarity of mass, heat and momentum transfer – Analogy and understand the humidification processes and use of psychometric chart	Analyze

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSOs**	
CO1	3	2	2	1	-	-	-	-	-	1	1	1	**1**	**2**
CO2	3	2	1	1	-	-	-	-	-	1	1	1	2	1
CO3	3	2	3	2	3	-	-	-	-	1	1	1	1	2
CO4	3	3	2	2	3	-	-	-	-	1	1	1	1	2
CO5	3	3	3	3	2	-	-	-	-	1	1	1	3	2
Avg	3	2.4	2.2	1.8	1.6	-	-	-	-	1	1	1	1.6	1.8

Syllabus

Module I (8 hours)

Mass Transfer and Diffusion: Steady-state ordinary molecular diffusion: Fick's law of diffusion; Velocities in mass transfer, Equimolar counter diffusion; unimolecular diffusion, Diffusion coefficients: Diffusivity in gas mixtures, diffusivity in liquid mixtures, Diffusivity in solids, One-dimensional, steady-state, molecular diffusion through stationary media, Mass transfer in turbulent flow: Reynolds analogy; Chilton-Colburn analogy; Other analogies, Models for mass transfer at a fluid-fluid interface: Film theory; Penetration theory; surface-

renewal theory; film-penetration theory, Two-film theory and overall mass transfer coefficients. Introduction to absorption.

Module II (8 hours)

Distillation: Pressure-composition, Temperature-composition, Enthalpy-composition diagrams for ideal and non-ideal solutions; Raoult's law and its application; Maximum and minimum boiling mixtures; Concept of relative volatility; Single Stage Distillation-Differential distillation, Flash vaporization; Vacuum, molecular and steam distillations.

Module III (8 hours)

Liquid-Liquid Extraction: Applications; Ternary liquid-liquid equilibria; Triangular graphical representation; Equipment used for single stage and multistage continuous operation; Analytical and graphical solution of single and multistage operation.

Module IV (8 hours)

Solid-Liquid Extraction: Applications; Solid-liquid equilibrium; Equipment used in solidliquid extraction; Single and multistage crosscurrent contact and countercurrent operations; Overall stage efficiency; Determination of number of stages. Introduction to Humidification and drying.

Module V (8 hours)

Adsorption: Description of adsorption processes and their application, Types of adsorption, Nature of adsorbents; Adsorption isotherms and adsorption hysteresis; Stagewise and continuous contact adsorption operations, Determination of number of stages, Equipments; Ion exchange, Equilibrium relationship; Principle of ion-exchange, techniques and applications. Introduction to Crystallization theory.

BOOKS:

1. Treybal, R.E. "Mass Transfer Operations", 3rd ed. New York: McGraw-Hill, (1980).
2. Seader, J.D. and Henley, E.J., "Separation Process Principles", 2nd ed., Wiley India Pvt. Ltd., New Delhi (2013).
3. Sherwood, T. K., Pigford, R. L. and Wilke, C.R. "Mass Transfer" McGraw Hill (1975).
4. Geankoplis, C.J. "Transport Processes and Separation Process Principles", 4th ed., PHI Learning Private Limited, New Delhi (2012).

TLT 353: CHEMICAL REACTION ENGINEERING

L	T	P	C
3	1	0	4

Assessment:

Sessional: 50 marks
End Semester: 50 marks

Course Objective: To apply knowledge from calculus, differential equations, thermodynamics, general chemistry, and material and energy balances to solve reactor design problems, To examine reaction rate data to determine rate laws, and to use them to design chemical reactors, To simulate several types of reactors in order to choose the most appropriate reactor for a given need, To design chemical reactors with associated cooling/heating equipment.

Course Outcomes:

CO 1	Able to develop an understanding of the basic concepts involved in using reaction rate equations and kinetic constants	Understand, Apply
CO 2	Perform derivations of rate equations for non-elementary reactions both in homogenous and in heterogeneous reacting systems	Apply
CO 3	Able to understand the role of temperature and concentration in the rate equation	Understand
CO 4	Perform constant volume batch reactor calculations	Apply
CO 5	Develop calculations using the integral method and applying differential method of analysis using reactions with different orders	Understand, Apply

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	**PSO s**	
CO 1	3	2	3	-	-	-	-	-	-	1	-	1	**1**	**2**
CO 2	3	3	3	1	-	1	-	-	-	1	-	1	2	1
CO 3	3	3	3	2	-	2	-	-	-	1	-	1	1	2
CO 4	3	3	1	-	2	1	-	-	-	1	-	1	1	2
CO 5	3	3	2	2	2	1	-	-	2	1	-	3	3	2
Av g.	3	2.8	2.4	1	0.8	1	-	-	0.2	1	-	1.4	1.6	1. 8

Syllabus

Module I (8 hours)

Rate of Reaction, Elementary and non-elementary homogeneous reactions, Molecularity and order of reaction, Mechanism of reaction, temperature dependency from thermodynamics, collision and activated complex theories. Integral and differential methods for analyzing kinetic data, interpretation of constant volume reactor, zero, first, second and third order reactions, half life period, irreversible reaction in parallel and series, catalytic reaction, auto catalytic reaction, reversible reactions.

Module II (8 hours)

Interpretation of variable volume batch reactions for zero, first and second order reactions, Space-time and state-velocity, design equation for ideal batch, steady-state continuous stirred tank, steady-state plug flow reactors for isothermal reaction.

Module III (8 hours)

Design for single reactions, Size comparison of single reactors, Multiple reactor systems, plug flow/mixed flow reactors in series and parallel, reactors of different types in series, optimum reactor size, recycle reactor, autocatalytic reactions.

Module IV (8 hours)

Introduction to multiple reactions, qualitative discussion about product distribution, quantitative treatment of product distribution and of reactor size, selectivity, the side entry reactor, irreversible first-order reactions in series, Quantitative treatment: plug flow or batch reactor, Quantitative treatment: mixed flow reactor, Successive irreversible reactions of different orders, reversible reactions, irreversible series-parallel reactions, the Denbigh reactions and their special cases, Heat of reaction from thermodynamics, equilibrium constants from thermodynamics, General graphical design procedure for non-isothermal reactors, Optimum temperature progression, Heat effects: Adiabatic operations and non-adiabatic operations, Exothermic reactions in mixed flow reactors.

Module V (8 hours)

Residence time distribution of fluids in vessels, State of aggregation of the flowing systems, Earliness of mixing, Role of RTD, State of Aggregation and earliness of mixing in determining reactor behavior, E, F and C curves, Conversion in Non-ideal flow reactors.

Reference Books:

Levenspiel, O., “Chemical Reaction Engineering”, 3rd edition, John Wiley (1998).

HHS 351/352 ENTREPRENEURSHIP DEVELOPMENT

L	T	P	C
3	0	0	3

Sessional Marks: 50
End Semester Exam: 50

Course Outcome (COs)

At the end of this course students should be able to:

CO 1	Describe what it takes an Entrepreneur; describe multiple ways to become an entrepreneur; including, intrapreneur, and manager, woman entrepreneur rural & urban: highlights motives to become entrepreneur	Understand
CO2	Apply the beginner concept, ownership and various forms with focus on small scale enterprises	Understand, Analyse, Apply
CO3	Identify opportunities using identification; project conceptualisation, formulation & evaluation	Analyse, Apply, Evaluate
CO4	Identify potential contribution of human resources, marketing, financial and strategic management with fund, opportunities	Analyse, Create
CO5	Decipher the role of Institution support and policy framework of Government for enterprises in India	Analyse, Apply

CO-PO Matrix

Course	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSOs	
HHS 341/342	**CO1**	0	0	0	0	0	1	1	1	0	0	3	2	**2**	**2**
	CO2	0	0	1	0	0	1	1	1	1	0	3	2	2	2
	CO3	1	2	2	1	2	1	1	1	1	0	3	1	2	1
	CO4	0	0	1	0	1	1	1	2	1	1	3	2	2	2
	CO5	1	1	1	0	0	1	1	1	0	1	2	2	2	1
average		0.4	0.6	1	0.2	0.6	1	1	1.2	0.6	0.4	2.8	1.8	2	1.6

Syllabus

UNIT I Entrepreneurship:
Definition, requirements to be an entrepreneur, entrepreneur and intrapreneur, entrepreneur and manager, growth of entrepreneurship in India, women entrepreneurship, rural and urban entrepreneurship.

Entrepreneurial Motivation: motivating factors, motivation theories-Maslow's Need Hierarchy Theory, McClelland's Acquired Need Theory, government's policy actions towards entrepreneurial motivation, entrepreneurship development programmes.

UNIT II Business Enterprises and Ownership Structure:
Small scale, medium scale and large scale enterprises, role of small enterprises in economic development; proprietorship, partnership, companies and co-operatives firms: their formation, capital structure and source of finance.

UNIT III Project Management:
Identification and selection of projects; project report: contents and formulation, concept of project evaluation, methods of project evaluation: internal rate of return method and net present value method.

UNIT IV Management of Enterprises:
Strategy & policy, introduction to human resource management, marketing strategies, financial management & strategies: raising and managing capital, shares, debentures and bonds, cost of capital; break- even analysis.

UNIT V Institutional Support and Policies:
Institutional support towards the development of entrepreneurship in India: Institutional framework, venture capitalist; technical consultancy organizations (TCOs), government policies for small scale enterprises.

References:

1. **Khanka, S S**. 'Entrepreneurial Development', S Chand & Company Ltd. New Delhi
2. **Desai, Vasant**, 'Project Management and Entrepreneurship', Himalayan Publishing House, Mumbai, 2002.

Additional Reference Books

1. **Gupta and Srinivasan**, 'Entrepreneurial Development', S Chand & Sons, New Delhi.
2. **Ram Chandran**, 'Entrepreneurial Development', Tata McGraw Hill, New Delhi
3. **Saini, J. S**. 'Entrepreneurial Development Programmes and Practices', Deep & Deep Publications (P), Ltd
4. **Holt, Davis, '**Entrepreneurship : New Venture Creations, PHI

SEMESTER- 6

TLT-354: PROCESSING OF LEATHER-II

L	T	P	C
2	0	2	3

OBJECTIVE:	The objective of this course is to enable the students understand • Manufacturing of Different types of goat upper leather. • Manufacturing of Different types of goat dressing leather. • Manufacturing of Different types of sheep leather. • Manufacturing of Different types of fur leather. • Up gradation of leather. • Processing of light leather & fashionable leather

Course Outcome

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

CO1	Understand the Manufacturing of Different types of goat upper leather.	Understand
CO2	Understand the Manufacturing of Different types of goat dressing leather	Understand
CO3	Understand Manufacturing of Different types of sheep leather	Understand
CO4	Understand the processing of hair on tanning.	Understand
CO5	Up gradation of leather by different finishing technique.	Understand
CO6	Apply knowledge of processing of leather.	Apply

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3											
CO2	3	2	2									
CO3	3	2	2									
CO4	3	2										
CO5	3	2	2			1		1				
CO6	3	2	3	2		2	1		2			1
Average	3	2	2.2	2		1.5	1	1	2			1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) *If there is no correlation, put "-"*

Course Level Assessment Questions

Course Outcome 1(CO1)

1. Glazed kid.
2. Glazed uppers, shoe suede.
3. Garment suede, Lining leathers

Course Outcome 2(CO2)

1. Chamois leathers
2. Printed leathers
3. Dressing into different types of leathers

Course Outcome 3(CO3)

1. Vegetable tanning and chrome tanning of sheep skins
2. Conversion into different types of finished leathers-sheep nappa garment.
3. Lining leathers, glove leathers.

Course Outcome 4(CO4)

1. Reptile leathers
2. hair on tanning
3. Dressing of fur skins

Course Outcome 5(CO5)

1. Special finishing effects for up gradation of leather.
2. Embossing, screen printing block printing.
3. Roller coating and other modern equipments.

Course Outcome 6(CO6)

1. Preparation of Different types of leathers using wet Blue Cow and Buffalo hides, calf skins.
2. Preparation of Different types of leathers using wet Blue of Goat and Sheep skins.
3. Application of Different types of leathers.

SYLLABUS

Module-I : Goat skins:

Glazed kid, resin uppers, glazed uppers, shoe suede, garment suede, Lining leathers.

Module-II :

Chamois leathers, printed leathers, morocco and book binding leathers, E.I. Goat skins and their dressing into different types of leathers.

Module-III : Sheep Skins:

Vegetable tanning and chrome tanning of sheep skins, conversion into different types of finished leathers-sheep nappa, garment, suede, uppers. Lining leathers, glove leathers, diaphragm leathers.

Module-IV : Exotics and others:

Reptile leathers, hair on tanning and dressing of fur skins.

Module-V : Upgrading of leathers:

Retanning special finishing effects for up gradation of lower ends like Embossing, screen printing block printing, transfer film finishing, seal and Sink finish, popcorn effect, punching etc. Roller coating and other modern equipment's, Burnishable and oil pull up leathers. laminated leather and synthetic leather.

