

Subject Code: 02CY0304
Subject Name: Analytical Chemistry
B.Sc. Sem - V
Objectives:

- To study the errors and statics
- To make students capable of understanding in the basics of environmental chemistry.
- To study the types of titration and classical methods of analysis
- To brief study analytical technique i.e. chromatography

Credits Earned: 6 Credits

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

- Understand the concepts errors and statics.
- Be aware of the basics of environmental chemistry and its effect on nature.
- Obtain the information regarding titration and methods of analysis.
- Understand the basic of chromatography method.

Pre-requisite of course: To get more insightful knowledge for this course student will have a rough idea about environment, analytical techniques and various analysis methods.

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	IA	CSE	Viva (V)	Term Work (TW)	
5	-	2	6	50	30	20	25	25	150

Contents

Unit	Topics	Contact Hours
1	Errors and statistics: Introduction, Types of errors, Method for minimization of errors, Absolute error, Relative error, Mean value, Deviation, Mean deviation, Relative mean deviation, Standard deviation, Co-efficient of variance, Spread or range, Confidence interval and limit, Accuracy, Precision, Difference between accuracy and precision, Significant figures, Law of significant figure, Law of addition and subtraction, Law of units of importance, Law of multiplication and division, Gaussian curve, Q-Test, F-Test, Numericals.	15
2	Selected topics on Environmental Chemistry: Concept and scope of environmental chemistry, Atmosphere, Composition of atmosphere, Atmosphere structure, Evolution of atmosphere, Earth's radiation balance, Particles, Ions and radicals in the atmosphere, Chemical and photochemical reactions in the atmosphere, Oxygen and ozone chemistry, Greenhouse effect, Ozone hole, Chemical toxicology, Biological effect of arsenic, Biological effect of cadmium, Biological effects of pesticides, Biological effects of DDT, Hydrocarbon and photochemical smog, Acid rain, Particulates, Effect of atmospheric pollution, Sampling, Waste water treatment, Trace elements in water, Dissolved oxygen, Chemical oxygen demand, Biochemical oxygen demand.	15
3	Types of titration and Classical methods of Analysis: Introduction, Acid-base titration or acidimetry and alkalimetry, Oxidation-reduction titration or redox titration, Precipitation titration, Complexometric titration, Gravimetric method of analysis and its applications, Properties of precipitates and precipitating reagents, Colloidal precipitates, Crystalline precipitates, Coprecipitation, Precipitation from homogeneous solution, Drying and Ignition of precipitates, Equivalence points and end points, Primary standards, Secondary standards, Solutions and indicators for acid base titrations, Acid base indicators, Choosing an indicator-The feasibility of titration.	15
4	Basics of Chromatography: Introduction, Classical and modern separation techniques, Comparison between classical and modern chromatography, Classification and types of chromatography, Adsorption, Partition, Basic theory and applications involved with Liquid chromatography, Gas chromatography, Paper chromatography, Thin layer chromatography, Column chromatography and ion exchange chromatography.	15
Total Hours		60

References:

1. A Textbook of Physical Chemistry; K. L. Kapoor
2. An Introduction to Chemical Thermodynamics; R. P. Rastogi, R. R. Misra, 6th Edition, Vikas Pub. Pvt. Ltd.
3. Physical Chemistry; G. W. Castellan, 3rd Edition, Narosa Publishing House, New Delhi.
4. Physical Chemistry; Arun Bahl & J. D. Tuli, S. Chand Publishing.
5. Organic Reactions and their Mechanisms; P. S. Kalsi, New Age International Publishers.
6. Organic Chemistry; R. T. Morrison and R. N. Boyd, 6th Edition, Prentice Hall of India.
8. Concise Inorganic Chemistry; J. D. Lee, 5th Edition, Blackwell Science, London.
9. Basic Inorganic Chemistry; F. A. Cotton, G. Wilkinson
10. Principles of Inorganic Chemistry; B. R. Puri, L. R. Sharma, K. C. Kalia, Vallabh Publications, Delhi
11. Organic Chemistry; Morrison and Boyd
12. Organic Chemistry (Volume I, II & III); S. M. Mukherji, S. P. Singh, R. P. Kapoor.
13. Principles of physical chemistry; B.R. Puri, L.R. Sharma, M.S. Pathania.

Suggested Theory distribution:

The suggested theory distribution as per Bloom's taxonomy is as per 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	Understand	Apply	Analyze	Evaluate	Create
20%	30%	25%	15%	10%	-

Iodometry and Iodimetry:

1. Estimation of Cu^{+2} and $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ in the given $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ using 0.05 N $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$ solution.
2. To determine by iodimetric method the amount of As^{+3} and As_2O_3 in the given As_2O_3 using 0.05 M $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$ solution.
3. Determination of % purity of H_2O_2 by iodometry.
4. Determination of chlorine in the given sample by iodometry.

Complexometric Titrations:

5. To determine the amount of Ni^{+2} in the given $\text{NiSO}_4 \cdot 7\text{H}_2\text{O}$ solution using 0.01 M EDTA solution.

6. Estimation of Mg^{+2} and Pb^{+2} in the given solution containing a mixture of Mg^{+2} and Pb^{+2} using 0.01 M EDTA solution.
7. Estimation of Ca^{+2} and Zn^{+2} in the given solution containing a mixture of Ca^{+2} and Zn^{+2} by using 0.01 M EDTA solution.

Water Analysis:

8. To determine COD of given sample by using potassium dichromate solution.

Reference Books

1. An Advanced Course in Practical Chemistry, A. K. Nad, B. Mahapatra and A. Ghoshal, New Central Book Agency (P) Ltd.
2. Practicals in Physical Chemistry, P S Sindhu, Macmillan.
3. Experimental Physical Chemistry: A Laboratory Textbook, Arthur Halpern, George McBane, W. H. Freeman.

Instructional Method:

1. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
2. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
3. Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
4. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory
5. Use of hazardous/toxic chemicals should be avoided as far as possible in laboratory.
6. All students in the laboratory must wear safety goggles and lab coats during lab session.

Supplementary Resources:

1. <http://nptel.ac.in/course.php?disciplineId=104>
2. <http://ocw.mit.edu/courses/chemistry/>
3. <http://vlab.amrita.edu/index.php?sub=2>
4. http://www.vlab.co.in/ba_labs_all.php?id=9
5. <https://www.youtube.com/user/TMPChem>
6. <https://www.youtube.com/playlist?list=PL166048DD75B05C0D>
7. <https://www.youtube.com/channel/UCqk-dmk3AOFtikaFDpsZorg>
8. <https://www.youtube.com/user/PradeepKshetrapal>