

AUXILIUM COLLEGE (AUTONOMOUS)**VELLORE****M.Sc. CHEMISTRY****Curriculum Development – Local Needs****SEMESTER I****PICHA20 - IEP - DAIRY CHEMISTRY**

Year: I SEM: I	Course Code PICHA20	Title of the Course Dairy Chemistry	Course Type Theory	Course Category Independent Elective	H/W Own Pace	Credits 2	Marks 100
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Learning Objectives:

- To impart knowledge on the principles and practical applications of various dairy products.
- To help the students to understand the analysis of dairy products by using physical, biochemical, and instrumental methods of analysis.

Course Outcomes:

The Learners will be able to

1. Summarize the knowledge on dairy products, processing, and their applications.
2. Discuss the physical and chemical properties of milk.
3. Explain the different processing techniques of milk.
4. Explain marketing of milk and apply skills in detecting adulterants in milk products.
5. Describe the nutritive value of milk and chemistry of dairy products in bone and muscle formation.

CO	PSO					
	1	2	3	4	5	6
CO1	H	H	H	H	H	M
CO2	H	H	H	H	H	M
CO3	H	H	H	H	H	M
CO4	H	H	H	H	H	M
CO5	H	H	H	H	H	M

CO	PO					
	1	2	3	4	5	6
CO1	H	H	H	H	H	M
CO2	H	H	H	H	H	M
CO3	H	H	H	H	H	M
CO4	H	H	H	H	H	M

CO5	H	H	H	H	H	M
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H-High (3), M-Moderate (2), L-Low (1)

Unit I

- 1.1 Milk - constituents of milk - water, lipids, carbohydrates, proteins, salts and miscellaneous constituents. (K1 & K2)
- 1.2 Milk products and their composition - fluid milks and creams, plain milk, skim milk, low fat milk, ultra-high temperature (UHT) sterile milk. (K1 & K2)
- 1.3 Flavoured fluid milk products, fermented and acidified milks, butter milk, yogurt, and kumis. (K1 & K2)
- 1.4 Concentrated fermented milks - fluid cream, table cream, whipping cream. (K1 & K2)
- 1.5 Concentrated milk products - evaporated milk, plain condensed milk, and sweetened condensed milk. (K1 & K2)
- 1.6 Concentrated milk products - condensed skim milk, butter, ghee, cheese and its classification. (K1 & K2)

Unit II

- 2.1 Sampling of milk. (K1 & K2)
- 2.2 Physical test - cream line - freezing point. (K1 & K2)
- 2.3 Physical test - refractive index - temperature. (K1 & K2)
- 2.4 Chemical test - albumin, casein, lactic acid, lactose. (K1 & K2)
- 2.5 Total solids - lactometer - gravimetric analysis. (K1 & K2)
- 2.6 Bacteriological test. (K1 & K2)

Unit III

- 3.1 Introduction - fluid milk products - cooling and agitation. (K1 & K2)
- 3.2 Clarification - separation and standardization. (K1 & K2)
- 3.3 Pasteurization - vacuum removal of off-flavours. (K1 & K2)
- 3.4 Homogenization - packaging and distribution. (K1 & K2)
- 3.5 Ice cream - ingredients and their functionality - butter - processing the cream. (K1 & K2)
- 3.6 Evaporated milk - standardization - cheese and curd processing. (K1 & K2)

Unit IV

- 4.1 Market milk - introduction and definition - market milk industry in India and abroad. (K1 & K2)
- 4.2 Indian standards - food chemical codex. (K1 & K2)
- 4.3 Milk and public health - milk adulteration - lactometer. (K1 & K2)
- 4.4 Safeguarding milk supply - clean milk production. (K1 & K2)
- 4.5 Buying and collection of milk - cooling and transportation of milk. (K1 & K2)
- 4.6 Cleaning and sanitation of equipment - judging and grading of milk. (K1 & K2)

Unit V

- 5.1 Nutrition and muscles - effect of various nutritional factors on muscle of agricultural animals. (K1 & K2)
- 5.2 Effects of under nutrition on human muscle. (K1 & K2)

- 5.3 Nutrition and bone formation - bone formation and remodeling. (K1 & K2)
- 5.4 Calcification - effects of nutrients on bone formation. (K1 & K2)
- 5.5 Nutrition, regeneration and repair - regeneration in lower animals. (K1 & K2)
- 5.6 Regeneration in man and other animals. (K1 & K2)

Reference Books:

1. N. P. Wong, R. Jenness, M. Keeney, E. H. Marth, Fundamentals of Dairy Chemistry, CBS publishers & Distributors, 3rd Edition, 2001.
2. J. G. Davis, Milk Testing, A laboratory control of milk, Agrobios(India), 2015.
3. V. K. Chhazllani, Dairy Chemistry and Animal Nutrition, Mangalam Publications, 2008.
4. Sukumar De, Outlines of Dairy Technology, Oxford University Press, 2003.
5. Clarence Henry Eckles, Willes Barnes Combs, Harold Macy, Milk and Milk Products, Tata McGraw-Hill Publishing Company Limited, 4th Edition, 2002.

Open Educational Resources (OER):

1. <http://www.digimat.in/nptel/courses/video/126105013/L44.html>
2. <https://freevidelectures.com/course/4443/nptel-dairy-food-process-products-technology>
3. <https://freevidelectures.com/course/4443/nptel-dairy-food-process-products-technology/3>

SEMESTER I

PICHB20 - IEP - QUALITY CONTROL AND CHEMICAL ANALYSIS

Year: I	Course Code PICHB20	Title of the Course Quality Control and Chemical Analysis	Course Type Theory	Course Category Independent Elective	H/W Own Pace	Credits 2	Marks 100
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Learning Objectives:

- To provide information on fundamental concepts of quality control, quality analysis and good laboratory practices and their applications in chemical industries.
- To understand the various methods of testing of food, textile, water, soil and air.
- To familiarize the standards and specifications involved in quality control.

Course Outcomes:

The Learners will be able to

1. Define quality control, quality assurance and describe the necessity of TQM.
2. Apply standards and specifications in quality control.
3. Discuss the testing methods involved in quality control of food and textile industries.
4. Evaluate quality analysis of water, soil, and air.
5. Demonstrate the basics of good laboratory practices and describe the importance of sampling, documenting and usage of computer aids in QC labs.

