

**AUXILIUM COLLEGE (AUTONOMOUS)****VELLORE****M.Sc. CHEMISTRY****Curriculum Development – Entrepreneurial Needs****SEMESTER I****PICHB20 - IEP - QUALITY CONTROL AND CHEMICAL ANALYSIS**

<b>Year:</b> I <b>SEM:</b> I	<b>Course Code</b> PICHB20	<b>Title of the Course</b> Quality Control and Chemical Analysis	<b>Course Type</b> Theory	<b>Course Category</b> Independent Elective	<b>H/W Own Pace</b>	<b>Credits</b> 2	<b>Marks</b> 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)
- 3.1 Textile testing methods - physical methods - dimension stability test, fabric shrinkage test, tensile strength, bursting strength. (K1, K2 & K3)
- 3.2 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), SO<sub>2</sub>, NO<sub>x</sub>, CO and CO<sub>2</sub>. (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>

**PECHH20 - ELECTIVE IVB: ORGANIC FARMING AND SOLID WASTE  
MANAGEMENT**

<b>Year:</b> II	<b>Course Code</b> PECHH20	<b>Title of the Course</b> Organic Farming and Solid Waste Management	<b>Course Type</b> Theory	<b>Course Category</b> Core Elective	<b>H/W</b> 5	<b>Credits</b> 4	<b>Marks</b> 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, 13<sup>th</sup> Reprint, 2002.
4. S. S. Dara, A Textbook of Environmental Chemistry and Pollution Control, S. Chand & Company Ltd., 7<sup>th</sup> 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](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](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](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:	Course Code	Title of the Course	Course Type	Course Category	H/W Own Pace	Credits	Marks
II SEM: IV	PICHJ20	Leather Chemistry	Theory	Independent Elective		2	100

### 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](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](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](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](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-limiting\\_process\\_in\\_the\\_leather\\_tanning\\_industry](https://www.researchgate.net/publication/223418622_Reducing_the_environmental_impact_of_the_unhairing-limiting_process_in_the_leather_tanning_industry)