

INSTITUTE	FACULTY OF SCIENCE
PROGRAM	BACHELOR OF SCIENCE (CHEMISTRY)
SEMESTER	5
COURSE TITLE	LABORATORY - V
COURSE CODE	02CY0309
COURSE CREDITS	6

Objective:

- 1 To equip students with the necessary skills to conduct experiments, analyse data, and interpret results accurately and to demonstrate the practical application of theory covered within the scope of Chemistry

Course Outcomes: After completion of this course, student will be able to:

- 1 In order to maintain a safe working environment, students will follow safety protocols and procedures, recognizing potential dangers, reducing risks, and reacting appropriately to crises
- 2 Students will be able to learn and develop different practical skills in Chemistry
- 3 Students will use the theoretical knowledge they have learned in lectures to plan experiments, evaluate information, and make decisions in a lab setting

Pre-requisite of course: Students having a background in the science stream with a focus on chemistry.

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
0	0	12	0	0	0	50	50
Contents : Unit	Topics						Contact Hours
Total Hours							

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	Inorganic & Industrial Chemistry Experiments 1. Aim: Qualitative analysis of given unknown inorganic salt.[Six radicals, mixture 1, 2. Aim: Qualitative analysis of given unknown inorganic salt.[Six radicals, mixture 2], 3. Aim: Qualitative analysis of given unknown inorganic salt.[Six radicals, mixture 3], 4 . Aim: Qualitative analysis of given unknown inorganic salt.[Six radicals, mixture 4], 5. Aim: Qualitative analysis of given unknown inorganic salt.[Six radicals, mixture 5], 6. Aim: Qualitative analysis of given unknown inorganic salt.[Six radicals, mixture 6], 7. Aim: Qualitative analysis of given unknown inorganic salt.[Six radicals, mixture 7], 8. Aim: Qualitative analysis of given unknown inorganic salt.[Six radicals, mixture 8] ,9. Aim: Qualitative analysis of given unknown inorganic salt.[Six radicals, mixture 9], 10. Aim: Qualitative analysis of given unknown inorganic salt.[Six radicals, mixture 10], 11. To determine the amount of Ni 2+ in the given NiSO 4 .7H 2 O solution using 0.01M EDTA solution. (Direct and Back titration method), 12. To determine the amount of Mg 2+ and Pb 2+ in the given solution containing a mixture of Mg 2+ and Pb 2+ using 0.01M EDTA solution	30
2	Organic Chemistry Experiments 1. Organic Qualitative Analysis – Identification of Unknown Compounds in a Mixture 2. Synthesis of Aspirin (Acetylsalicylic Acid) React salicylic acid with acetic anhydride in presence of H ₂ SO ₄ . 3. Preparation of Ibuprofen (Anti-inflammatory Drug) Synthesis through Friedel-Crafts Acylation followed by reduction. 4. Synthesis of Paracetamol (Acetaminophen) Acetylation of p-aminophenol with acetic anhydride. 5. Preparation of Methyl Orange (Azo Dye Synthesis) Diazotization of sulfanilic acid and coupling with dimethylaniline. 6. Synthesis of Malachite Green Dye Condensation of benzaldehyde and dimethylaniline in acidic medium. 7. Preparation of Benzophenone (Friedel-Crafts Acylation)React benzene with benzoyl chloride in presence of AlCl ₃ . 8. Synthesis of Benzimidazole (Heterocyclic Compound) React o-phenylenediamine with formic acid. 9. Preparation of Dibenzalacetone (Claisen-Schmidt Condensation) React benzaldehyde with acetone in basic medium. 10. Extraction of Citral (Terpenoid) from Lemongrass Oil 11. Steam distillation and purification of citral from lemongrass. 12. Extraction of caffeine from tea leaves	30