CO	PSO					
	1	2	3	4	5	6
CO1	H	M	M	M	M	M
CO2	H	M	H	M	M	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	M	H

CO	PO					
	1	2	3	4	5	6
CO1	H	H	H	M	H	H
CO2	H	H	H	M	H	H
CO3	H	H	H	M	H	H
CO4	H	H	H	M	H	H
CO5	H	H	H	M	H	H

H-High (3), M-Moderate (2), L-Low (1)

Unit I

- 1.1 Definition and dimension of quality - need for quality. (K1 & K2)

- 1.2 Quality control - objects of quality control - advantages of quality control - relation to quality assurance. (K1, K2 & K3)
- 1.3 Statistical quality control - merit, difference between quality control and statistical quality control. (K1, K2 & K3)
- 1.4 Quality assessment - internal and external methods. (K1, K2, K3 & K4)
- 1.5 Total quality management - Six Sigma, 5S- KAIZEN TQM approach. (K1, K2, K3 & K4)
- 1.6 Barrier to total quality management implementation - a case study of TQM. (K1, K2, K3 & K4)

Unit II

- 2.1 Specifications - role of specifications and its benefits. (K1 & K2)
- 2.2 Standards - reasons for developing standards. Difference between standards and specifications. (K1, K2 & K3)
- 2.3 Data Sheets - MSDS, typical specification of industrial chemicals. (K1, K2 & K3)
- 2.4 Specific specifications - colour, flash and fire points, density of liquids and solids, particle size, viscosity, thixotropy, loss on drying and residue on ignition. (K1, K2 & K3)
- 2.5 International standards: ISO 9001 series, ISO 14001, ASTM, FAO, FDA and their functions. (K1, K2, K3 & K4)
- 2.6 National standard developing organizations: ISI, BIS, APEDA, BEE, FSSAI, AGMARK, CDSCO, CPCB and their functions. (K1, K2, K3 & K4)

Unit III

- 3.1 Quality control and testing of food additives in industries - food preservatives - Class I and Class II preservatives - qualitative analysis of Class II preservatives (sodium benzoate and benzoic acid). (K1, K2, K3 & K4)
- 3.2 Food colours - natural and artificial food colours - identification of colours by chromatographic techniques. (K1, K2, K3 & K4)
- 3.3 HACCP - definition, principles, plan, implementing and managing HACCP system. (K1, K2 & K3)
- 3.4 Quality control and testing in textile industries - importance of quality control. (K1, K2 & K3)
- 3.5 Textile testing methods - physical methods - dimension stability test, fabric shrinkage test, tensile strength, bursting strength. (K1, K2 & K3)
- 3.6 Chemical Methods - solubility test, colour fastness properties. Quality standards in textile - handloom mark, wool mark and silk mark. (K1, K2, K3 & K4)

Unit IV

- 4.1 Physico-chemical analysis of water - sampling procedure - analysis of physical parameter - colour, temperature, turbidity. (K1, K2, K3 & K4)
- 4.2 Chemical parameter - pH, conductivity, total hardness, DO, BOD, COD and their measurements. (K1, K2, K3 & K4)
- 4.3 Physico-chemical analysis of soil - sampling procedure - analysis of physical parameter - bulk density, moisture content. (K1, K2, K3 & K4)
- 4.4 Chemical parameter - pH, total nitrogen, available phosphorous, estimation of available S and common metals like Ca, Mg, Na, K and Fe. (K1, K2, K3 & K4)
- 4.5 National ambient air quality standards and permissible limits. (K1, K2 & K3)

- 4.6 Air quality monitoring of particulate matter (PM 10, PM 2.5), SO₂, NO_x, CO and CO₂. (K1, K2, K3 & K4)

Unit V

- 5.1 Good Laboratory Practices (GLP) - definition - 10 GLP principles and their functions. (K1, K2 & K3)
- 5.2 Quality control laboratory - responsibilities, routine control, sampling plans, data generation and storage. (K1, K2 & K3)
- 5.3 Sampling techniques - terms involved - developing the sample plan depending on sample size, location and collection. (K1, K2, K3 & K4)
- 5.4 Preparation of laboratory samples - making homogeneous samples, reducing size, prevention of changes in sample. (K1, K2, K3 & K4)
- 5.5 Protocols for handling chemicals and their disposal. (K1, K2, K3 & K4)
- 5.6 Use of computers and sensors in quality control. (K1, K2 & K3)

Reference Books:

1. Piot Konieczka, Jacek Namiesnik, Quality Assurance and Quality Control in the Analytical Chemical Laboratory: A Practical Approach, CRC Press, First Edition, 2016.
2. G. R. Basotia, Total Quality Management, Mangal Deep Publications, 2001.
3. Marton E. Bader, Practical Quality Management in the Chemical Process Industry, CRC Press, 1983.
4. S. N. Mahindru, Food Additives - Characteristics, Detection and Estimation, APH Publishing, 2009.
5. Manual of methods of Analysis of Food: As Issued by FSSAI, ILBCO India, 2018.
6. Elliot B, Grover D, Hamby S, Handbook of Textile Testing and Quality Control, Textile Book Publishers, 1960.
7. K. Amutha, A Practical Guide to Textile Testing, CRC Press, 2016.
8. S. P. Maharajan, Pollution Control in Process Industries, Tata McGraw-Hill Education, 1985.
9. R. J. Heinsoln and R. L. Kabel, Sources and Control of Air pollution, Prentice Hall, 1999
10. Revised National Ambient Air Quality Standards, 2009.
11. B. S. Dhillon, Applied Reliability and Quality - Fundamentals, Methods and Procedures, Springer, 2007.
12. Allen F. Hirsch, Good Laboratory Practice Regulation, 1989.

Open Educational Resources (OER):

1. <http://indiastandardsportal.org/StandardBodies.aspx>
2. <http://www.inchem.org/documents/ehc/ehc/ehc141.htm#SectionNumber:3.2>
3. <http://ecoursesonline.iasri.res.in/course/view.php?id=185>
4. <https://dst.gov.in/oecd-principles-glp>

SEMESTER II

PECHC20 - ELECTIVE II A: PHARMACEUTICAL CHEMISTRY

Year: I	Course Code PECHC20	Title of the Course Pharmaceutical Chemistry	Course Type Theory	Course Category Core Elective	H/W 5	Credits 4	Marks 100
SEM: II							

Learning Objectives:

- To learn about the drugs, metabolism and the side effects.
- To understand the importance of drug design and development of drugs.
- To know the cancer and the drugs used.
- To learn about the various nutraceuticals and anticoagulants.

Course Outcomes:

The Learners will be able to

1. Classify the pharmaceutical drugs and explain the mechanism of drug action and absorption of drugs.
2. Elaborate the biological role of important inorganic compounds and the drugs used in the treatment of mental disorders.
3. Summarize the methods of drug design and development.
4. Review the causes of cancer and its treatment, and to assess the mechanism and the mode of action of anticancer drugs.
5. Formulate the different types of Nutraceuticals and their applications, and to justify the role of anticoagulants in the treatment of blood disorder.