Module-VI : Laboratory experiments

Different types of leathers using Raw / wet Blue/ E.I. of Cow and Buffalo hides, calf skins. Different types of leathers using Raw / wet Blue of Goat and Sheep skins. Vegetable tanned sole leather, Chrome tanned sole leather, Belting leather, Cycle saddle leathers, Picking band leathers, Picker, Apron leather, Football leather, Cricket ball leathers, Volley ball leathers, Upholstery leathers, E.I. Kips , Upper leathers from different raw materials and tannages.

References :

1. Dey, J.M. Practical Aspects of the manufacture of upper leathers.
2.Tuck, D.H. "The Manufacture of upper leathers".
3. CLRI Publication.
4. Dutta. S.S., "An Introduction to the Principles of Leather Manufacture".
5. Sarkar K.T., "Theory & Practice of Leather Manufacture".

Course Content and lecture Schedule

Module No.	Topic	No. of Lectures
1	**Goat skins:**	
1.1	Process for manufacturing of Glazed kid leather.	01
1.2	Process for manufacturing of resin uppers leather.	01
1.3	Process for manufacturing of glazed uppers leather.	01
1.4	Process for manufacturing of shoe suede leather.	01
1.5	Process for manufacturing of garment suede leather.	01
1.6	Process for manufacturing of Lining leathers.	01
2		
2.1	Process for manufacturing of Chamois leathers.	02
2.2	Process for manufacturing of printed leathers.	01
2.3	Process for manufacturing of Morocco and book binding leathers	01
2.4	Process for manufacturing of E.I. Goat skins and their dressing into different types of leathers.	01
3	**Sheep Skins:**	

3.1	Vegetable tanning and chrome tanning of sheep skins conversion into different types of finished leathers.	02
3.2	Process for manufacturing of sheep nappa, garment.	02
3.3	Process for manufacturing of suede uppers.	01
3.4	Process for manufacturing of Lining leathers.	01
3.5	Process for manufacturing of glove leathers.	01
3.6	Process for manufacturing of diaphragm leathers.	01
3.7	Process for manufacturing of garment suede.	01
4	**Exotics and others:**	
4.1	Reptile leathers	02
4.2	hair on tanning	02
4.3	dressing of fur skins.	02
5	**Upgrading of leathers:**	
5.1	Retanning special finishing effects for up gradation of lower ends like Embossing.	01
5.2	Special finishing effects for up gradation of lower ends like screen printing	01
5.3	Special finishing effects for up gradation of lower ends like block printing,	01
5.4	Special finishing effects for up gradation of lower ends like transfer film finishing,	01
5.5	Special finishing effects for up gradation of lower ends like seal and Sink finish.	01
5.6	Special finishing effects for up gradation of lower ends like popcorn effect, punching etc.	01
5.7	Roller coating and other modern equipment's.	02
5.8	Burnishable and oil pull up leathers, laminated leather and synthetic leather.	02
	Total hours	**30**
6	**Laboratory experiments**	
6.1	Preparation of Different types of leathers using Raw / wet Blue/ E.I. of Cow and Buffalo hides, calf skins.	9
6.2	Preparation of Different types of leathers using Raw / wet Blue of Goat and Sheep skins.	9
6.3	vegetable tanned sole leather	3
6.4	Chrome tanned sole leather	3
6.5	Belting leather	3
6.6	Cycle saddle leathers	3
6.7	Picking band leathers & Picker	3
6.8	Apron leather	3
6.9	Foot ball leather, Cricket ball leathers & Volley ball leathers	3
6.10	Upholstery leathers	3

6.11	E.I. Kips , Upper leathers from different raw materials and tannages.	3
	Total hours	**45**
	Grand hours	**75**

TLT-356: ORGANIC TANNAGES

L	T	P	C
2	1	0	3

Course Outcome

OBJECTIVE: The objective of this course is t**o** enable the students understand

- Concept of tanning.
- Hydrolysable & Condensed tannins.
- Synthetic tannins.
- Resin and Polymeric Tannages.
- Aldehyde tannage.
- The principles and process of vegetable tannage & synthetic tanningin leather processing.

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

CO1	Understand the classification & properties of tannins.	Understand
CO2	Understand the concept of Hydrolysable & Condensed tannins.	Understand
CO3	Understand the mechanism of tanning with syntans.	Understand
CO4	Understand the vegetable tanning & synthetic tannins.	Understand
CO5	Understand the Different aldehydes used for tanning	Understand

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	1	3	1	1		1					
CO2	3	1	3	1	1		1					
CO3	3	1	3	2	2		2					
CO4	3	1	3	1	1		3					
CO5	3	1	3	2	2		2	1				
Average	3	1	3	1.4	1.4		1.8	1				

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) *If there is no correlation, put "-"*

Course Level Assessment Questions

Course Outcome 1(CO1)

1. Process of vegetable tanning
2. Properties and use of different types of syntans in leather manufacture

3. General chemistry of syntans.

Course Outcome 2(CO2)

1. Hydrolysable tannins.
2. Condensed tannins.
3. Biosynthesis of plant polyphenols.

Course Outcome 3(CO3)

1. Mechanism of vegetable tanning.
2. General chemistry of syntans.
3. Properties and use of different types of syntans.

Course Outcome 4(CO4)

1. Study different methylol compounds of nitrogen basis.
2. Properties of oil tanned leather.
3. Synthetic oil tannge.

Course Outcome 5(CO5)

1. Different aldehydes used for tanning.
2. Mechanism of tanning with formaldehyde glutaraldehyde.
3. Properties of leather tanned with different aldehydes.

SYLLABUS

Module-I :

Collagen Tanning: Concept of tanning, leather properties of dependent on tanning.

Vegetable tannins: classification of vegetable tannins, physico-chemical properties of vegetable tannin, vegetable tanning materials and their properties, leaching of vegetable tanning and general methods of tannin extract preparation.

Module-II :

Hydrolysable tannins: chemistry of poly phenolic tannins present in major hydrolysable tanning material methods of separation of poly phenolic substance from tanning extracts, structure of galotannins an ellagitannins.

Condensed tannins: Chemistry of flavonoid tannins present in major condensed tanning materials, methods of separation of monomeric flavonoid compounds from tanning extracts, structure of leucoanthocynaidin catchins and polymeric flavonoid tannins.

Biosynthesis of plant polyphenols: path ways for biosynthesis of gallotannins and ellagitannins in plant biosynthesis of flavonoids and condensed tannins.

Module-III :

Vegetable tanning: Mechanism of vegetable tanning, factors affecting vegetable tannage, process of vegetable tanning.

Synthetic tannins: General chemistry of syntans; their classification, general methods of manufacture properties and use of different types of syntans in leather manufacture, mechanism of tanning with syntans.

Module-IV :

Resin and Polymeric Tannages: study different methylol compounds of nitrogen basis and polymeric compounds used in leather manufacture.

Module-V :

Aldehyde tannages: Different aldehydes used for tanning, mechanism of tanning with formaldehyde glutaraldehyde and starch dialdehydes, factors involved in tannages, properties of leather tanned with different aldehydes.

Reference Book

1. Sarkar, K.T., "Theory and Practice of Leather Manufacture".
2. Dutta. S.S., "An Introduction to the Principles of Leather Manufacture"
3. Wilson, J. A., "The chemistry of Leather Manufactures" Vol. II
4. Gustavson, K. H., " The Chemistry of Tanning Process"
5. Flaherty, Roddy, Lollar, "The Chemistry and Technology of Leather" Vol. II

Course content and lecture Schedule

Module No.	Topic	No. of Lectures
1	**Collagen Tanning & Vegetable Tannins:**	
1.1	Concept of tanning, leather properties of dependent on tanning.	01
1.2	classification of vegetable tannins	01
1.3	classification of vegetable tannins	01
1.4	tanning materials and their properties	01
1.5	leaching of vegetable tanning and general methods of tannin extract preparation.	01
2	**Hydrolysable tannins** , **Condensed tannins** & **Biosynthesis of plant polyphenols**:	
2.1	chemistry of poly phenolic tannins present in major hydrolysable tanning material methods of separation of poly phenolic substance from tanning extracts	03
2.2	structure of galotannins an ellagitannins.	01
2.3	Chemistry of flavonoid tannins present in major condensed tanning materials, methods of separation of monomeric flavonoid compounds from tanning extracts	02
2.4	structure of galotannins an ellagitannins.	01
2.5	path ways for biosynthesis of gallotannins and ellagitannins in plant biosynthesis of flavonoids and condensed tannins	02
3	**Vegetable tanning & Synthetic tannins**:	
3.1	Mechanism of vegetable tanning, factors affecting vegetable tannage, process of vegetable tanning.	02

3.2	General chemistry of syntans; their classification, general methods of manufacture properties and use of different types of syntans in leather manufacture, mechanism of tanning with syntans.	03
4	**Resin and Polymeric Tannages** & **Oil Tanning**:	
4.1	study different methylol compounds of nitrogen basis and polymeric compounds used in leather manufacture	02
4.2	Methods of oil tannage, properties of oil tanned leather, mechanism of oil tannage, factor involved in oil tannage, synthetic oil tannge	02
5	**Aldehyde tannage**:	
5.1	Different aldehydes used for tanning	02
5.2	Mechanism of tanning with formaldehyde glutaraldehyde and starch dialdehydes	02
5.3	Factors involved in tannages	02
5.4	Properties of leather tanned with different aldehydes.	01
	Total hours	**30**

TLT-358: LEATHER ANALYSIS AND QUALITY CONTROL

L	T	P	C
3	0	2	4

OBJECTIVE: The objective of this course is t**o** enable the students understand

- Principles and methods of analysis of limed and pickled pelt
- chemical testing of vegetable tanned/chrome tanned
- Physical Testing of Leather
- Quality control in leather processing
- Instrument Analysis.

Course Outcome

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

CO1	Understand the Chemical analysis of pelts and Leathers	Understand
CO2	Understand the Physical Testing of Leather	Understand
CO3	Principle involved in Static and Dynamic methods of non destructive testing of leathers	Understand
CO4	Understand the Standards and quality Control	Understand
CO5	Understand the Instrument Analysis	Understand
CO6	Analysis of chrome tanning agents & Physical testing of heavy and light leather.	Apply

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO 8	PO9	PO10	PO11	PO12
CO1	3	_	_	_	_	_	_	_	_	_	_	_
CO2	3	2	2	_	_	_	_	_	_	_	_	_
CO3	3	2	2	_	_	_	_	_	_	_	_	_
CO4	3	2	_	_	_	_	_	_	_	_	_	_
CO5	3	2	2	_	_	1	_	1	_	_	_	_
CO6	3	2	3	2	_	2	1		2	_	_	1
Average	3	2	2.2	2	_	1.5	1	1	2	_	_	_

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) *If there is no correlation, put "-*

Course Level Assessment Questions

Course Outcome 1(CO1)

1**.** Principles and methods of analysis of limed and pickled pelt,

2. Chemical testing of vegetable tanned, chrome tanned etc.

3. Chemical testing of combination tanned leathers.

Course Outcome 2(CO2)

1. Sampling position.
2. Physical testing of leather.
3. Different methods employ for physical testing of leather

Course Outcome 3(CO3)

1. Principle involved in Static methods of non destructive testing of leathers.
2. Principle involved in Dynamic methods of non destructive testing of leathers.
3. Different methods in testing of color fastness of leathers.

Course Outcome 4(CO4)

1**.** Quality control in leather processing

2. Rectification of defects in hides, Skin and Leathers

3. Physical and chemical characteristics of various types of leathers.

Course Outcome 5(CO5)

1**.** Potentiometry.

2. Non-aqueous titrations.

3. Spectrophotometry and colorimertry.

Course Outcome 6(CO6)

1**.** Testing of chrome tanning agents.

2 Chemical analysis of vegetable tanned/chrome tanned

3. Physical testing of heavy and light leather

SYLLABUS

Module-I:

Chemical analysis of pelts and Leathers: Principles and methods of analysis of limed and pickled pelt, chemical testing of vegetable tanned/chrome tanned/aluminum tanned/zirconium tanned/ formaldehyde tanned, combination tanned leathers.

Module-II

Physical Testing of Leather: Sampling position for physical testing of leather. Different methods employ for physical testing of leather.

Module-III:

Principle involved in Static and Dynamic methods of nondestructive testing of leathers. Different methods in testing of color fastness of leathers. Standards for metal free leather (ISO), Fire retardancy, Reach standards for leather, top coat soil resistance.

Module-IV:

Standards and quality Control: Quality control in leather processing, Rectification of defects in hides, Skin and Leathers, control of yield, color and finish of leather etc. Physical and chemical characteristics (standard specifications) of various types of leathers.

Module-V:

Instrument Analysis: Potentiometry, non-aqueous titrations, conductometry chromatography, spectrophotometry and colorimertry, ion-exchange resins, electrophoresis. Principles and their application analysis.