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
3	Physical Chemistry Experiments 1. To determine the hydrolysis constant of sodium acetate by pH meter. 2. To determine the cell constant of a given conductivity bridge. 3. To find out the constant of the given cell by conductometer method and determine the normality of xN HCl and g/litre. 4. To determine the unknown concentration of sulphuric acid and acetic acid in a given mixture by pH meter. 5. To determine the concentration of strong acid and weak acid in a beaker mixture conductometrically. 6. To determine the normality of HCl and acetic acid in a mixture with the help of 0.1N NaOH solution using potentiometer. 7. To determine the concentration of given KMnO ₄ solution by verifying the Beer's law using colorimeter. 8. Determination of Relative Viscosity of A, B, C, D Using an Ostwald Viscometer. 9. To determine the normality and dissociation constant of xN Oxalic acid by potentiometric titration. 10. To find out the entropy of vaporization of given liquid by plotting a graph between log (1/time) v/s (1/Temperature). 11. To determine the distribution coefficient of iodine between CCl ₄ and water at room Temperature. 12. To investigate the adsorption of oxalic acid from aqueous solution by activated charcoal and examine the validity of adsorption isotherm.	30
4	Analytical Chemistry Experiments 1. Estimation of Cu ²⁺ and CuSO ₄ .5H ₂ O in the given CuSO ₄ .5H ₂ O using 0.05 N Na ₂ S ₂ O ₃ .5H ₂ O solution. 2. To determine the amount of Ni ²⁺ in the given NiSO ₄ .7H ₂ O solution using 0.01 M EDTA solution. 3. Determination of % purity of H ₂ O ₂ by iodometry. 4. To determine by iodimetric method the amount of As ³⁺ and As ₂ O ₃ in the given As ₂ O ₃ using 0.05 M Na ₂ S ₂ O ₃ .5H ₂ O solution. 5. Determination of the Chloride Content in the supplied water sample using Mohr's Method. 6. Determination of chlorine in the given sample by iodometry. 7. Estimation of Pb ²⁺ and Ca ²⁺ mixtures using EDTA as a complexing agent. 8. Estimation of Ni ²⁺ and Cu ²⁺ mixtures using EDTA as a complexing agent. 9. Estimation of Zn ²⁺ and Ca ²⁺ mixtures using EDTA as a complexing agent. 10. Estimation of Bi ³⁺ and Pb ²⁺ mixtures using EDTA as a complexing agent. 11. Determination of total, permanent and temporary hardness of water by complexometry. 12. To determine the chemical oxygen demand of given sample.	30
Total Hours		120

Textbook :

- 1 Vogel's Textbook of Practical Organic Chemistry, A.I. Vogel, A.R. Tatchell, Prentice Hall, 1989
- 2 Textbook of quantitative chemical analysis, G. H. Jeffery J. Bassett J. Mendham R C. Denney, John Wiley & Sons, 1989

Textbook :

- 3 Experimental Physical Chemistry: A Laboratory Textbook, Arthur Halpern and George McBane, W.H. Freeman & Co Ltd, 2006
- 4 An Advanced Course in Practical Chemistry, A. K. Nad, B. Mahapatra and A. Ghoshal, New Central Book Agency (P) Ltd, 2022

References:

- 1 Vogel's Qualitative Inorganic Analysis (7th Edition), Vogel's Qualitative Inorganic Analysis (7th Edition), G. Svehla, Dorling Kindersley (India) Pvt. Ltd, 2009
- 2 Practical in Physical Chemistry, Practical in Physical Chemistry, P S Sindhu, Macmillan, 2005
- 3 Environmental microbiology : a laboratory manual, Environmental microbiology : a laboratory manual, I.L. Pepper, C.P. Gerba ; photography and technical editor, K.L. Josephson, Amsterdam ; Boston, Elsevier Academic Press, 2005
- 4 Analytical Chemistry Lab Manual, Analytical Chemistry Lab Manual, Binyomin Abrams, Hunt Publishing Co, 2019
- 5 Vogel's Textbook of Practical Organic Chemistry, Vogel's Textbook of Practical Organic Chemistry, FURNISS , Pearson India, 2003

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative
10.00	20.00	30.00	30.00	10.00	0.00

Instructional Method:

- 1 Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
- 2 Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.
- 3 Use of hazardous/toxic chemicals should be avoided as far as possible in laboratory.
- 4 All students in the laboratory must wear lab coats during lab session.
- 5 During practical and experimental section student must wear shoes to avoid accidents cause by spilling or rush handling of acidic chemicals (Especially during inorganic estimation experiments).

Supplementary Resources:

- 1 <http://ocw.mit.edu/courses/chemistry/>
- 2 <https://www.youtube.com/watch?v=FUo428guKt0>
- 3 <https://www.youtube.com/watch?v=qPjGbrd4nJw>

Supplementary Resources:

- 4 <https://www.youtube.com/watch?v=3WvrzQceIso>
- 5 <https://www.youtube.com/watch?v=oqSGrRzd0mI>
- 6 <https://www.youtube.com/watch?v=4UH9ciVrCes>
- 7 <https://www.youtube.com/watch?v=0nKiVn1jcqg>
- 8 <https://www.youtube.com/watch?v=zo8-LToVuFk>
- 9 <https://www.youtube.com/@sdchemistryacademy-b.sc.526>