CO	PSO					
	1	2	3	4	5	6
CO1	H	M	L	H	H	H
CO2	H	M	L	H	H	H
CO3	H	M	L	H	H	H
CO4	H	M	L	H	H	H
CO5	H	M	L	H	H	H

CO	PO					
	1	2	3	4	5	6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

H-High (3), M-Moderate (2), L-Low (1)

Unit I

(15 Hours)

- 1.1 Classification of drugs: biological, chemical, commercial consideration and lay public. (K1, K2, K3, K4, K5 & K6)

- 1.2 Mechanism of drug action and metabolism of drugs - mechanism of action, drug receptors binding, biological responses - covalent bond, hydrogen bond, van der Waal's forces. (K1, K2, K3, K4, K5 & K6)
- 1.3 Metabolism of drugs - chemical pathways - phase I and phase II reactions, biotransformation. (K1, K2, K3, K4, K5 & K6)
- 1.4 Routes of administration of drugs. (K1, K2, K3, K4, K5 & K6)
- 1.5 Absorption of drugs - factors affecting absorption. (K1, K2, K3, K4, K5 & K6)
- 1.6 Digestion and absorption of proteins and fats. (K1, K2, K3, K4, K5 & K6)

Unit II

(15 Hours)

- 2.1 Assay of drugs - chemical, biological, and immunological assay. (K1, K2, K3, K4 & K5)
- 2.2 Psychopharmacology - antipsychotic drugs, phenothiazines, LSD, marijuana. (K1, K2, K3, K4 & K5)
- 2.3 Barbiturates - mechanism of action. (K1, K2, K3, K4 & K5)
- 2.4 Biological role of some inorganic compounds - sodium and potassium and their compounds. (K1, K2, K3, K4 & K5)
- 2.5 Calcium and iodine and their compounds. (K1, K2, K3, K4 & K5)
- 2.6 Copper and zinc and their compounds. (K1, K2, K3, K4 & K5)

Unit III

(15 Hours)

- 3.1 Drug design and development - introduction, discovery of drugs and lead compounds, different approaches to find lead compounds. (K1, K2, K3, K4, K5 & K6)
- 3.2 Development of drugs: Lead modification - pharmacophore modification, modification of structure or functional group, Structure Activity Relationship (SAR) - Prontosil, Streptomycin. (K1, K2, K3, K4, K5 & K6)
- 3.3 Structure modification methodologies to increase potency - homologation, chain branching, ring-chain transformation, extension of structure, isosteres and bioisosteres. (K1, K2, K3, K4, K5 & K6)
- 3.4 Quantitative Structure Activity Relationship (QSAR) - Hammett equation (electronic effects), Taft Equation (steric effects), Hansch equation (lipophilicity effect), Hansch analysis. (K1, K2, K3, K4, K5 & K6)
- 3.5 Craig plot, drug design using QSAR. (K1, K2, K3, K4, K5 & K6)
- 3.6 Computer assisted drug design (CADD). (K1, K2, K3, K4, K5 & K6)

Unit IV

(15 Hours)

- 4.1 Cancer chemotherapy - terms used - types of neoplasms, stages of cancer, metastasis, and difference between cancer and normal cells. (K1, K2, K3, K4 & K5)
- 4.2 Tumor formation mechanism, causes of cancer, ways of reducing the risks. (K1, K2, K3, K4 & K5)
- 4.3 Treatment of cancer - radiation, surgery, chemotherapy, photodynamic therapy (PDT), immunotherapy, combined therapy, actions of antitumor agents. (K1, K2, K3, K4 & K5)
- 4.4 Determination of drug response - growth fraction, the mass doubling time, total tumor burden, tumor heterogeneity, cell cycle phase, drug resistance, host factors. (K1, K2, K3, K4 & K5)
- 4.5 Cytotoxic anticancer drugs - alkylating agents (Mustards) and their modes of action, antimetabolites - folic acid antagonist, purine antagonist and their modes of action. (K1, K2, K3, K4 & K5)

4.6 Pyrimidine agents and their modes of action, antitumor antibiotics and their modes of action, plant products, podophyllotoxins and their modes of action, endocrine agents and their modes of action, miscellaneous anticancer agents. (K1, K2, K3, K4 & K5)

Unit V

(15 Hours)

- 5.1 Nutraceuticals - introduction, types - plant sources. (K1, K2, K3, K4, K5 & K6)
- 5.2 Animal sources, microbial sources, nutraceuticals derived from all sources. (K1, K2, K3, K4, K5 & K6)
- 5.3 Antioxidants - definition, examples, role of antioxidants. (K1, K2, K3, K4, K5 & K6)
- 5.4 Toxins and their medicinal values - introduction, classification of toxins, toxins from reptiles and animals. (K1, K2, K3, K4, K5 & K6)
- 5.5 Toxins from insects, plants, marine origin, and microorganisms. (K1, K2, K3, K4, K5 & K6)
- 5.6 Anticoagulants - blood coagulation pathway, prevention of coagulation, direct and indirect acting anticoagulants, and anticoagulation therapy. (K1, K2, K3, K4, K5 & K6)

Reference Books:

1. V. K. Ahluwalia, Madhu Chopra, Medicinal Chemistry, ANE Books India, 2008.
2. Jayashree Ghosh, Fundamental Concepts of Applied Chemistry, S. Chand Company Ltd., 2nd Edition, 2006.
3. Graham L. Patrick, An Introduction to Medicinal Chemistry, Oxford University Press, 6th Edition, Reprinted 2017.
4. David A. Williams, Foye's Principles of Medicinal Chemistry, Lippincott Williams and Wilkins, 2012.
5. Asuthosh Kar, Medicinal Chemistry, New Age International Publishers, New Delhi, 7th Edition, 2018.
6. N. K. Jain, Progress in Controlled and Novel Drug Delivery Systems, CBS Publishers & Distributors, New Delhi, 2013.
7. P. S. Kalsi and Sangeeta Jagtap, Pharmaceutical, Medicinal and Natural Product Chemistry, Narosa Publishing House, New Delhi, 2013.

OER:

1. <https://opentextbc.ca/anatomyandphysiology/chapter/18-5-hemostasis/>
2. <https://nptel.ac.in/courses/102/106/102106070/>

SEMESTER II

PECHD20 - ELECTIVE II B: MEDICINAL CHEMISTRY

Year:	Course Code	Title of the Course	Course Type	Course Category	H/W	Credits	Marks
I	PECHD20	Medicinal Chemistry	Theory	Core Elective	5	4	100
SEM: II							

Learning Objectives:

- To have a clear understanding about drug designing and the principles involved in it.
- To deepen the knowledge on biochemical considerations of drug designing.