Module-VI:

Laboratory Experiments

Analysis of chrome tanning agents- Moisture, Cr2O3 content, basicity, Degree of olation. Analysis of Alum tanning agents. Analysis of formaldehyde. Chemical analysis of vegetable tanned/chrome tanned/combination tanned leathers. Physical testing of heavy and light leather, Spectrophotometry, chromatography and electrophoresis.

References and suggested readings:

1. Mahadevan, T. S. K., "A Practical Guide for Chemical Analysis and Physical Testing of Leather".
2. Sarkar, P. K., "Analysis of Materials of Leather Manufactures"
3. "I.S. Standards for Chemical Testing**.**

Course contents and lecture schedule

Module No.	Topic	No. of lectures
1.	**The role of leather auxiliaries in up gradation of leather**	
1.1	The roll of leather auxiliaries in up gradation of leather	02
1.2	an overview of Indian leather auxiliaries industry development,	01
1.3	Important aspects of auxiliaries production such as plant and equipment design.	01
1.4	Unit operations and unit process & Instrumentation.	02
1.5	quality control	01
2.	**Fatliquaring agents & Dyes:**	
2.1	Fatliquaring agents	01
2.2	Vegetable tanning agents and systems manufacturers unit processes involved, evaluation and quality control. Fatliquoring Chemicals	02
2.3	Oils, and Fats-extration, fatliquor preparations.	02
2.4	Sulphation, Sulphonation, Sulphitation synthetic fatliquors-quality control.	02
2.5	Chemistry and technology of Dyes.	01
2.6	acid, basic, direct, premetalised dyes etc.	02
2.7	Reactive and solvent dyes.	02
3.	**Pigments:**	

3.1	Chemistry and technology of organic and inorganic pigments,	02
3.2	Products mixture and machinery requirements for pigment dispersions with or without binders for leather finishing,	02
3.3	Factors controlling brilliancy, transparency, opacity, solvent, thermal and light resistances	02
3.5	Evaluation and quality control.	01
3.6	Standards for metal free leather (ISO), Fire retardancy, Reach standards for leather, top coat soil resistance.	02
4.	**Binders:**	
4.1	Protein and resin binders	02
4.2	preparation and properties of various types of binders with special reference of their resistance to water, Solvent, rubbing, cold track, oxidation etc.	04
4.3	Evaluation and quality control	01
5.	**Lacquers**:	
5.1	Lacquers emulsions and Thinners	02
5.2	Production of lacquers from various source-Nitrocellulose, PVC, Cellulose acctate butyrate, PU Etc.,	02
5.3	Thinner formation, lacquer emulsions,.	02
5.4	quality control	01
6.1	Analysis of chrome tanning agents- Moisture	04
6.2	Analysis of Cr2O3 content	04
6.3	Analysis of basicity, Degree of olation.	04
6.4	Analysis of Alum tanning agents.Analysis of formaldehyde.Chemical	04
6.5	analysis of vegetable tanned/chrome tanned/combination tanned leathers.	04
6.6	Physical testing of heavy and light leather	04
6.7	Spectrophotometery, chromatography and electrophoresis	04
	Total hours	**70**

TLT-360: POST TANNING AND FINISHING OPERATION

L	T	P	C
2	1	0	3

Course Outcome

OBJECTIVE: The objective of this course is t**o** enable the students understand:

- Chemistry of Bleaching and Mordanting agent
- Theory of Oil, Fat and Fat liquoring.
- Principle of Water Proofing.
- Properties and chemistry of Finishing Materials.
- Properties, Chemistry and methods of preparation of the following finishing materials
- Once the wet blue is ready how to further process it to process to finished leather and its underlying Techniques.

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

CO1	Understand Chemistry of Bleaching and Mordanting agent & dyeing	Understand
CO2	Understand Theory & mechanism of Oil, Fat and Fat liquoring.	Understand
CO3	Understand Principle of Water Proofing & film formation.	Understand
CO4	Understand Properties and chemistry of Finishing Materials.	Understand
CO5	Understand Properties, Chemistry and methods of preparation of the following finishing materials	Understand

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO 6**	**PO 7**	**PO 8**	**PO9**	**PO10**	**PO1 1**	**P O1 2**
CO1	3	_	_	_	_	_	_	_	_	_	_	_
CO2	3	_	_	_	_	_	_	_	_	_	_	_
CO3	3	2	_	_	_	_	_	_	_	_	_	_
CO4	2	2	_	1	_	_	2	_	_	_	_	_
CO5	1	_	2	_	_	_	2	_	2	_	_	1
Average	2.4	2	2	1	_	_	2	_	2	_	_	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) *If there is nocorrelation, put "-"*

Course Level Assessment Question

Course Outcome 1(CO1)

1. Classification of leather dyes

2. Theory and mechanism of dyeing
3. Dyeing methods

Course Outcome 2(CO2)

1. Types and properties of oils and fats applied in Leather.
2. Principal and methods of sulphation, sulphonation and sulphitation of oils.
3. Chemistry and Preparation of Synthetic fatliquors.

Course Outcome 3(CO3)

1. Classification and types of leather finishes
2. Theory of film formation
3. Methods of application finishes

Course Outcome 4(CO4)

1. Aqueous pigment pastes
2. Synthetic polymer dispersions
3. Binders.

Course Outcome 5(CO5)

1. Nitrocellulose lacquers
2. Wax emulsions,
3. Silicone emulsions.

SYLLABUS

Module-I

Chemistry of Bleaching and Mordanting agent: Dyeing: Principles of colour chemistry, Classification of leather dyes, Blending of dyes, Principles of cilour matching, Theory and mechanism of dyeing, Dyeing methods, Light fastness of dyeing, Dyeing auxiliaries such as leveling agents, wetting agents, Dispersing agents and Dye fixatives.

Module-II:

Oil, Fat and Fat liquoring: Theory of emulsions, Types and properties of oils and fats applied in Leather, Types of fatliquor, Principal and methods of sulphation, sulphonation and sulphitation of oils, Chemistry and Preparation of Synthetic fatliquors, Fatliquoring methods, Mechanism of fatliquoring

Module-III:

Water Proofing: Classification and types of leather finishes, Cohesion and Adhesion, Theory of film formation, Methods of application finishes, Other mechanical operation involved in finishing

Module-IV:

Finishing Materials: Properties, Chemistry and methods of preparation of the following finishing materials: Aqueous pigment pastes, Synthetic polymer dispersions, binders.

Module-V

Properties, Chemistry and methods of preparation of the following finishing materials: Nitrocellulose lacquers and lacquer emulsions, Wax emulsions, silicone emulsions.

References and suggested readings

1. Dutta. S.S., "An Introduction to the Principles of Leather Manufacture".
2. Sarkar K.T., "Theory & Practice of Leather Manufacture".
3. Flaherty, Roddy, Lollar, “The Chemistry and Technology of Leather” Vol. III
4. Heidemann, “Fundamentals of Leather Manufacture”.
5. Sharp house, J.H., “Leather Technician's Handbook”.
6. Reed. R., “Science for student of leather technology”.

Course contents and lecture schedule

Module No.	Topic	No. of Lectures
1.	**Chemistry of Bleaching and Mordanting agent:**	
1.1	Dyeing: Principles of colour chemistry,	02
1.2	Classification of leather dyes,	02
1.3	Blending of dyes, Principles of cilour matching,	01
1.4	Theory and mechanism of dyeing,	02
1.5	Dyeing methods,	02
1.6	Light fastness of dyeing,	01
1.7	Dyeing auxiliaries such as leveling agents, wetting agents, Dispersing agents and Dye fixatives.	02
2.	**Oil, Fat and Fat liquoring:**	
2.1	Theory of emulsions,	01
2.2	Types and properties of oils and fats applied in Leather, Types of fatliquor,	02
2.3	Principal and methods of sulphation, sulphonation and sulphitation of oils,	02
2.4	Chemistry and Preparation of Synthetic fatliquors, Fatliquoring methods,	02
2.5	Mechanism of fatliquoring	01
3.	**Water Proofing:**	
3.1	Classification and types of leather finishes,	02
3.2	Cohesion and Adhesion,.	01
3.3	Theory of film formation,	01
3.4	Methods of application finishes,	01
3.5	Other mechanical operation involved in finishing	01
4.	**Finishing Materials:**	
4.1	Properties, Chemistry and methods of preparation of Aqueous pigment pastes,	02
4.2	Properties, Chemistry and methods of preparation of Synthetic polymer dispersions.	02

4.3	Properties, Chemistry and methods of preparation of binders.	02
5.	**Properties, Chemistry and methods of preparation of finishing materials:**	
5.1	Properties, Chemistry and methods of preparation of Nitrocellulose lacquers	02
5.2	Properties, Chemistry and methods of preparation of lacquer emulsions,.	01
5.3	Properties, Chemistry and methods of preparation of Wax emulsions,	01
5.4	Properties, Chemistry and methods of preparation of silicone emulsions	01
	Total hours	**40**

TLT 362: LEATHER AUXIALARIES TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVE: The objective of this course is t**o** enable the students understand

- The role of leather auxiliaries in up gradation of leather.
- To analyze of tanning agents & evaluation and quality control
- To know Chemistry and technology of organic and inorganic pigments
- To understand the preparation and properties of various types of binders.
- Lacquers emulsions and Thinners
- Use and application of auxiliaries & how it help in leather processing manufacturing

Course Outcome

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

CO1	Understand the role of leather auxiliaries in up gradation of leather.	Understand
CO2	To analyze of tanning agents & evaluation and quality control	Understand
CO3	Understand the Chemistry and technology of organic and inorganic pigments	Understand
CO4	Understand the preparation and properties of various types of binders	Understand
CO5	Production of lacquers from various source-Nitrocellulose	Understand

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO 6**	**PO 7**	**PO 8**	**PO9**	**PO10**	**PO1 1**	**P O1 2**
CO1	3	_	_	_	_	_	_	_	_	_	_	_
CO2	3	_	_	_	_	_	_	_	_	_	_	_
CO3	3	2	_	_	_	_	_	_	_	_	_	_
CO4	2	2	_	1	_	_	2	_	_	_	_	_
CO5	1	_	2	_	_	_	2	_	2	_	_	1
Average	2.4	2	2	1	_	_	2	_	2	_	_	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) *If there is nocorrelation, put "-"*

Course Level Assessment Question

Course Outcome 1(CO1)

1. An overview of Indian leather auxiliaries industry development
2. Important aspects of auxiliaries production
3. Instrumentation and quality control**.**

Course Outcome 2(CO2)

1. Fatliquoring Chemicals
2. Sulphation, Sulphonation, Sulphitation.
3. Chemistry and technology of dyes.

Course Outcome 3(CO3)

1. Chemistry and technology of organic and inorganic pigments.
2. Factors controlling brilliancy, transparency, opacity, solvent, thermal and light resistances
3. Evaluation and quality control.

Course Outcome 4(CO4)

1. preparation and properties of various types of binders.
2. Protein and resin binders.
3. Evaluation and quality control

Course Outcome 5(CO5)

1. Lacquers emulsions and Thinners.
2. Nitrocellulose, PVC,Cellulose acctate butyrate & PU.
3. Thinner formation**.**

Syllabus:

Module-I The role of leather auxiliaries in up gradation of leather, an overview of Indian leather auxiliaries industry development, important aspects of auxiliaries production such as plant and equipment design, unit operations and unit process, Instrumentation and quality control.

Module- II

Fatliquaring agents: Vegetable tanning agents and systems manufacturers unit processes involved, evaluation and quality control. Fatliquoring Chemicals, Oils, and Fats-extration, fatliquor preparations, Sulphation, Sulphonation, Sulphitation synthetic fatliquors-quality control, Dyes: Chemistry and technology of acid, basic, direct, premetalised, Reactive and solvent dyes.

Module-III

Pigments: Chemistry and technology of organic and inorganic pigments, Products mixture and machinery requirements for pigment dispersions with or without binders for leather finishing,

Factors controlling brilliancy, transparency, opacity, solvent, thermal and light resistances, Evaluation and quality control.

Module-IV

Binders: Protein and resin binders- preparation and properties of various types of binders with special reference of their resistance to water, Solvent, rubbing, cold track, oxidation etc. Evaluation and quality control.

Module-V

Lacquers: Lacquers emulsions and Thinners-Production of lacquers from various source-Nitrocellulose, PVC, Cellulose acctate butyrate, PU Etc., Thinner formation, lacquer emulsions, quality control.Global policies and regulations. Social and environmental challenges of Leather waste in India. Leather and environment. Salient features of the Leather waste management (PWM) rules. Waste treatment of various Leather plants, estimation of power requirement and efficiency of size reduction operation of Leathers

References :

1. Flaherty, Roddy, Lollar, “The Chemistry and Technology of Leather” Vol. III
2. Dutta. S.S., "An Introduction to the Principles of Leather Manufacture".

Course contents and lecture schedule

Module No.	Topic	No. of lectures
1.	**The role of leather auxiliaries in up gradation of leather**	
1.1	The roll of leather auxiliaries in up gradation of leather	02
1.2	an overview of Indian leather auxiliaries industry development,	01
1.3	Important aspects of auxiliaries production such as plant and equipment design.	01
1.4	Unit operations and unit process & Instrumentation.	02
1.5	quality control	01
2.	**Fatliquaring agents & Dyes:**	
2.1	Fatliquaring agents	01
2.2	Vegetable tanning agents and systems manufacturers unit processes involved, evaluation and quality control. Fatliquoring Chemicals	02
2.3	Oils, and Fats-extration, fatliquor preparations.	02
2.4	Sulphation, Sulphonation, Sulphitation synthetic fatliquors-quality control.	02
2.5	Chemistry and technology of Dyes.	01
2.6	acid, basic, direct, premetalised dyes etc.	02
2.7	Reactive and solvent dyes.	02
3.	**Pigments:**	
3.1	Chemistry and technology of organic and inorganic pigments,	02

3.2	Products mixture and machinery requirements for pigment dispersions with or without binders for leather finishing,	02
3.3	Factors controlling brilliancy, transparency, opacity, solvent, thermal and light resistances	02
3.5	Evaluation and quality control.	01
4.	**Binders:**	
4.1	Protein and resin binders	02
4.2	preparation and properties of various types of binders with special reference of their resistance to water, Solvent, rubbing, cold track, oxidation etc.	04
4.3	Evaluation and quality control	01
5.	**Lacquers**:	
5.1	Lacquers emulsions and Thinners	02
5.2	Production of lacquers from various source-Nitrocellulose, PVC, Cellulose acctate butyrate, PU Etc.,	02
5.3	Thinner formation, lacquer emulsions,.	02
5.4	quality control	01
	Total hours	**40**

TLT 352 INSTRUMENTATION & PROCESS CONTROL

L	T	P	C
2	1	0	3

Assessment:

Sessional: 50 marks

End Semester: 50 marks

Course Objectives:

To gain the knowledge of different process instruments and various control processes for closed loop and open loop systems.

Course outcomes:

CO1	Understand and interpret control diagrams	Understand
CO2	.Design and tuning of controllers for specific applications	Apply
CO3	Calculate the dynamic response of closed loop systems	Analyze
CO4	Understand the principles involved in measurements, Attain knowledge on different measurement methods employed in industrial processing and manufacturing.	Understand
CO5	Understand and Analyze the different temperature measurement devices in Chemical industries.	Understand and Analyze

	PO 1	PO2	PO3	PO 4	PO5	PO 6	PO 7	PO8	PO 9	PO10	PO 11	PO1 2	PSO 1	PSO 2
CO 1	3	3	2	2	1	-	-	-	-	1	1	2	**2**	**2**
CO 2	3	3	3	2	3	-	-	-	-	1	1	2	2	2
CO 3	3	3	3	3	3	-	-	-	-	-	-	2	2	2
CO 4	3	1	1	-	-	-	-	-	-	1	1	2	2	2
CO 5	3	2	1	2	2	-	-	-	-	-	-	2	2	2
CO 6	3	3	3	2	2	-	-	-	3	2	1	2	2	2
Avg	3	2.5	2.16	1.83	1.83	-	-	-	0.5	0.83	0.66	2	**3**	**2**

Module 1 (8 hours)

Introduction to Process control systems, Use of Laplace & Inverse Laplace Transformation in study of Process Dynamics & Control. Characteristics of measurement system, classification of measuring instruments.

Module 2 (8 hours)

Dynamic Modeling of a Process, Dynamic behavior of First order system, First order systems in series & second & higher order systems for various kind of inputs, Linearization of nonlinear systems, Transportation & Transfer Lag.

Module 3 (8 hours)

Classification of control systems, Regulator & Servo control, Feed Forward & Feed backward control, Negative & Positive Feedback Control, Modes of control action, Controllers & Final control Elements, Reduction of Block & Signal Flow Diagrams.

Module 4 (8 hours)

Principles of measurements and classification of process control instruments, Functional elements of an instrument, Static & Dynamic Characteristics of instruments, Transducers, Error analysis, Measurement of temperature: expansion thermometers, Resistance Thermometers, thermocouples, Thermistors, Pyrometers.

Module 5 (8 hours)

Flow measurement: Inferential flow measurements, Quantity flow meters, Mass flow meters. Flow measurement, head types-area flow meters, mass flow meters, positive displacement type flow meters, electrical type flow meters and solid flow measurement.

Suggested Text Books

1. Coughnour and Koppel, " Process Systems Analysis and Control ", McGraw-Hill, New York, 1986.
2. George Stephanopolous, " Chemical Process Control ", Prentice-Hall of India Pvt-Ltd., New Delhi, 1990.
3. Singh, S. K. , Industrial Instrumentation and Control , Prentice Hall of India, 2016

4 .Eckman, D.P., Industrial Instrumentation, Wiley Eastern Ltd., New York, 1990

BMA 352 OPERATIONS RESEARCH

L	T	P	C
3	0	0	3

OBJECTIVE: The objective of this course is to educate the students about:

- mathematical formulation and solution of Linear programming problems by various method.
- transportation problems and assignment problems and their solutions.
- advanced LPP and Travelling salesman Problem and their solutions.
- fundamentals of Network problems and their solutions by CPM and PERT Methods.
- dynamic programming problem and genetic algorithm.

Course Outcome

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

CO1	understand and solve linear programming problems.	Apply, Evaluate
CO2	formulate and solve Transportations models, Assignment models and integer linear programming problems.	Apply, Evaluate, Create
CO3	formulate and solve sequencing and scheduling models.	Apply, Evaluate, Create
CO4	formulate and solve Replacement and inventory models.	Apply, Evaluate, Create
CO5	learn and use Dynamic programming and Genetic Algorithms.	Apply, Evaluate

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	**PSO1**	**PSO2**
CO1	3	3	3	3	3	2	3	1	2	-	3	3	**1**	**2**
CO2	3	3	3	3	3	2	3	1	2	-	3	3	3	3
CO3	3	3	3	3	3	2	3	1	3	-	3	3	3	3
CO4	3	3	3	3	3	2	3	1	3	-	3	3	3	3
CO5	3	3	3	3	3	2	3	-	3	-	3	3	3	3
Average	3	3	3	3	3	2	3	.8	2.6	-	3	3	3	3
													3	**3**

1: Slight (Low)2: Moderate (Medium) 3:Substantial (High) *If there is no correlation, put "-*

Detailed Syllabus:

UNIT I: <u>Linear Programming Problems (LPP)</u>

OR model, Formulation of LPP. model, Graphical LPP solution and sensitivity analysis, simplex method, M-method, Two-phase method, Special cases in simplex method application, Duality theory, Dual simplex method, Revised simplex method, Degeneracy, Sensitivity analysis, Various industrial application of LP.

UNIT II: Transportation Models, Assignment Models and Integer Programming:
Formulation and Optimal solution of transportation models, Assignment models, Transshipment models, Degeneracy in TP model, Industrial application, Formulation and Solution of integer linear programming problems; Cutting-plane algorithm, Branch and Bound algorithm, 0-1 ILPP, applications, Knapsack problem, facility-location problem.

UNIT III: Sequencing and Scheduling Model:
Sequencing problems- Travelling salesman problem, Machine-scheduling problem (Job shop), Network based planning models, Objectives of CPM and PERT, Characteristics of CPM/PERT projects, Network diagram, Terminology, Critical path, Project duration, PERT Network, Activity time, Probabilities of project completion, Optimal crashing of project activities.

UNIT IV: Replacement and Inventory models:

Replacement Problems: Optimal age of equipment replacement, capital equipment discounting cost, Replacement of items that fail, Individual and group replacement policies.
Inventory Models: Deterministic inventory models, Classic EOQ model, EOQ with price breaks, Multiterm, stochastic inventory models under probabilistic demand and lead times.

UNIT V: Dynamic Programming and Genetic Algorithms:
Dynamic programming: Bellman's principle of optimality, computations in DP, Forward and Backward recursions, Dynamic Programming formulations, Investment problem, General allocation problem, Storage coach problem, Production scheduling.
Genetic Algorithms: Working principles, similarities and differences between Gas and Traditional methods, Gas for constrained optimization, Applications of Gas to solve simple problems.

Text Books Recommended:
1. S.S. Rao, "Optimization: Theory and Applications" Willey Eastern Limited.
2. H.A. Taha, " Operations Research- AN Introduction", Macmillan.
3. Hiller, F.S., G.J. Lieberman, "Introduction to Operations Research", Hoiden-Day.
4. Kalyanmoy Deb, "Optimizaton for Engineering Design: Algorithms & Examples " Prentice-Hall of India.
5. B.E. Gillet, Introduction Operations Research- A Computer Oriented Algorithmic Approach, McGraw Hill 1989.

SEMESTER- 7

TLT 451: LEATHER TRADES ENGINEERING

L	T	P	C
2	0	0	2

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

- mechanism and development of tannery machines
- The fundamental concepts of development of hydraulic and pneumatic steering mechanisms accessories and control applied to tannery machines.
- Detailed study of Beam-house, tanning and finishing machines
- Drainage and disposal in tanneries.
- Maintenance of tannery buildings.

Course Outcome

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

CO1	Understand mechanism and development of tannery machines	Understand
CO2	Understand hydraulic and pneumatic steering mechanisms accessories	Understand
CO3	Understand working of Beam-house, tanning and finishing machines.	Understand
CO4	Understand internal transport & Drainage and disposal in tanneries	Understand
CO5	Understand maintenance of tannery buildings.	Understand

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3						2					2
CO2	3						3	2				
CO3	3											2
CO4	2						2	2				
CO5	1											
Average	2.4						2.3	2				2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) *If there is no correlation, put "-*

Course Level Assessment Questions

Course Outcome 1(CO1)

1. Clutch mechanism

2. Balancing and Vibration

3. Helically bladed cylinders, Bush, ball, roller and ring oil bearings, cam, springs and their application.

Course Outcome 2(CO2)

1. Air compressors, dust control equipment, blowers.
2. Automatic controls and their application.
3. Drying mechanisms and different types of dryers.

Course Outcome 3(CO3)

1. study of machines used in a tannery.
2. Foundation and Erection of machinery.
3. Latest development of leather processing vessels.

Course Outcome 4(CO4)

1. Internal transport
2. Safety precautions.
3. Drainage and disposal in tanneries.

Course Outcome 5(CO5)

1. Maintenance of tannery buildings.
2. Tanning machinery maintenance.
3. Automatic and mechanization of tanneries

SYLLABUS

Module- I :

Clutch mechanism, crank-slede and straight motion and lever mechanism and development of tannery machines, Balancing and Vibration - their application in high speed slicking action for helically bladed cylinders, Bush, ball, roller and ring oil bearings, cam, springs and their application and function in tannery machines, TAIC machine drying technology, Pazsucco, Embossing machine, drying technology

Module-II :

Development of hydraulic and pneumatic steering mechanisms accessories and control applied to tannery machines, air compressors, dust control equipment, blowers, etc. Automatic controls and their application in all Instruments, drying mechanisms and different types of dryers.

Module-III: Detailed study of Beam-house, tanning and finishing machines, their description, construction with sketch, selection, Foundation and Erection of machinery. Latest development of leather processing vessels

Module-IV: Internal transport, safety precautions, power, water and steam distribution, drainage and disposal in tanneries.

Module-V: Maintenance of tannery buildings: Electrical, steam and water lines, tanning machinery, routing prevent maintenance, automatic and mechanization of tanneries.