Course Outcomes:

The Learners will be able to

1. Explain the designing of drugs by different approaches.
2. Define the physiochemical properties of drug molecules, and illustrate pharmacophore, toxicophore, metabophore and interchangeable bioisosteres.
3. Describe the nature of drug receptors and their binding interactions.
4. Explain the stereochemical properties and biological activity of drug molecules, and to identify the properties of drug molecules by quantum mechanics and molecular mechanics.
5. Describe the physiological and pathological approaches while designing newer drugs for newer diseases, and to Discuss the biological activity of steroids and radioisotopes.

CO	PSO					
	1	2	3	4	5	6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

CO	PO					
	1	2	3	4	5	6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

H-High (3), M-Moderate (2), L-Low (1)

Unit I

(15 Hours)

- 1.1 Drug design - rational approach and conceptual approach. (K1, K2, K3, K4, K5 & K6)
- 1.2 Practical approach and humanitarian approach. (K1, K2, K3, K4, K5 & K6)
- 1.3 The method of variation. (K1, K2, K3, K4, K5 & K6)
- 1.4 Drug design through disjunction and conjunction. (K1, K2, K3, K4, K5 & K6)
- 1.5 Research and development strategies. (K1, K2, K3, K4, K5 & K6)
- 1.6 Molecular hybridization, rigidity, and flexibility versus drug design, tailoring of drugs. (K1, K2, K3, K4, K5 & K6)

Unit II

(15 Hours)

- 2.1 Definition and properties of drug molecules. (K1, K2, K3, K4 & K5)

- 2.2 Physiochemical properties of drug design. (K1, K2, K3, K4 & K5)
- 2.3 Structural integrity of drug molecules. (K1, K2, K3, K4 & K5)
- 2.4 Pharmaceutical, pharmacokinetics and pharmacodynamic phases. (K1, K2, K3, K4 & K5)
- 2.5 Structural fragments of drug molecules - pharmacophore and toxicophore. (K1, K2, K3, K4 & K5)
- 2.6 Metabophores and interchangeable bioisosteres. (K1, K2, K3, K4 & K5)

Unit III (15 Hours)

- 3.1 The receptor concept - the nature of receptors and criteria for receptor identity. (K1, K2, K3, K4, K5 & K6)
- 3.2 Definitions of drug - receptor binding interactions. (K1, K2, K3, K4, K5 & K6)
- 3.3 Selection of drug - receptor binding forces in drug design. (K1, K2, K3, K4, K5 & K6)
- 3.4 General molecular concepts of drug receptor action, functional molecular properties of drug receptors. (K1, K2, K3, K4, K5 & K6)
- 3.5 Definition of classical binding terms for drug - receptor interactions. (K1, K2, K3, K4, K5 & K6)
- 3.6 The clinical-molecular interface: The concept of rational poly pharmacy - drug-drug interactions in drug design. (K1, K2, K3, K4, K5 & K6)

Unit IV (15 Hours)

- 4.1 Structure and properties of drug molecules. (K1, K2, K3, K4 & K5)
- 4.2 Conformational, topological, and steric properties of drug molecules. (K1, K2, K3, K4 & K5)
- 4.3 Enantiomers and diastereomers of drug molecules. (K1, K2, K3, K4 & K5)
- 4.4 Stereochemistry and biological activity of drug molecules. (K1, K2, K3, K4 & K5)
- 4.5 Electronic properties of drug molecules. (K1, K2, K3, K4 & K5)
- 4.6 Predicting the properties of drug molecules - quantum mechanics and molecular mechanics. (K1, K2, K3, K4 & K5)

Unit V (15 Hours)

- 5.1 Biochemical considerations in drug design - the physiological and pathological approaches. (K1, K2, K3, K4, K5 & K6)
- 5.2 Newer drugs for newer diseases - introduction, newer drugs. (K1, K2, K3, K4, K5 & K6)
- 5.3 Hormone antagonists - anti estrogen - aldosterone antagonists. (K1, K2, K3, K4, K5 & K6)
- 5.4 Anti progestational steroids - cardiac steroids and related inotropic drugs. (K1, K2, K3, K4, K5 & K6)
- 5.5 Cardiac steroids, phosphodiesterase inhibitors, adenylate cyclase stimulants, drugs that enhance the Ca²⁺ sensitivity of myocardial contractile proteins. (K1, K2, K3, K4, K5 & K6)
- 5.6 Radio sensitizer - therapeutic radioisotopes, imaging radioisotopes - drugs to combat AIDS. (K1, K2, K3, K4, K5 & K6)

Reference Books:

1. Thomas Nogrady, Dona Id F. Weaver, Medicinal Chemistry: A Molecular and Biochemical Approach, Oxford University Press, Third Edition, 2005.
2. V. K. Ahluwalia, Madhu Chopra, Medicinal Chemistry, Ane Books India, 2008.
3. D. Sriram, P. Yogeewari, Medicinal Chemistry, Pearson Education, 2007.
4. Asuthosh Kar, Medicinal Chemistry, New Age International Publishers, New Delhi, 7th Edition, 2018.

OER:

1. <http://epj.eg.net/article.asp?issn=1687-4315;year=2013;volume=12;issue=2;spage=95;epage=108;aulast=Kamel;type=3>
2. <https://www.britannica.com/science/steroid/Steroid-numbering-system-and-nomenclature>
3. <https://nptel.ac.in/courses/102/106/102106070/>

SEMESTER II

PICHD20 - IEP - WATER CHEMISTRY

Year:	Course Code	Title of the Course	Course Type	Course Category	H/W Own Pace	Credits	Marks
I SEM: II	PICHD20	Water Chemistry	Theory	Independent Elective		2	100

Learning Objectives:

- To gain a thorough knowledge on the properties of water, water quality monitoring methods and water pollutants.
- To understand the various waste water treatment methods.

Course Outcomes:

The Learners will be able to

1. Explain the physical and chemical properties of water.
2. Describe the instruments used for water quality monitoring.
3. Examine the physical, chemical and biological pollutants in water.
4. Demonstrate the treatment methods used for recycling of waste water.
5. Explain the policies and laws related to water in Indian constitution.