References and suggestive readings:

1. Sharp house, J.H., “Leather Technician's Handbook”.
2. Mechanical Engineering Text Book.

Course content and lecture schedule

Module No.	Topic	No. of Lectures
1.		
1.1	Clutch mechanism, crank-slede and straight motion and lever mechanism and development of tannery machines,	02
1.2	Balancing and Vibration - their application in high speed slicking action for helically bladed cylinders, Bush, ball, roller and ring oil bearings, cam, springs and their application and function in tannery machines. , TAIC machine drying technology, Pazsucco, Embossing machine, drying technology	03
2.		
2.1	Development of hydraulic and pneumatic steering mechanisms accessories and control applied to tannery machines, air compressors, dust control equipment, blowers, etc.	03
2.2	Automatic controls and their application in all Instruments, drying mechanisms and different types of dryers.	02
3.		
3.1	Detailed study of Beam-house, tanning and finishing machines, their description, construction with sketch, selection,	03
3.2	Foundation and Erection of machinery	01
3.3	Latest development of leather processing vessels.	01
4.		
4.1	Internal transport.	01
4.2	Safety precautions.	01
4.3	Power, water and steam distribution.	01
4.4	Drainage and disposal in tanneries.	02
5.		
5.1	Maintenance of tannery buildings: Electrical, steam and water lines, tanning machinery.	03
5.2	Routing prevent maintenance.	01
5.3	Automatic and mechanization of tanneries.	01

Total hours	**25**

TLT 453: PROFESSIONAL AREAS OF LEATHER TECHNOLOGY

L	T	P	C
2	0	2	3

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

- The fundamental concepts of leather biotechnology.
- Technology of Tannery by Products Utilization
- Entrepreneurship in Leather Sector
- Fashion Technology
- Leather Goods, Garment, and Saddlery Technology

Course Outcome

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

CO1	Understand the fundamental concepts of leather biotechnology.	Understand
CO2	Understand Technology of Tannery by Products Utilization	Understand
CO3	Understand Entrepreneurship in Leather Sector	Understand
CO4	Understand Fashion Technology	Understand
CO5	Understand Leather Goods, Garment, and Saddlery Technology	Understand

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3						2					2
CO2	3						3	2				
CO3	3											2
CO4	2						2	2				
CO5	1											
Average	2.4						2.3	2				2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) *If there is no correlation, put "-*

Course Level Assessment Questions

Course Outcome 1(CO1)

1. Proteins and nucleic acid & enzymology; Enzymes
2. Types of fermentation, Preparation of media

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

Course Outcome 2(CO2)

1. Beam house products
2. Chemistry and processing
3. Recovery of chrome, Protein and biogas

Course Outcome 3(CO3)

1. Industrial enterprise
2. Resource management
3. Production planning

Course Outcome 4(CO4)

1 Meaning of clothing and fashion
2. Marketing, Business
3. Fashion promotion.

Course Outcome 5(CO5)

1. Classification of leather goods
2. Accessories
3. Saddlery and harness

Module – 1

Leather Biotechnology: Proteins and nucleic acid & enzymology; Enzymes; Classification and assay, characterization, Biotechnology in leather processing; Cleaner leather processing, Types of enzymes, Types of fermentation, Preparation of media, Waste management and utilization of collagenous tissues for biomedical and other applications; Treatment of tannery effluents, Energy recovery, Collagen and its application in food, cosmetic and medical fields.

Module – II

Technology of Tannery by Products Utilization: Beam house products; Recovery of fats, proteins, chemicals and glue, Leather shavings and trimmings; Chemistry and processing into hydrolysates, glue gelatin, syntans, fertilizers, Recovery of salts and re-use; Recovery of chrome, Protein and biogas, Tannery hair, Process studies; Glue and protein meal from tannery fleshings

Module – III

Entrepreneurship in Leather Sector: Industrial enterprise; Venture planning and development; Techno-Economic feasibility reports; Resource management; Production planning; Managing markets.

Module – IV

Fashion Technology: Meaning of clothing and fashion, fashion movement, substance of the fashion industry, Designing, Marketing, Business fundamentals, Fashion promotion business.

Module – V

Leather Goods, Garment, and Saddlery Technology: Classification of leather goods and garment materials, accessories, production and planning, cutting and clicking, assembling, process scheduling, Design and development, Saddlery and harness.

References and suggested books:

1. Rohm, H.J. and Reed, G. "A Comprehensive treaties on Biotechnology", Verlag Chemie, lecinheim, 1983.

2. Lehniger, A.L., "Principles of Biochemistry", Butterworth 1982.

3. Rao, T.V., "Human Resources Development: Experiences. Interventions, Strategies", Sage Publications, New Delhi, 1996.

4. Mann, I. "Process of Utilization of Animal By Products", FAO Rome, 1962.

5. Scaria, K.J. Mahendrakumar and Divakaran, S. "Animal By Products – Their processing and utilization" CLRI, Madras, 1961.

6. Fashion Drawing Method, ESMOD, Paris, 1992.

7. Training in Tanning Techniques and Leather Goods Manufacture – Course material, CLRI, Madras, 1990.

Course contents and lecture schedule

Module No.	Topic	No. of Lectures
1.	**Leather Biotechnology**:	
1.1	Proteins and nucleic acid & enzymology; Enzymes; Classification and assay, characterization	02
1.2	Biotechnology in leather processing; Cleaner leather processing, Types of enzymes, Types of fermentation, Preparation of media	03
1.3	Waste management and utilization of collagenous tissues for biomedical and other applications	02
1.4	Treatment of tannery effluents, Energy recovery	02
1.5	Collagen and its application in food, cosmetic and medical fields	02
2.	**Technology of Tannery by Products Utilization:**	
2.1	Beam house products; Recovery of fats, proteins, chemicals and glue	02

2.2	Leather shavings and trimmings; Chemistry and processing into hydrolysates, glue gelatin, syntans, fertilizers	03
2.3	Recovery of salts and re-use; Recovery of chrome, Protein and biogas, Tannery hair	03
2.4	Process studies; Glue and protein meal from tannery fleshings	02
3.	**Entrepreneurship in Leather Sector:**	
3.1	Industrial enterprise; Venture planning and development	02
3.2	Techno-Economic feasibility reports, Resource management	02
3.3	Production planning, Managing markets.	02
4.	**Fashion Technology:**	
4.1	Meaning of clothing and fashion, fashion movement	02
4.2	substance of the fashion industry, designing, marketing	02
4.3	Business fundamentals, Fashion promotion business	02
5.	**Leather Goods, Garment, and Saddlery Technology:**	
5.1	Classification of leather goods and garment materials, accessories	02
5.2	production and planning, cutting and clicking, assembling, process scheduling	03
5.3	Design and development, Saddlery and harness	02
Total hours		**40**

TLT 455: TANNERY EFFLUENT TREATMENT

L	T	P	C
3	0	0	3

OBJECTIVE: The objective of this course is t**o** enable the students

- To understand types of water pollution.
- To know Types of tannery effluents, characteristics of effluents.
- To know primary & secondary treatments.
- To know effluent disposal and specification for industrial effluent discharge.
- To understand solid waste management.

Course Outcome

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

CO1	Understand types of water pollution.	Understand
CO2	Understand Types of tannery effluents, characteristics of effluents.	Understand
CO3	Understand primary & secondary treatment systems.	Understand
CO4	Understand effluent disposal and specification for industrial effluent discharge	Understand
CO5	Understand recovery and reuse of water in tanning Industry.	Understand

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

Average	3	1.3	2	2.5	3	1.6	1.6	2	1			3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) *If there is no correlation, put "-"*

Course Level Assessment Questions

Course Outcome 1 (CO1)

1. Types of water pollution
2. physical, chemical, physiological and biological pollutants,
3. pollution effects

Course Outcome 2(CO2)

1. characteristics of effluents from Beam House Process,
2. characteristics of effluents from tan yard process and finishing yard process.
3. Estimation of OD. BOD, COD

Course Outcome 3 (CO3)

1. Waste water drainage and collection system in tanneries
2. Primary treatment unit.
3. Trickling filter, design criteria.

Course Outcome 4 (CO4)

1. Types of effluent disposal.
2. Indian Standards.
3. Specification for industrial effluent discharge.

Course Outcome 5(CO5)

1. Recovery and reuse of water in tanning Industr
2. Utilization of treated effluents
3. Solid wastes from tanneries origin and disposal.

SYLLABUS

Module-I:

Pollution: Types of water pollution, physical, chemical, physiological and biological pollutants, pollution effects of land ground after, surface water, aquatic life and sea.

Module-II:

Tannery Effluents: Types of tannery effluents,characteristics of effluents from Beam House Process, tan yard process and finishing yard process- Estimation of OD. BOD, COD, heavy metals(Ca, Cr, Pb and Hg) and total dissolved solids in waste water.

Module-III:

Primary treatments: Waste water drainage and collection system in tanneries, screens, equalisation of waste water, primary treatment unit.

Secondary Treatment Systems: Lagoon treatment, aeration systems, trickling filter, design criteria, Biotechnology in effluent and disposals.

ZLD, Electro coagulation, UV etc.

Module-IV:

Effluent Disposal: Types of effluent disposal, standards and specification Indian Standards, specification for industrial effluent discharge.

Module-V:

Water for Tanning: Water for tanning process, recovery and reuse of water in tanning Industry, utilization of treated effluents.

Solid Waste Management: Solid wastes from tanneries origin and disposal, utilization sludge disposal from treatment system.

Reference Books and Suggested Readings :

1. Metcalf and Eddy,"Wastewater Enginnering (treatment Disposal Reuse)".
2. Steel, E.W. & Meghee J.T.," Water Supply and Sewerage".
3. Hardenbergh, W.A. & Rodie, E.R.," Water Supply and Waste Disposal".
4. Chambolle, " Environment & Tannery".
5. Dutta. S.S., "An Introduction to the Principles of Leather Manufacture".

Course contents and lecture schedule

Module No.	Topic	No. of lectures
1.	**Pollution:**	
1.1	Types of water pollution	01
1.2	Physical & chemical pollutants	02
1.3	Physiological and biological pollutants	02
1.4	Pollution effects of land ground after, surface water, aquatic life and sea..	02
2.	**Tannery Effluents:**	
2.1	Types of tannery effluents	02
2.2	Characteristics of effluents from Beam House Process,	03
2.3	Characteristics of effluents from tan yard process.	02
2.4	Characteristics of effluents from finishing yard process.	02
2.5	Estimation of OD. BOD, COD, heavy metals(Ca, Cr, Pb and Hg) and total dissolved solids in waste water	03

3.	**Primary & secondary treatment systems:**	
3.1	Waste water drainage and collection system in tanneries, screens.	02
3.2	Equalization of waste water, primary treatment unit.	02
3.3	Lagoon treatment, aeration systems,	02
3.4	Trickling filter, design criteria,	01
3.5	Biotechnology in effluent and disposals	01
3.6	ZLD, Electro coagulation, UV etc.	02
4.	**Effluent Disposal:**	
4.1	Types of effluent disposal	03
4.2	standards and specification Indian Standards	02
4.3	specification for industrial effluent discharge	02
5.	**Water for Tanning & Solid Waste Management:**	
5.1	Water for tanning process, recovery and reuse of water in tanning Industry.	02
5.2	Utilization of treated effluents.	02
5.3	Solid wastes from tanneries origin and disposal.	02
5.4	Utilization sludge disposal from treatment system.	02
	Total hours	**40**

TLT 457: LEATHER BIOTECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVE: The objective of this course is t**o** enable the students

- To know about Protein and Nucleic Acid
- To know about Enzymology
- To know Genetics Engineering & Recombinant DNA Technology
- To understand Biotechnology for Hides/Skins Improvement
- Waste Management & Utilization.

Course Outcome

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

CO1	Understand about Protein and Nucleic Acid	Understand
CO2	Understand Enzymology	Understand
CO3	Understand Genetics Engineering & Recombinant DNA Technology	Understand
CO4	Understand Biotechnology for Hides/Skins Improvement	Understand
CO5	Understand Waste Management & Utilization.	Understand

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

Average	3	1.3	2	2.5	3	1.6	1.6	2	1			3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) *If there is no correlation, put "-"*

Course Level Assessment Questions

Course Outcome 1 (CO1)

1. Chemistry of DNA & RNA
2.Structure conformation and function of Proteins
3.Structure and function, Separation principles on Proteins

Course Outcome 2(CO2)

1. Assay Characterization,
2.Mechanism of action immobilized enzymes.

Course Outcome 3 (CO3)

1. Principles and methods Essentials of Biotechnology
2. Products of Biotechnology
3.DNA Cloning strategies.

Course Outcome 4 (CO4)

1. Biotechnology for Hides/Skins Improvement
2. Application in animal nutrition
3. Use of enzyme options in beam house operation

Course Outcome 5(CO5)

1. Waste Management & Utilization
2. Energy recovery
3. Collagen and its application in food, Cosmetics and fields

Syllabus

Module-I:

Protein and Nucleic Acid: Chemistry of DNA & RNA, Structure conformation and function of Proteins, Chemistry, Structure and function, Separation principles on Proteins.

Module-II:

Enzymology: Classification, Assay Characterization, Mechanism of action immobilized enzymes.

Module-III:

Genetics Engineering & Recombinant DNA Technology : Principles and methods Essentials of Biotechnology, Products of Biotechnology, Restrictions of Enzymes, Vectors, DNA Cloning strategies.

Module-IV:

Biotechnology for Hides/Skins Improvement, Application in animal nutrition and animal production, Embryo Transfer, Gene Transfer, Transgenic animals, Use of enzyme options in beam house operation, Soaking, Unhairing, Bating, and Degreasing, Types of Fermentation, Preparation of Media, Preparation of Inoculum, Separation and purification of products.

Module-V:

Waste Management & Utilization of Collagenous Tissue for Biomedical and other Application: General features of the organic and inorganic pollutants of Tannery stabilization and disposal of organic and chemical wastes and their biological treatment, Treatment of tannery effluents, Energy recovery, Collagen and its application in food, Cosmetics and fields.

Recommended Books:

1. White, Handler, Smith., "Principles of Bio-Chemistry".
2. Lehinger,A.L., Neston D.L. "Principles of Bio-Chemistry".
3. Reed R. "Science for Schedule of Leather Technology".

TLT 459: FOOTWEAR TECHNOLOGY

L	T	P	C
3	0	0	3

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

- Different types of upper and lining leathers.
- History of shoe.
- Principles of cutting.
- Principles and methods of pre-lasting and lasting.
- Various methods of shoe construction.

Course Outcome

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

CO1	Understand the Different types of upper and lining leathers.	Understand
CO2	Understand the History of shoe.	Understand
CO3	Understand the Principles of cutting.	Understand
CO4	Understand the Principles and methods of pre-lasting and lasting.	Understand
CO5	Understand the Various methods of shoe construction.	Understand

CO	PO1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO12
CO1	3											
CO2	3	2	1									
CO3	3	2	3	2	3							
CO4	3	2			1	1						
CO5	3	2	2	3	3	1	2	2				
Ave rage	3	2	2	2.5	2.3	1	2	2				

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) *If there is no correlation, put "-"*

Course level assessment questions

Course Outcome 1(CO1)

1. Different types of soling materials.
2. Different types of adhesives used in footwear industry.
3. Shoe dressing materials etc.

Course Outcome 2(CO2)

1. History of shoe.
2. Fashion & designs.
3. Preparation of standards and section for men, ladies & children.

Course Outcome 3(CO3)

1. Principles of cutting.
2. skiving, punching and gimping
3. Top line and other edge treatments.

Course Outcome 4(CO4)

1. Sole attaching.
2. Upper preparation.
3. Quality control and fault finding problems- solving.

Course Outcome 5(CO5)

1. Various methods of shoe construction.
2. Shoe room techniques.

SYLLABUS

Module-I :

FOOTWEAR MATERIALS AND COMPONENTS

Different types of upper and lining leathers; Different types of soling materials; Different types of adhesives used in footwear industry; Kinds of insole boards, Grinderies; Fasteners; Shoe dressing materials etc.

Module-II :

DESIGN AND PATTERN DEVELOPMENT

History of shoe; Purposes and styles; Fashion & designs; Preparation of standards and section for men, ladies & children; Classic and other types of shoes and boots.

Module-III :

CUTTING, PRE-CLOSING AND CLOSING

Principles of cutting – Hand, machine; Clicking room design and management. Checking incoming work, stitchmaking, skiving, punching and gimping, heat embossing, flow moulding, toe puff attachment, attaching linings and scrims, trimming linings, finishing off closed seams. Top line and other edge treatments, local reinforcements, attaching fastners and trims

Module-IV:

PRELASTING AND LASTING

Principles and methods of pre-lasting and lasting for different types of construction; Sole attaching; Lasted margin; Upper preparation; Sole preparation; Sole cementing; Upper 76 cementing; Bottom fillers and shanks; Adhesive drying, Heat activation, Spotting, Pressing, Last slipping, Health and safety, Quality control and fault finding problems-solving.

Module-V:

METHODS OF SHOE CONSTRUCTION

Various methods of shoe construction; shoe room techniques

Recommended Books:

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 contents and lecture schedule

Module No.	Topic	No. of Lectures
1.	**FOOTWEAR MATERIALS AND COMPONENTS**	
1.1	Different types of upper and lining leathers.	01
1.2	Different types of soling materials.	01
1.3	Different types of adhesives used in footwear industry.	01
1.4	Kinds of insole boards.	01
1.5	Grinderies; Fasteners; Shoe dressing materials etc.	01
2.	**DESIGN AND PATTERN DEVELOPMENT**	
2.1	History of shoe.	01
2.2	Purposes and styles; Fashion & designs.	01
2.3	Preparation of standards and section for men, ladies & children;	02
2.4	Classic and other types of shoes and boots.	02
3.	**CUTTING, PRE-CLOSING AND CLOSING**	
3.1	Principles of cutting – Hand, machine; Clicking room design and management.	02
3.2	Checkingi ncoming work, stitchmaking, skiving, punching and gimping, heat embossing, flow moulding.	02
3.3	toe puff attachment, attaching linings and scrims.	02
3.4	Trimming linings, finishing off closed seams..	02
3.5	Top line and other edge treatments, local reinforcements, attaching fastners and trims.	01
4.	**PRELASTING AND LASTING**	

4.1	Principles and methods of pre-lasting and lasting for different types of construction; Sole attaching.	02
4.2	Lasted margin; Upper preparation; Sole preparation; Sole cementing; Upper 76 cementing.	02
4.3	Bottom fillers and shanks; Adhesive drying, Heat activation, Spotting.	01
4.4	Pressing, Last slipping.	01
4.5	Health and safety, Quality control and fault finding problems- solving.	01
5.	**METHODS OF SHOE CONSTRUCTION**	
5.1	Various methods of shoe construction.	02
5.2	Shoe room techniques.	01
	Total hours	**30**

TLT-461 ANIMAL AND TANNERY BY - PRODUCT

L	T	P	C
3	0	0	3

OBJECTIVE: The objective of this course is t**o** enable the students understand:

- Types of animal by-products
- Different Methods of Rendering
- Animal Blood, its products and their Utilization
- Collection and Conservation of Organs and Glands from Slaughtered Animal
- Present Industrial Status of Various By-products.

Course Outcome

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

CO1	Understand the Types of animal by-products	Understand
CO2	Understand Different Methods of Rendering	Understand
CO3	Understand Animal Blood, its products and their Utilization	Understand
CO4	Understand Collection and Conservation of Organs and Glands from Slaughtered Animal	Understand
CO5	Understand the Present Industrial Status of Various By-products	Understand

CO	**PO1**	**PO 2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO1 0**	**PO1 1**	**PO12**
CO1	3											
CO2	3	2	1									
CO3	3	2	3	2	3							
CO4	3	2			1	1						
CO5	3	2	2	3	3	1	2	2				
Ave rage	3	2	2	2.5	2.3	1	2	2				

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) *If there is no correlation, put "-"*

Course level assessment questions

Course Outcome 1(CO1)

1. Present methods of collection, processing and utilization
2. conservation techniques

3. animals by-products

Course Outcome 2(CO2)

1. Bone products and their utilization
2.Keratinous protein
3.keratinous based by-products and their uses

Course Outcome 3(CO3)

1. present status of the industry in the country
2. pet foods methods of preparation

Course Outcome 4(CO4)

1. Possible Scope and Utilization of slaughtered animal
2. Quality control including microbiological aspects of products

Course Outcome 5(CO5)

1. Glue making from tannery waste
2.Bone glue and deproteinisation of bone
3.Horn and hoof meal, Protein meals Shoe room techniques.

Animal and Tannery By-products

Module – 1

Types of animal by-products – From abattoirs, meat processing plants, poultry, fishing and other sources including fallen animals, Present methods of collection, processing and utilization in developing countries vis-à-vis developed countries : conservation techniques and concept of two tier technology. Protein meals from animals by-products including fallen animals and their significant in livestock feeds.

Module – 2

Different Methods of Rendering – Bone products and their utilization, Keratinous protein – various sources keratinous based by-products and their uses.

Module – 3

Animal Blood, its products and their Utilization – Alimentary tract and its processing into various products, present status of the industry in the country, pet foods methods of preparation in brief.

Module – 4

Collection and Conservation of Organs and Glands from Slaughtered Animal– Possible Scope of their Utilization – anaerobic digestion, its signification for the preparation of animal feed fuel gas, fertilizer, etc. Quality control including microbiological aspects of products processed from animal by-products

Module – 5

Present Industrial Status of Various By-products in the Country – Process studies on

(a) Glue making from tannery waste
(b) Bone glue and deproteinisation of bone
(c) Horn and hoof meal, Protein meals by different method

References and suggested books:

1. Burnham, F. `Rendering – the invisible industry" , Aero Publishers, inc., CA 92028, 1978.
2. Mann, I. "Processing and Utilization of animal by-products", Food and Agriculture organisation, Rome 1962.
3. Scaria, K. J., Mahendrakumar and Divakaran, S. "Animal by-products – processing and utilisation", Central Leather Research Institute, Madras, 1981.
4. Mahendrakumar, "Hand Book of rural technology for the processing of animal by-products", FAO Agriculture Services Bulletin 79, Food and Agriculture Organisation.
5. Divakaran, S. Animal Blood – Processing and utilisation, Food and Agriculture Organisation, 1978.

Course contents and lecture schedule

Module No.	Topic	No. of Lectures
1.	**Types of animal by-products:**	
1.1	From abattoirs, meat processing plants, poultry, fishing and other sources including fallen animals	03
1.2	Present methods of collection, processing and utilization in developing countries vis-à-vis developed countries	03
1.3	conservation techniques and concept of two tier technology	03
1.4	Protein meals from animals by-products including fallen animals and their significant in livestock feeds.	03
2.	**Different Methods of Rendering:**	
2.1	Bone products and their utilization	03
2.2	Keratinous protein – various sources keratinous based by-products and their uses	03
3.	**Animal Blood, its products and their Utilization:**	
3.1	Alimentary tract and its processing into various products	03
3.2	present status of the industry in the country	02
3.3	pet foods methods of preparation in brief	03
4.	**Collection and Conservation of Organs and Glands from Slaughtered Animal:**	
4.1	Possible Scope of their Utilization – anaerobic digestion	02
4.2	its signification for the preparation of animal feed fuel gas, fertilizer, etc.	03

4.3	Quality control including microbiological aspects of products processed from animal by-products	03
5.	**Present Industrial Status of Various By-products in the Country:**	
5.1	Process studies on: Glue making from tannery waste	02
5.2	Bone glue and deproteinisation of bone	02
5.3	Horn and hoof meal, Protein meals by different method	02
Total hours		**40**

OLT 491: INTRODUCTION TO LEATHER TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVE: The objective of this course is to enable the students

- To understand General physical and chemistry of proteins.
- To understand pretanning process.
- To understand concept of tanning.
- To understand principle of dyes, oils, binders etc.
- To understand effluent disposal, machine in leather processing and footwear making.

Course Outcome

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

CO1	To understand General physical and chemistry of proteins.	Understand
CO2	To understand pretanning process.	Understand
CO3	To understand concept of tanning.	Understand
CO4	To understand principle of dyes, oils, binders etc.	Understand
CO5	To understand effluent disposal, machine in leather processing and footwear making.	Understand

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3											
CO2	3					2						
CO3	3	2	3	2								2
CO4	3	2	3	2								2
CO5	3	2		2		2						2
Average	3	2	3	2		2						2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) *If there is no correlation, put "-"*

Course Level Assessment Question

Course Outcome 1(CO1)

1. Various fibrous and non fibrous proteins, Non proteinous skin 142omponents
2. General physical and chemistry of proteins.
3. Primary structure of collagen

Course Outcome 2(CO2)

1. Keratin, Reticulin, Elastin
2. Pretanning process

Course Outcome 3(CO3)

1. Concept of tanning
2. Theory of neturalisation
3. combination tannages.

Course Outcome 4(CO4)

1. Classification of leather dyes.
2. oils & fats.
3. Classification and types of leather finishes.

Course Outcome 5(CO5)

1. Tannery effluents
2. different machine used in leather processing.
3. Making of footwear

SYLLABUS

Module-I : Various fibrous and non fibrous proteins, Non proteinous skin 142omponents. General physical and chemistry of proteins. Chemical constitution of hides and skins. Reaction of proteins with acids, bases and salts. Primary structure of collagen, effect of enzymes on collagen.

Module-II :

Keratin, Reticulin, Elastin, histology of hides and skins-cell, tissue, fibers, muscels, glands, epidermics, pretanning process-soaking, liming, deliming, bating, degreasing, pickling & depickling).

Module-III :

Concept of tanning and leather, leather properties dependent on tanning, Vegetable tannins and vegetable tanning, classification of vegetable tannins, vegetable tanning materials and their properties, hydrolyable and condensed tannins, Mechanism of vegetable tanning, process of vegetable tanning, synthetic tannins, chrome complexes and their structures, method of chrome tanning, preparation of chrome liquors & Powders, mechanism of chrome tannage. Study of Aluminium, Zirconium, iron, Titanium, Sodium silicate & polyphosphates. Theory of neturalisation, combination tannages

Module-IV :

Principle of color chemistry, classification of leather dyes, color matching, theory and mechanism of dyeing, oils, fats, classification and types of leather finishes, pigments, binders, intro cellulose lacquers, wax emulsions, silicon emulsion.

Module-V

Tannery effluents, effluent disposal, leather machinery-different machine used in leather processing. Anatomy of human foot, closing, making of footwear, classification of leather goods, method and material for construction.

References :

1. Dutta. S.S., "An Introduction to the Principles of Leather Manufacture".
2. Sarkar K.T., "Theory & Practice of Leather Manufacture".