CO	PO					
	1	2	3	4	5	6
CO1	H	H	H	M	H	H
CO2	H	H	H	M	H	H
CO3	H	H	H	M	H	H
CO4	H	H	H	M	H	H
CO5	H	H	H	M	H	H

CO	PSO					
	1	2	3	4	5	6
CO1	H	H	H	H	M	H
CO2	H	H	H	H	M	H
CO3	H	H	H	H	M	H
CO4	H	H	H	H	M	H
CO5	H	H	H	H	M	H

H-High (3), M-Moderate (2), L-Low (1)

Unit I

- 1.1 Elements, radicals, and compounds. (K1 & K2)
- 1.2 Potable drinking water. (K1 & K2)
- 1.3 Sources of water - hardness, definition, types of hardness - temporary & permanent. (K1 & K2)
- 1.4 Chemical water analysis - hydrogen ion concentration and pH, gas solubility. (K1, K2, K3 & K4)
- 1.5 Alkalinity - colloids & coagulation. (K1, K2, K3 & K4)
- 1.6 Organic compounds - organic matter in waste water. (K1 & K2)

Unit II

- 2.1 Boiler feed water - requirements - formation of deposits in steam boilers and heat exchangers. (K1, K2 & K3)
- 2.2 Disadvantages - wastage of fuels, decrease in efficiency and boiler explosion. (K1, K2 & K3)
- 2.3 Water softening methods - external treatment - ion-exchange method, activated charcoal method & zeolite method. (K1, K2 & K3)

- 2.4 Internal treatment - boiler compounds (phosphate, calgon, carbonate, colloidal methods) - caustic embrittlement. (K1, K2 & K3)
- 2.5 Water quality monitoring instruments - types of water quality instruments - pH meter, conductivity meter, DO meter, turbidity meter, BOD incubator, COD meter. (K1, K2 & K3)
- 2.6 Nephelometer - turbidity, GC - volatile organics, AAS - metal pollutants. (K1, K2 & K3)

Unit III

- 3.1 Water pollution: Physical examination of water - colour, conductivity, temperature, odour, taste, turbidity & hardness. (K1, K2 & K3)
- 3.2 Chemical characterization of water - calcium, magnesium, sodium, potassium, chlorine, sulphate, carbonates, bicarbonates, and solids. (K1, K2 & K3)
- 3.3 Minor elements of water - fluorine, iron, manganese, silica, and nitrogen elements. (K1, K2 & K3)
- 3.4 Biological investigation of water - deoxygenation - dissolved oxygen in water, biological oxygen demand and chemical oxygen demand - algal toxins. (K1, K2, K3 & K4)
- 3.5 Water pollution. (K1 & K2)
- 3.6 Water borne diseases. (K1 & K2)

Unit IV

- 4.1 Introduction - characteristics of waste water - nutrient content and controls - toxicity evaluation. (K1, K2 & K3)
- 4.2 Recovery of aluminium by liquid ion exchangers - removal of iron as its chelated complex with plants. (K1, K2 & K3)
- 4.3 Treatment of waste water for reuse - membrane based filtration - microfiltration, ultra filtration, desalinization of brackish water - reverse osmosis, nanofiltration, electrolysis, electro dialysis and electro oxidation - method, diagram and advantages. Biosensors in water monitoring. (K1, K2, K3 & K4)
- 4.4 Recycle and reuse of treated waste water - recycling and reuse of distillery waste water. (K1, K2 & K3)
- 4.5 Recycling of waste water - status in India - reuse of water. (K1, K2, K3, K4 & K5)
- 4.6 Health guidelines before reuse of waste water - health protection - recycled water - use in metropolitan cities. (K1, K2, K3, K4 & K5)

Unit V

- 5.1 Water and the Constitution of India. (K1, K2 & K3)
- 5.2 Inter-state Water Disputes Act-1956 - difficulties and solution. The Cauvery Water Dispute. . (K1, K2 & K3)
- 5.3 The story of the National Water Policy-1987. (K1, K2, K3 & K4)
- 5.4 The Water Prevention and Control of Pollution Act-2003 and the National Water Policy-2012. (K1, K2, K3 & K4)
- 5.5 National Rain-fed Authority, Inland Waterways Authority of India, Central Ground Water Authority, Central Pollution Control Board. (K1, K2, K3, K4 & K5)
- 5.6 National Water Resources Council, Integrated Watershed Management Programme, National Rural Drinking Water Programme. (K1, K2, K3, K4, K5 & K6)

Reference Books:

1. S. M. Khopkar, Environmental pollution monitoring and control, New age International Publishers, Second Edition, 2015.
2. N. F. Gray, Water Technology - An Introduction for Environmental Scientists and Engineers, Butterworth – Heinemann An imprint of Elsevier, Second Edition, 2006.
3. Mark J. Hammer, Mark J. Hammer Jr, Water and waste water Technology, Asoke K Ghosh Publishers, Third Edition, 2000.
4. Ramaswamy R. Iyer, Water, Perspectives, Issues, Concerns, Sage publications, 2008.
5. Jain & Jain, Engineering Chemistry, Dhanpat Rai Publishing Company, 17th Edition, 2015.
6. B. K. Sharma, Engineering Chemistry, Krishna's Educational Publishers, 2014.
7. A. Ravikrishnan, Engineering Chemistry, Sri Krishna Hitech Publishing Company Pvt. Ltd., 2017.

OER:

1. <http://cwc.gov.in/sites/default/files/constitutional-provisions-and-central-water-laws.pdf> (Provisions and laws)
2. <http://epgp.inflibnet.ac.in/Home/ViewSubject?catid=14> (Prevention and control of pollution act)
3. <http://epgp.inflibnet.ac.in/Home/ViewSubject?catid=5> (Water quality standards)

SEMESTER III

PECHE20 - ELECTIVE III A: ANALYTICAL CHEMISTRY

Year:	Course Code	Title of the Course	Course Type	Course Category	H/W	Credits	Marks
II SEM: III	PECHE20	Analytical Chemistry	Theory	Core Elective	5	5	100

Learning Objectives:

- To study in detail the different types of chromatographic techniques and their applications.
- To give an in-depth knowledge on environmental chemistry and its impacts.
- To understand the applications of computers in chemistry.

Course Outcomes:

The Learners will be able to

1. Compare different thermal methods of analysis and explain their applications in material science.
2. Elaborate the principle, instrumentations of the Gas, HPLC and SCF chromatographic techniques and their applications.
3. Examine the identification of metal ions using AAS and photo acoustic spectroscopy.
4. Solve simple problems in chemistry using 'C' program.
5. Analyze the importance of Green Chemistry and its impact on the sustainable environment and the quality of water.