Course content and lecture Schedule

Module No.	Topic	No.of lectures
1		
1.1	Various fibrous and non-fibrous proteins, Non proteinous skin 143omponents.	**02**
1.2	General physical and chemistry of proteins. Chemical constitution of hides and skins. Reaction of proteins with acids, bases and salts.	**02**
1.3	Primary structure of collagen, effect of enzymes on collagen.	**02**
2		
2.1	Keratin, Reticulin, Elastin, histology of hides and skins-cell, tissue, fibers, muscels, glands, epidermics,	**02**
2.2	pretanning process-soaking, liming, deliming,	**02**
2.3	bating, degreasing, pickling & depickling	**02**
3		
3.1	Concept of tanning and leather, leather properties dependent on tanning, Vegetable tannins and vegetable tanning, classification of vegetable tannins, vegetable tanning materials and their properties, hydrolyable and condensed tannins,	**02**
3.2	Mechanism of vegetable tanning, process of vegetable tanning, synthetic tannins, chrome complexes and their structures, method of chrome tanning, preparation of chrome liquors & Powders, mechanism of chrome tannage. Study of Aluminium, Zirconium, iron, Titanium, Sodium silicate & polyphosphates.	**02**
3.3	Theory of neturalisation, combination tannages.	**02**
4		

4.1	Principle of color chemistry, classification of leather dyes, color matching, theory and mechanism of dyeing,	**02**
4.2	oils, fats, classification and types of leather finishes,	**02**
4.3	pigments, binders, intro cellulose lacquers, wax emulsions, silicon emulsion,	**02**
5		
5.1	Tannery effluents, effluent disposal,	**02**
5.2	Leather machinery-different machine used in leather processing.	**01**
5.3	Anatomy of human foot.	**01**
5.4	closing, making of footwear, classification of leather goods, method and material for construction	**02**
	Total hours	**30**

TLT – 493: INDUSTRIAL TRAINING

L	T	P	C
0	0	4	2

The students after summer internship of 6 to 8 weeks would be giving presentation on the work they performed or learned during training

OBJECTIVE: The objective of this course is t**o** enable the students

- To expose to industrial environment
- To acquaint with the various machines for the manufacturing of Leathers
- For testing of raw materials and finished products
- Handle the research project.
- To improve professional attitude

Course Outcome

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

CO1	Understand the work culture and human relationship.	Understand
CO2	Apply the theoretical knowledge in understanding the working of various machines	Apply
CO3	Understand the process sequence and optimization of process parameters.	Understand
CO4	To get exposure to various conventional and model tools and equipments for testing of raw materials and finished products	Apply
CO5	To analyze the research problem and devise methodology/ steps to solve it	Analyze

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	2									
CO2	2	2	2		2	2						

CO3	2	3		2	3							
CO4		3	2	3	3							
CO5		3	3	3	3							
Average	1.6	2.8	2.5	2.6	2.7	2						

TLT - 495 : SEMINAR

L	T	P	C
0	0	4	2

OBJECTIVE: The objective of this course is t**o** enable the students

- Study a topic of latest developments/innovative technology on their own and to prepare a dissertation report on this topic.
- Present a lecture on the topic on power point format.
- Improve the communication skill of the students.

Course Outcome

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

CO1	Understand a topic of latest developments/innovative technology.	Understand
CO2	Apply the knowledge to prepare a dissertation report on this topic.	Apply
CO3	Deliver a lecture on the topic on power point format.	Apply
CO4	Improve the communication skill of the students.	Communication
CO5	Analyze environment and sustainability of related technology	Analyze Environment& Sustainability

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3			1		2	1		1			
CO2	2	2	2	1	1	2	3		2	3	1	2
CO3										3		1
CO4										3		1
CO5						2	3		2			2
Average	2.5	2	2	1	1	2	2.3		1.6	3	1	1.5

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) *If there is no correlation, put "-"*

TLT – 497: PROJECT

L	T	P	C
0	0	8	4

OBJECTIVE: The objective of this course is t**o** enable the students

- To identify a Leather product that can be manufactured in India or a research problem and conduct experiment.
- To prepare a feasibility report for a project based on manufacturing of product.
- To present a lecture on the topic on power point format.
- To improve the communication skill of the students.

Course Outcome

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

CO1	Understand a topic of latest developments/innovative technology.	Understand
CO2	Apply the knowledge to prepare a feasibility/dissertation report on this topic.	Apply
CO3	Deliver a lecture on the topic on power point format.	Apply
CO4	Improve the communication skill of the students.	Communication
CO5	Analyze environment and sustainability of related technology	Analyze

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3			1		2	1		1			
CO2	2	2	2	1	1	2	3		2	3	3	2
CO3										3		2
CO4										3		2
CO5						2	3		2			2
Average	2.5	2	2	1	1	2	2.3		1.6	3	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) *If there is no correlation, put "-"*

SEMESTER- 8

TLT – 452: COMPUTER AIDED LEATHER PRODUCT DESIGN

L	T	P	C
3	1	0	4

OBJECTIVE: The objective of this course is t**o** enable the students understand:

- The Anatomy of human foot.
- Different types of footwear
- Basic methods of cutting different components
- Different method of footwear construction
- Role of Computer aided design .

Course Outcome

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

CO1	Understand the Anatomy of human foot	Understand
CO2	Understand the Different types of footwear & their components.	Understand
CO3	Understand Basic methods of cutting different components	Understand
CO4	Understand the Different method of footwear construction.	Understand
CO5	Understand the Role of Computer aided design .	Understand

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2	3	2	1									
CO3	3	2	3	2	2							
CO4	3	2			1	1						
CO5	3	2	2	3	2	1	2	2				
Average	3	2	2	2.5	1.6	1	2	2				

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) *If there is no correlation, put "-"*

Course Level Assessment Questions

Course Outcome 1(CO1)

1. Anatomy of human
2. Function of the foot, Foot comfort and Common foot abnormalities.
3. Shoe sizing system and fittings.

Course Outcome 2(CO2)

1. Different types of footwear
2. Basics concepts of design and pattern cutting.
3. leather materials for different components of footwear

Course Outcome 3(CO3)

1. Basic methods of cutting different components
2. Tools and equipment for footwear making.
3. Closing of simple uppers.

Course Outcome 4(CO4)

1. Different method of footwear construction.
2. Classification of Leather goods.
3. Material selection criteria for leather garments.

Course Outcome 5(CO5)

1. CAD, CPU, Data storage, Input/output devices.
2. Operating system.
3. Application of software for Footwear.

SYLLABUS

Module-I

Anatomy of human foot, Function of the foot, Foot comfort and Common foot abnormalities, Foot and Last measurement, Shoe sizing system and fittings.

Module-II

Designing and pattern making, Different types of footwear, Various components of footwear, Basics concepts of design and pattern cutting, Grading methods, Various allowances, Applications of computer aid designing, Materials of leather products- Selection of leather and non-leather materials for different components of footwear and garments.

Module-III

Basic methods of cutting different components, Tools and equipment for clicking, marking, skiving, edge treatments, fitting, stitching and types of stitches, closing of simple uppers.

Module-IV

Different method of footwear construction, Cemented, Direct vulcanized, Injection-moulded, Veldschoen, Machine welted, Slip and sting Lasted, Finishing and Treening operation, ,

Classification of Leather goods, Type and selection of materials, Methods of construction, Tools and Machinery. Classification of leather, Material selection criteria for leather garments. Lining materials, Factors such as light weight, Porosity, Water absorption, Accessories metal fittings for garments, Designing methods, Various components, Preparation of Standards & pattern of Garment/Material.

Module-V

Computer aided design, CAD, CPU, Data storage, Input/output devices, Function of CPU, Main memory and backup storage devices, Selection of Input/output devices, Operating system, Application of software for Footwear.

Recommended Books

1. Clarks,"Manual on shoe Making".
2. "Tips for shoe Making"
3. CLRI, SATRA, FDDI, Publication

Course contents and lecture schedule

Module No.	**Topic**	**No. of lectures**
1.		
1.1	Anatomy of human foot.	02
1.2	Function of the foot, Foot comfort and Common foot abnormalities,	01
1.3	Foot and Last measurement.	01
1.4	Shoe sizing system and fittings.	01
2.	**Designing and pattern making:**	
2.1	Different types of footwear	01
2.2	Various components of footwear	01
2.3	Basics concepts of design and pattern cutting, Grading methods, Various allowances,.	01
2.4	Applications of computer aid designing,	01
2.5	Materials of leather products- Selection of leather and non-leather materials for different components of footwear and garments	01
3.		
3.1	Basic methods of cutting different components	01
3.2	Tools and equipment for clicking, marking, skiving, edge treatments, fitting, stitching.	02
3.3	types of stitches.	01
3.4	Closing of simple uppers.	01
4.		

4.1	Different method of footwear construction, Cemented, Direct vulcanized Injectionmoulded, Veldschoen, Machine welted, Slip and sting Lasted,	02
4.2	Finishing and Treening operation.	02
4.3	Classification of Leather goods.	01
4.4	Type and selection of materials.	01
	Methods of construction, Tools and Machinery, Classification of leather, Material selection criteria for leather garments	02
	.Lining materials, Factors such as light weight, Porosity, Water absorption,	01
	Accessories metal fittings for garments, Designing methods, Various components,Preparation of Standards & pattern of Garment/Material	01
5.	**Bulk nano structured materials**	
5.1	Computer aided design, CAD, CPU, Data storage, Input/output devices, Function of CPU, Main memory and backup storage devices,	02
5.2	Selection of Input/output devices, Operating system,	02
5.3	Application of software for Footwear.	01
	Total Hours	**30**

TLT: 454 FOOTWEAR MATERIAL AND COMPONENTS

L	T	P	C
3	1	0	4

Course Outcome

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

CO1	Understand the Different types of upper and lining leathers.	Understand
CO2	Understand soling material and adhesives.	Understand

OBJECTIVE: The objective of this course is t**o** enable the students understand:

- Uppers and lining.
- Soling material and adhesives
- Insoles and grinderies
- Fasteners
- Dressing materials .

CO3	Understand the insoles and grinderies	Understand
CO4	Understand the fasteners	Understand
CO5	Understand the dressing materials	Understand

CO	PO1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO12
CO1	3											
CO2	3	2	1									
CO3	3	2	3	2	3							
CO4	3	2			1	1						
CO5	3	2	2	3	3	1	2	2				
Ave rage	3	2	2	2.5	2.3	1	2	2				

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) *If there is no correlation, put "-"*

Course level assessment questions

Course Outcome 1(CO1)

1. Different types of upper and lining leathers
2. defects, grain characteristics.
3. comfort properties

Course Outcome 2(CO2)

1. Different types of soling materials
2. Different types of adhesives

Course Outcome 3(CO3)

1. Kinds of insole boards
2. synthetic fibre, non wovens
3. performance and evaluation of toe puff, steel shanks etc.

Course Outcome 4(CO4)

1. Materials, manufacture, use and properties of elastics

2. buckles and trims
3. shoelaces

Course Outcome 5(CO5)

1. dressing materials
2. waxes, cream

Syllabus

Module-I:

UPPERS AND LINING

Leather: Different types of upper and lining leathers, manufacturing techniques, defects, grain characteristics, stretch direction, cuttability, area measurement, evaluation-strength, wear and comfort properties.

Coated Fabrics & Poromerics: Types of yarn, thread manufacturing, twist, coated fabric, method of weaving-brarding, knitting, coated of fabric, synthetic leather and poromerics, method of evaluation.

Module-II:

SOLING MATERIAL AND ADHESIVES

Different types of soling materials-leather, rubber, PU, PVC, EVA, TPR, resin rubber methods of manufacture, assessment and application.

Different types of adhesives used in footwear industry- latex, polychloroprene, polyurethane-single and double component hot melt adhesives, methods of manufacturing, evalution techniques and applications.

Module-III:

INSOLES AND GRINDERIES: Kinds of insole boards, leathers, cellulose, synthetic fibre, non wovens, seat boards, manufacture, performance, evaluation.

Manufacture, performance and evaluation of toe puff, steel shanks, heels and tapes and bindings.

Module-IV:

FASTENERS: Materials, manufacture, use and properties of elastics, touch and close fasteners, slide fasteners, buckles and trims, and shoelaces.

Module-V:

DRESSING MATERIALS: Shoe polishes, waxes, cream: Different types of dressing materials, formulation technique, application and evaluation.

Recommended Books:

1. Modern Shoemaking Series, SATRA, UK Publications.
2. Quality manual for leather manufacture, LTM-CLRI Publication, Chennai.
3. Ganga Radhakrishnan, Polymers in Footwear Manufacture, Indian Leather Publications, Chennai.
3. Juran, J.M., Gryna, F.M. Jr. Quality Control Handbook, 4th Edition, McGraw Hill Book Co. New York, 1988.

PROGRAMME ELECTIVE COURSE I V

TLT 456 PROCESS MODELING AND SIMULATION

L	T	P	C
2	1	0	3

Assessment:
Sessional: 50 marks
End Semester: 50 marks

Course Objectives:

This course explores the basic concepts and steady state equations of simple systems in chemical process industries. It deals with the techniques for derivation of system model equations, data analysis and visualization. The course aims to present the basic idea and concept on process model with detailed analysis and solution of model equations for steady operation.