CO	PSO					
	1	2	3	4	5	6
CO1	H	M	L	H	H	H
CO2	H	M	L	H	H	H
CO3	H	M	L	H	H	H
CO4	H	M	L	H	H	H
CO5	H	M	L	H	H	H

CO	PO					
	1	2	3	4	5	6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

H-High (3), M-Moderate (2), L-Low (1)

Unit I

(15 Hours)

- 1.1 Thermal Analysis - Thermo Gravimetric Analysis (TGA) - principle, instrumentation, thermogravimetric curves of $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$, MgCr_2O_4 , Hg_2CrO_4 , Ag_2CrO_4 , AgNO_3 and $\text{Cu}(\text{NO}_3)_2$. (K1, K2, K3, K4, K5 & K6)
- 1.2 Factors affecting TGA, applications of TGA. (K1, K2, K3, K4, K5 & K6)
- 1.3 DTG - principles, comparison of DTG & TGA. (K1, K2, K3, K4, K5 & K6)
- 1.4 Differential Thermal Analysis (DTA) - principle, instrumentation, simultaneous TGA and DTA curves and applications. (K1, K2, K3, K4, K5 & K6)
- 1.5 Differential Scanning Calorimetry (DSC) - principle, instrumentation and applications. (K1, K2, K3, K4, K5 & K6)
- 1.6 Thermometric titrations - principle, instrumentation and applications. (K1, K2, K3, K4, K5 & K6)

Unit II

(15 Hours)

- 1.1 Chromatographic techniques: Gas Chromatography, principle, types, instrumentation with block diagram - carrier gas, sample injection system, column, thermal compartment, detectors, recorder. (K1, K2, K3, K4 & K5)
- 1.2 Applications of GC. ((K1, K2, K3, K4 & K5)
- 1.3 High Pressure Liquid Chromatography (HPLC) - principle, characteristics of HPLC. (K1, K2, K3, K4 & K5)
- 1.4 Instrumentation, applications, comparison of HPLC with GLC. (K1, K2, K3, K4 & K5)
- 1.5 Super Critical Fluid Chromatography (SCFC) - principle, properties, instrumentation. (K1, K2, K3, K4 & K5)
- 1.6 Comparison with other types of chromatography, super critical fluid extraction and applications. (K1, K2, K3, K4 & K5)\

Unit III

(15 Hours)

- 3.1 Atomic absorption spectrometry - principle, difference between AAS and AES, measurement of absorption. (K1, K2, K3, K4, K5 & K6)
- 3.2 Instrumentation with block diagram - radiation source, atomization unit, oxidizing agents, flame and non-flame atomizer, burners, monochromators, detectors, and amplifier and readout devices. (K1, K2, K3, K4, K5 & K6)
- 3.3 Interferences in AAS - spectral, chemical, ionization, dissociation of metal compounds, effect of solvent. (K1, K2, K3, K4, K5 & K6)
- 3.4 Differences between atomic absorption and emission methods, advantages and disadvantages of atomic emission spectroscopy, advantages of AAS over flame emission spectroscopy, disadvantages of AAS. (K1, K2, K3, K4, K5 & K6)
- 3.5 Applications of AAS, some typical analysis like determination of metals like Na, K, Ca and Mg in blood serum, lead in petrol, metals in food stuff. (K1, K2, K3, K4, K5 & K6)
- 3.6 Photo acoustic spectroscopy: Principle, instrumentation with block diagram and applications. (K1, K2, K3, K4, K5 & K6)

Unit IV**(15 Hours)**

- 4.1 Computers in Chemistry - introduction to computers - types of computers, hardware, software, types of software and programming languages - implementation and uses. (K1, K2, K3, K4 & K5)
- 4.2 C-Programming - definition, types of variables with examples, constant - definition, types with examples, C-operators - classification with examples. (K1, K2, K3, K4 & K5)
- 4.3 Input and output functions, control statement, loop, go to statement - functions, arrays and pointers. (K1, K2, K3, K4 & K5)
- 4.4 Calculation of pH, solubility product, calculation of bond energy using Born-Landé equation. (K1, K2, K3, K4 & K5)
- 4.5 Internet: Introduction to internet service providers in India, terms used in internet, www, http, html, TCP/IP band width, dialup service. (K1, K2, K3, K4 & K5)
- 4.6 ISDN and search engines. (K1, K2, K3, K4 & K5)

Unit V**(15 Hours)**

- 5.1 Environmental chemistry: Water quality standards - BOD, COD, TDS, TSS & TS. (K1, K2, K3, K4, K5 & K6)
- 5.2 Analysis of waste water and its treatment. (K1, K2, K3, K4, K5 & K6)
- 5.3 Salinity of water and its treatment - Reverse Osmosis. (K1, K2, K3, K4, K5 & K6)
- 5.4 Toxic chemicals in environment - toxicity of mercury, lead, chromium, arsenic. (K1, K2, K3, K4, K5 & K6)
- 5.5 Green chemistry - principle, conditions followed in green synthesis. (K1, K2, K3, K4, K5 & K6)
- 5.6 Carbon-carbon bond formation in aldol condensations like silyl enol ethers in aqueous media, solid phase, supercritical water and asymmetric aldol condensation. (K1, K2, K3, K4, K5 & K6)

Reference Books:

1. H. Kaur, Instrumental Methods of Chemical Analysis, Pragati Prakashan, Meerut, 3rd Edition, 2010.
2. B. K. Sharma, Instrumental Methods of Chemical Analysis, Krishna Prakashan Media (P) Ltd., 2014.
3. Y. Anjaneyulu, K. Chandrasekhar, Valli Manickam, A Textbook of Analytical Chemistry, Pharma Book Syndicate, Hyderabad, 2019.
4. V. K. Ahluwalia, Strategies for green organic synthesis, Ane Books Pvt. Ltd., New Delhi, 2012.
5. Willard Merritt, Dean Settle, Instrumental Methods of Analysis, CBS Publishers and Distributors, New Delhi, 7th Edition, 2018.
6. Skoog, Holler, Nieman, Principles of Instrumental Analysis, Thomson Books, United Kingdom, 5th Edition, 2005.
7. Skoog, West, Holler, Rouch, Fundamentals of Analytical Chemistry, Brooks/ Cole Cengage Learning, 9th Edition, 2013.
8. Jag Mohan, Organic Analytical Chemistry Theory and Practice, Narosa Publishing House, New Delhi, 2014.
9. A. K. De, Environmental Chemistry, New Age International Publishers, New Delhi, 7th Edition, 2010.