Course Outcomes:

Students completing the course will be able to

CO 1	Model deterministic systems and differentiate between nonlinear and linear models	Remember, Apply, Analyze
CO 2	Numerically simulate linear and non linear ordinary differential equations for deterministic systems	Apply, Analyze, Evaluate
CO 3	Estimate and validate a model based upon input and output data.	Apply, Analyze, Evaluate
CO 4	Create a model prediction based upon new input and validate the output data	Understand, Apply, Analyze, Evaluate, Create

CO 5	Develop steady state models for flash vessels, equilibrium staged processes, distillation columns, absorbers, strippers, CSTR, heat exchangers and packed bed reactors.	Remember, Apply, Analyze, Evaluate

	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	3	2	-	-	1	-	1	1	2	**1**	**1**
CO2	3	3	3	3	3	1	-	1	-	1	1	2	3	3
CO3	3	3	3	2	3	1	-	1	-	1	1	2	3	3
CO4	3	3	3	2	2	1	-	1	-	1	1	2	3	3
CO5	3	3	3	3	3	1	1	1	-	1	2	3	3	3
Avg.	3	3	3	2.6	2.6	0.8	0.2	1	-	1	1.2	2.2	3	3

Module1 (6 hours)

Introduction to mathematical modeling; Advantages and limitations of models and applications of process models of stand-alone unit operations and unit processes; Classification of models: Linear vs. Non linear, Lumped parameter vs. Distributed parameter; Static vs. Dynamic, Continuous vs. Discrete; Numerical Methods: Iterative convergence methods, Numerical integration of ODE- IVP and ODE-BVP.

Module2 (6 hours)

Concept of degree of freedom analysis: System and its subsystem, System interaction, Degree of freedom in a system e.g. Heat exchanger, Equilibrium still, Reversal of information flow, Design variable selection algorithm, Information flow through subsystems, Structural effects of design variable selection, Persistent Recycle.

Module3 (6 hours)

Simple examples of process models; Models giving rise to nonlinear algebraic equation (NAE) systems, - steady state models of flash vessels, equilibrium staged processes distillation columns, absorbers, strippers, CSTR, heat exchangers, etc.; Review of solution procedures and available numerical software libraries.

Module4 (6 hours)

Steady state models giving rise to differential algebraic equation (DAE) systems; Rate based approaches for staged processes; Modeling of differential contactors – distributed parameter

models of packed beds; Packed bed reactors; Modeling of reactive separation processes; Review of solution strategies for Differential Algebraic Equations (DAEs), Partial Differential Equations (PDEs), and available numerical software libraries.

Module5 (6 hours)

Simulation and their approaches, Modular, Sequential, Simultaneous and Equation solving approach, Simulation softwares and their applications, Review of solution techniques and available numerical software libraries.

Suggested Text Books

1. Luyben W.L., "Process Modeling, Simulation, and Control for Chemical Engineering", Mc Graw Hill.
2. D. F. Rudd and C. C. Watson, " Strategy of Process Engineering", Wiley international.
3. M.M. Denn, "Process Modelling", Wiley, New York, (1990).

Suggested Reference Books

1. A. K. Jana, "Chemical Process Modelling and Computer Simulation", PHI,(2011)
2. C.D. Holland, "Fundamentals of Modelling Separation Processes", Prentice Hall, (1975)
3. Hussain Asghar, "Chemical Process Simulation", Wiley Eastern Ltd., New Delhi, (1986)

PROGRAMME ELECTIVE COURSE I V

TLT 458 COMPUTER AIDED EQUIPMENT DESIGN

L	T	P	C
2	1	0	3

Assessment:
Sessional: 50 marks
End Semester: 50 marks

Course Objectives:

The objective of this course is to acquire basic understanding of design parameters, complete knowledge of design procedures for commonly used process equipment and their attachments (e.g. internal and external pressure vessels, tall vessels, high pressure vessels, supports etc.), and different types of equipment testing methods.

Course outcomes:

Students completing the course will be able to

CO1	vUnderstand the basics of process equipment design and important parameters of equipment design	Understand
CO2	Understand the basics of process equipment design and important parameters of equipment design	Understand
CO3	Design special vessels such as tall vessels, self supporting vessels, and skirt (and other support for vertical vessels).	Apply
CO4	Design liquid and gas storage tanks with and without floating roof	Apply
CO5	Select standard piping, flanges, gaskets and bolts associated with the vessels and storage tanks.	Analyze

Syllabus

Module 1 (6 hours)

Introduction: Classification of engineering materials, properties of Ferrous metals, Non ferrous metals, alloys & Ceramic materials Structure-Property relationship in materials. Deformation of Materials Fracture: Elastic deformation, Plastic deformation, Creep, Visco-elastic deformation, Different types of fracture, Corrosion And Prevention: Direct Corrosion, electro-chemical corrosion, Galvanic cells, High temperature corrosion, Passivity, factor influencing corrosion rate, Control and of corrosion-modification of corrosive environment, Inhibitors,

Cathodic protection, protective coatings. Corrosion charts, Metal forming techniques (bending, Rolling, Forming) & Metal joining techniques, welding – such as Butt, Lap, fillet, corner. Inspection and testing of process vessel.

Module 2 (6 hours)
Pressure Vessels: Type of pressure vessels, Thin cylinder theory for internal pressure. Code & standard for pressure vessels (IS:2825: 1969), Design considerations, classification of pressure vessels as per codes, design of cylindrical and spherical shells under internal and external pressure, selection and design of closures and heads such as Flat, hemispherical, tori-spherical, elliptical & conical.; Introduction to compensation for opening such as nozzles & manholes etc.

Module 3 (6 hours)
Flanges: Selection of gaskets, selection of standard flanges, optimum selection of bolts for flanges, design of flanges. Inspection and testing of vessels, heads and flanges as per code specifications. Piping: Pipe thickness calculation under internal and external pressure, introduction to flexibility analysis of piping system.

Module 4 (6 hours)
Tall Tower Design: Design of shell, skirt, bearing plate and anchor bolts for tall tower used at high wind and seismic conditions. Supports: Design of lug support and saddle support including bearing plates and anchor bolts.

Module 5 (6 hours)
Storage Tanks: Introduction to Indian standards, filling and breathing losses; classification of storage tanks; Design of liquid and gas storage tanks with and without floating roof. High-pressure vessels, Fundamental equations, Compound vessels, Liquid storage tanks, Mechanical design of centrifuges, Centrifugal pressure, Bowl and spindle motion: critical speed.

Suggested Text Books

1. Brownell L. E. and Young H. E., "Process Equipment Design", John Wiley and Sons. 2009.
2. Bhattacharya B. C., "Introduction of Chemical Equipment Design", 1st Edition, CBS Publisher. 2008.
3. I.S.:2825-1969, "Code for Unfired Pressure Vessels", Bureau of Indian Standards.1969.
4. I.S.:803-1962, "Code of Practice for Design, Fabrication and Erection of Vertical Mild Steel Cylindrical Welded Oil Storage Tanks", Bureau of Indian Standards.1962.

Suggested Reference Books

1. Moss D. R., "Pressure Vessel Design Manual", 3rd Edition, Gulf Publishers, 2004.
2. Annartone D., "Pressure Vessel Design", 3rd Edition, Springer 2007.
3. Joshi M.V., and Mahajani, V.V., "Process Equipment Design", 3rd Edition, Macmillan India, 2000.
4. Coulson, J.M., Richardson, J.F., and Sinnott, R.H., "Chemical Engineering Volume 6, 3rd revised Edition, Butterworth-Heinemann Ltd., 1999.

OPEN ELECTIVE COURSE IV

OLT 492- Introduction to Footwear Technology

L	T	P	C
3	1	0	4

Assessment:
Sessional: 50 marks
End Semester: 50 marks

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

- Different types of upper and lining leathers.
- History of shoe.
- Principles of cutting.
- Principles and methods of pre-lasting and lasting.
- Various methods of shoe construction.

Course Outcomes:

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CO1	Understand the Different types of upper and lining leathers.	Understand
CO2	Understand the History of shoe.	Understand
CO3	Understand the Principles of cutting.	Understand
CO4	Understand the Principles and methods of pre-lasting and lasting.	Understand
CO5	Understand the Various methods of shoe construction.	Understand

CO	PO1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO12
CO1	3											
CO2	3	2	1									
CO3	3	2	3	2	3							
CO4	3	2			1	1						
CO5	3	2	2	3	3	1	2	2				
Ave rage	3	2	2	2.5	2.3	1	2	2				

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) *If there is no correlation, put "-"*

Course level assessment questions

Course Outcome 1(CO1)

1 Different types of soling materials.
2 Different types of adhesives used in footwear industry.
3 Shoe dressing materials etc.

Course Outcome 2(CO2)
1 History of shoe.
2 Fashion & designs.
3 Preparation of standards and section for men, ladies & children.

Course Outcome 3(CO3)
1. Principles of cutting.
2. skiving, punching and gimping
3. Top line and other edge treatments.

Course Outcome 4(CO4)
1 Sole attaching.
2 Upper preparation.
3 Quality control and fault finding problems- solving.

Course Outcome 5(CO5)
1 Various methods of shoe construction.
2 Shoe room techniques.

SYLLABUS

Module I

Anatomy of human foot, Function of the foot, Foot comfort and Common foot abnormalities, Shoe sizing system and fittings.

Module II

Designing and pattern making, Different types of footwear, Basics concepts of design and pattern cutting, Grading methods, Preparation of standards and sections.

Module III

Different types of upper and lining leathers; Different types of soling materials; Different types of adhesives used in footwear industry; Kinds of insole boards, Grinderie, Toe puff stiffener, Shank.

Module IV

Principles of cutting, characteristics & variation in cutting leather, skiving, heat embossing, punching, moulding, toe puff attachment, Top line and edge treatments, Reinforcements.

Module V

Principles & methods of Closing, Prelasting and Lasting for different types of construction, Upper preparation, Sole preparation, Sole attaching, Sole cementing, **Heat activation,** Quality control, Various methods of shoe construction

Recommended Books:

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 contents and lecture schedule

Module No.	Topic	No. of Lectures
1.	**FOOTWEAR MATERIALS AND COMPONENTS**	
1.1	Different types of upper and lining leathers.	01
1.2	Different types of soling materials.	01
1.3	Different types of adhesives used in footwear industry.	01
1.4	Kinds of insole boards.	01
1.5	Grinderies; Fasteners; Shoe dressing materials etc.	01
2.	**DESIGN AND PATTERN DEVELOPMENT**	
2.1	History of shoe.	01
2.2	Purposes and styles; Fashion & designs.	01
2.3	Preparation of standards and section for men, ladies & children;	02
2.4	Classic and other types of shoes and boots.	02
3.	**CUTTING, PRE-CLOSING AND CLOSING**	
3.1	Principles of cutting – Hand, machine; Clicking room design and management.	02
3.2	Checkingi ncoming work, stitchmaking, skiving, punching and gimping, heat embossing, flow moulding.	02
3.3	toe puff attachment, attaching linings and scrims.	02
3.4	Trimming linings, finishing off closed seams..	02
3.5	Top line and other edge treatments, local reinforcements, attaching fastners and trims.	01
4.	**PRELASTING AND LASTING**	

4.1	Principles and methods of pre-lasting and lasting for different types of construction; Sole attaching.	02
4.2	Lasted margin; Upper preparation; Sole preparation; Sole cementing; Upper 76 cementing.	02
4.3	Bottom fillers and shanks; Adhesive drying, Heat activation, Spotting.	01
4.4	Pressing, Last slipping.	01
4.5	Health and safety, Quality control and fault finding problems- solving.	01
5.	**METHODS OF SHOE CONSTRUCTION**	
5.1	Various methods of shoe construction.	02
5.2	Shoe room techniques.	01
	Total hours	**30**

TLT – 498 : PROJECT

L	T	P	C
0	0	20	10

OBJECTIVE: The objective of this course is t**o** enable the students

- To identify the project, product ideas may emerge mainly from survey of raw materials
- To prepare a detailed project report on fabrication of a product/equipment/process of a plant for production of Leathers product with complete lay-out or a research problem and conduct experiment.
- To assess the economic analysis and to prepare a feasibility report for a project based on manufacturing of product/equipment/process.
- To prepare the students for entrepreneurship. .
- To develop marketing skill in the students.

Course Outcome

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

CO1	Understand a topic of latest developments/innovative technology	Understand
CO2	Apply the knowledge to prepare a feasibility/dissertation report on this topic.	Apply
CO3	Deliver a lecture on the topic on power point format.	Apply
CO4	Improve the communication skill of the students.	Communication
CO5	Analyze environment and sustainability of related technology	Analyze

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2		1		2	1		3		2	
CO2	2	2	2	1	1	2	3		2	3	3	2
CO3										3		2
CO4										3		2
CO5						2	3		2			2
Average	2.5	2	2	1	1	2	2.3		2.3	3	2.5	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) *If there is no correlation, put "-"*