10. G. S. Sodhi, Fundamental Concept of Environmental Chemistry, Narosa Publishing House, 3rd Edition, New Delhi, 2013.
11. S. S. Dara, A Textbook of Environmental Chemistry and Pollution Control, S. Chand and Company Ltd., New Delhi, 2004.
12. S. M. Khopkar, Basic Concept of Analytical Chemistry, New Age International (P) Ltd. Publishers, New Delhi, 3rd Edition, 2008.
13. G. I. David Krupadanan, D. Vijaya Prasad, K. Varaprasad Rao, K. L. N. Reddy, C. Sudhakar, Analytical Chemistry, University Press, Hyderabad, Andhra Pradesh, 2001.
14. K. V. Raman, Computers in Chemistry, Tata McGraw-Hill, New Delhi, 2013.
15. Krishnan Kannan, Environmental Chemistry, Chand and Co. Ltd., 1995.
16. M. S. Yadav, Instrumental Methods of Chemical Analysis, Campus Books International, 2006.
17. A.K. Srivatasava, P.C. Jain, Instrumental Approach to Chemical Analysis, S. Chand & Company, 2010

OER:

1. <https://www.americanpharmaceuticalreview.com/Featured-Articles/36776-Thermal-Analysis-A-Review-of-Techniques-and-Applications-in-the-Pharmaceutical-Sciences/>
2. <https://nptel.ac.in/content/storage2/courses/102103044/pdf/mod5.pdf>
3. <https://www.iitk.ac.in/che/pdf/resources/AAS-GTA-reading-material.pdf>
4. <https://www.epa.gov/greenchemistry/basics-green-chemistry>

SEMESTER IV

PECHH20 - ELECTIVE IVB: ORGANIC FARMING AND SOLID WASTE

MANAGEMENT

Year: II SEM: IV	Course Code PECHH20	Title of the Course Organic Farming and Solid Waste Management	Course Type Theory	Course Category Core Elective	H/W 5	Credits 4	Marks 100
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Learning Objectives:

- To understand the importance of solid waste management.
- To learn about hazardous waste management.
- To get a thorough knowledge on the concept of organic farming, components and practices.

Course Outcomes:

The Learners will be able to

1. Elaborate the concept of organic farming.
2. Explain the vision and importance of organic farming movements, apply vermicomposting process and prepare bio-fertilizers.
3. Evaluate the technology to approach the benefits of organic farming.
4. Explain the various aspects of solid waste management.
5. Demonstrate the methods to reduce hazards.

CO	PSO					
	1	2	3	4	5	6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

CO	PO					
	1	2	3	4	5	6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

H-High (3), M-Moderate (2), L-Low (1)

Unit I (15 Hours)

- 1.1 Organic farming - concepts, relevance of organic farming to Indian agriculture. (K1, K2, K3, K4, K5 & K6)
- 1.2 Effects of green revolution, adverse effects of continuous use of chemicals. (K1, K2, K3, K4, K5 & K6)
- 1.3 Categories of organic farming, organic vs natural farming. (K1, K2, K3, K4, K5 & K6)
- 1.4 Essential characteristics of organic farming. (K1, K2, K3, K4, K5 & K6)
- 1.5 Key principles in organic farming system - components of organic farming systems. (K1, K2, K3, K4, K5 & K6)
- 1.6 Management of organic farming - research needs. (K1, K2, K3, K4, K5 & K6)

Unit II (15 Hours)

- 2.1 Principles and practices of organic farming. (K1, K2, K3, K4 & K5)
- 2.2 The vision and importance of organic farming movements. (K1, K2, K3, K4 & K5)
- 2.3 Guidelines for organic production system - organic farming practices - bulky organic manures. (K1, K2, K3, K4 & K5)
- 2.4 Role of micro-organisms (bio-fertilizers) in organic farming. (K1, K2, K3, K4 & K5)
- 2.5 Vermitechnology. (K1, K2, K3, K4 & K5)
- 2.6 Research advances in organic farming. (K1, K2, K3, K4 & K5)

Unit III (15 Hours)

- 3.1 Benefits of organic farming. (K1, K2, K3, K4, K5 & K6)
- 3.2 Nutritional values of organic foods. (K1, K2, K3, K4, K5 & K6)
- 3.3 Health benefits of organic foods. (K1, K2, K3, K4, K5 & K6)
- 3.4 SREP approach for promoting organic farming. (K1, K2, K3, K4, K5 & K6)
- 3.5 Use of organic practices in enhancing crop productivity. (K1, K2, K3, K4, K5 & K6)
- 3.6 Participatory technology development in organic farming. (K1, K2, K3, K4, K5 & K6)

Unit IV (15 Hours)

- 4.1 Solid Waste Management - introduction. (K1, K2, K3, K4 & K5)
- 4.2 Classification of solid wastes. (K1, K2, K3, K4 & K5)
- 4.3 Mismanagement and side effects. (K1, K2, K3, K4 & K5)
- 4.4 Physical and chemical characteristics. (K1, K2, K3, K4 & K5)
- 4.5 Waste collection, storage and transport. (K1, K2, K3, K4 & K5)
- 4.6 Waste disposal - types - composting, incineration, bio gasification. (K1, K2, K3, K4 & K5)

Unit V (15 Hours)

- 5.1 Plastics, bio medical and hazardous waste management. (K1, K2, K3, K4, K5 & K6)
- 5.2 Various types of plastics - plastic recycling and the environment. (K1, K2, K3, K4, K5 & K6)
- 5.3 Guidelines for the plastic waste hazards control. (K1, K2, K3, K4, K5 & K6)
- 5.4 Sources of biomedical waste - pathological waste, pharmaceutical wastes, genotoxic wastes, chemical wastes, radioactive wastes. (K1, K2, K3, K4, K5 & K6)
- 5.5 Measures to reduce hazards. (K1, K2, K3, K4, K5 & K6)
- 5.6 Household hazardous waste management - precautions, disposal, waste minimization. (K1, K2, K3, K4, K5 & K6)

References Books:

1. L. V. Hirevenkanagoudar, Extension Strategies for Promotion of Organic Farming, Agrotech Publishing Academy, 2007.
2. B. B. Hosetti, Prospects and Perspectives of Solid Waste Management, New Age International Publishers, 2006.
3. A. Kamala, D. L. Kanth Rao, Environmental Engineering, Water Supply, Sanitary Engineering and Pollution, Tata McGraw-Hill Publishing Ltd., New Delhi, 13th Reprint, 2002.
4. S. S. Dara, A Textbook of Environmental Chemistry and Pollution Control, S. Chand & Company Ltd., 7th Edition, 2004.
5. B. K. Sharma, Environmental Chemistry, Goel Publishing House, Meerut, 2005.

OER:

1. http://agritech.tnau.ac.in/org_farm/orgfarm_introduction.html
2. <https://www.nationalgeographic.com/environment/future-of-food/organic-farming-crops-consumers/>
3. <https://www.britannica.com/topic/organic-farming>
4. <https://www.conserve-energy-future.com/sources-effects-methods-of-solid-waste-management.php>
5. https://ec.europa.eu/echo/files/evaluation/watsan2005/annex_files/WEDC/es/ES07CD.pdf
6. https://www.geo.lu.lv/fileadmin/user_upload/lu_portal/projekti/gzzf/videunilgtspejiga_attistiba/VidZ1000/16.LECTURE-Solid_waste_management.pdf
7. <http://www.indiaenvironmentportal.org.in/files/file/municipal%20solid%20waste%20management.pdf>

SEMESTER IV

PICHJ20 - IEP - LEATHER CHEMISTRY

Year: II SEM: IV	Course Code PICHJ20	Title of the Course Leather Chemistry	Course Type Theory	Course Category Independent Elective	H/W Own Pace	Credits 2	Marks 100
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Learning Objectives:

The Learners will be able

- To acquire technical competence on leather manufacturing with eco -friendly and sustainable approach.
- To develop indigenous and adaptable technologies related to leather for small scale production and to develop entrepreneurial skills, towards betterment of society.
- To develop state-of-art facilities for testing and consultancy for leather industries.

Course Outcomes:

The Learners will be able to

1. Outline the tanning processes in leather industry.
2. Discuss the cleaner technology in leather industry.
3. Illustrate the chrome tanning process.
4. Outline the mechanism of tanning and role of surface charge and importance of electrostatic, H-bond, dipole-dipole and hydrophobic interactions.
5. Apply waste water management and zero discharge approaches in leather industry.

CO	PSO					
	1	2	3	4	5	6
CO1	H	M	H	H	L	M
CO2	H	H	M	H	L	M
CO3	H	M	H	H	M	H
CO4	H	H	H	H	M	H
CO5	H	H	H	H	M	H

CO	PO					
	1	2	3	4	5	6
CO1	H	H	H	H	H	H
CO2	H	H	H	H	H	H
CO3	H	H	H	H	H	H
CO4	H	H	H	H	H	H
CO5	H	H	H	H	H	H

H-High (3), M-Moderate (2), L-Low (1)

Unit I

- 1.1 Raw materials, stages in the leather processing. (K1 & K2)
- 1.2 Pre-tanning operations - soaking, liming, deliming, bating, pickling, degreasing. (K1 & K2)
- 1.3 Tanning process - chrome tanning, vegetable tanning. (K1 & K2)
- 1.4 Post-tanning operations - rechroming of wet blue leathers, neutralization. (K1 & K2)
- 1.5 Retanning, dyeing and fatliquoring. (K1 & K2)
- 1.6 Drying and finishing. (K1 & K2)

Unit II

- 2.1 Environmental challenges in leather industries. (K1 & K2)
- 2.2 Cleaner technology options - curing, air drying, frame drying, freezing, chemical methods, biocides for curing and control drying. (K1 & K2)
- 2.3 Desalting, soaking after desalting. (K1 & K2)
- 2.4 Liming and unhairing. (K1 & K2)
- 2.5 Advantages of sulphide free unhairing system by using dehairing process, advantages of less sulphide unhairing system, and advantages of sulphide lime unhairing system. (K1 & K2)
- 2.6 Delimiting and bating. (K1 & K2)

Unit III

- 3.1 Chrome tanning - method of chrome tannage, masking principle of masking, effect of masking on chrome tannage. (K1 & K2)
- 3.2 Influence of reducing agent on nature of chrome complexes. (K1 & K2)
- 3.3 Mechanism of chrome tanning, variable parameters of chrome tanning. (K1 & K2)
- 3.4 Wet finishing operations - rechroming, neutralization, retanning, dyeing, fatliquoring and finishing. (K1 & K2)
- 3.5 Chrome management options - chrome recovery and reuse - partial replacement of chrome tanning agent by other tanning agents. (K1 & K2)
- 3.6 High exhaust tanning systems - closed loop tanning systems. (K1 & K2)

Unit IV

- 4.1 Mechanism of tanning - transport of tanning materials into pelt. (K1 & K2)
- 4.2 Role of surface charge and importance of electrostatic, H-bond, dipole-dipole and hydrophobic interactions. (K1 & K2)
- 4.3 Theory of finishing with special emphasis to optical properties of pigments and binders. (K1 & K2)
- 4.4 Diffusion equilibria and mechanism of vegetable, mineral and combination tannages. (K1 & K2)
- 4.5 Role of crosslinking in leather finishing. (K1 & K2)
- 4.6 Fibre coating in matrix stability. (K1 & K2)

Unit V

- 5.1 Quality control in leather processing. (K1 & K2)
- 5.2 Tannery effluents, effluent disposal, types of effluent disposal. (K1 & K2)
- 5.3 Recovery and reuse of water in tanning industry, utilization of treated effluents. (K1 & K2)
- 5.4 Productivity and quality consistency. (K1 & K2)
- 5.5 Waste water management and zero discharge approaches. (K1 & K2)

5.6 Energy audit and environmental footprints. (K1 & K2)

Reference Books:

1. P. S. Briggs, Gloving, clothing and special leathers, Tropical Products Institute, London, 1981.
2. J. H. Sharphouse, Leather Technicians Hand Book, Leather Producers Association, Northampton NN3 1 JD, Reprinted 1995.
3. O. Flaherty, William T. Roddy and Robert M. Lollar, The Chemistry and Technology of Leather, Vol. 1, Preparation for tannages, EL. Robert Krieger Publishing Company, New York, 1978.
4. Bienkiewicz, Physical Chemistry of Leather Making, Krieger Publishing Co., Florida, 1982.
5. D. Covington, Tanning Chemistry: The Science of Leather, Royal Society of Chemistry, 2009.

OER:

1. <http://wwwchem.uwimona.edu.jm/courses/CHEM2402/Textiles/Leather.html>
2. https://www.researchgate.net/publication/337720281_Leather_Processing_Its_Effects_on_Environment_and_Alternatives_of_Chrome_Tanning
3. <https://www.iloencyclopaedia.org/component/k2/item/872-tanning-and-leather-finishing>
4. https://shodhganga.inflibnet.ac.in/bitstream/10603/7476/10/10_chapter%201.pdf
5. https://www.researchgate.net/publication/337720281_Leather_Processing_Its_Effects_on_Environment_and_Alternatives_of_Chrome_Tanning
6. https://shodhganga.inflibnet.ac.in/bitstream/10603/75047/14/14_chapter%206.pdf
7. <http://en.kimyasal.boun.edu.tr/webpages/courses/leathertechnology/deri16.htm>
8. https://www.researchgate.net/publication/223418622_Reducing_the_environmental_impact_of_the_unhairing-liming_process_in_the_leather_tanning_industry
