

**Subject Code: 02CY0454****Subject Name: Analytical Chemistry-II****M.Sc. Sem - II****Objectives:**

- To understand the scope, principle and general aspect of various Separation methods, Solvent Extraction methods, Electro Gravimetric methods.
- To understand the role of Environmental chemistry and environmental issues in our day to day life.

**Credits Earned:** 6 Credits**Course Outcomes:** After completion of this course, student will be able

- Recognized basic principle of various Extraction techniques.
- Explain different Separation methods and also get idea about how to clean up sample from complex mixture.
- Extend skills for Separation methods as well as Extraction methods for analytical tasks.
- Capable to provide practical experience in selected Electro Gravimetric methods of analysis.
- Realize the role of chemist for solve various kind of environmental issues.

**Pre-requisite of course:** NA.**Teaching and Examination Scheme:**

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE	Mid Sem	CSE	Viva	Term work	
4	0	3	6	50	30	20	25	25	150

**Contents:**

<b>Unit</b>	<b>Topics</b>	<b>Contact Hours</b>
1	<b>General aspects of Separation Methods:</b> Introduction, Objectives, Separation methods, Basic separation methods, Classification of separation methods, Scope of separation methods, Classification based on property resulting in separation (Volatility, Solubility, Partition, ion Exchange, Surface Activity, Molecular Geometry, Electromigration) Classification based on equilibrium and rate processes, Criteria for selection of separation methods (Selectivity, Detectability, Reproducibility, Yield, Speed and Convenience, Capability for Hyphenation, Ease in scaling up and economics)	<b>15</b>
2	<b>Solvent Extraction Methods:</b> The distribution law, Extraction process, Liquid-liquid extraction, Extractants, Factors affecting extraction, Techniques for solvent extraction, Completion of analysis, Classification, Types of extraction system, Transition of substances from an aqueous phase into an organic phase, Advantages of solvent extraction, Numericals.	<b>15</b>
3	<b>Thermal methods of analysis:</b> Introduction of thermal analysis, Types of thermal analysis, Principle, theory and instrumentation of TGA, DTA, DSC, Types and characteristics of thermo balance and sample holders, Factor affecting to the results of TGA, TDA and DSC, Advantages and Applications of TGA, DTA and DSC.	<b>15</b>
4	<b>Coulometric, Polarography and Voltammetry methods of analysis:</b> Introduction, Principle and theory of of Coulometry, Polarography and Voltammetry, Ilkovic equation, Dropping mercury electrode. Advantages and Disadvantages of DME, Polarographic measurement, Coulometer, Silver coulometer, Iodine coulometer, Various coulometric techniques, Coulometric titration, Potential errors in coulometric titration, Advantages Coulometry and Polarography.	<b>15</b>
	<b>Total Hours</b>	<b>60</b>

**References:**

1. Principles of Environmental Chemistry – H. Kolhandaraman and Geetha Swaminathan.
2. Atmospheric Pollution – Black W. (McGrow Hill Company) New York
3. Analytical Chemistry - G. D. Christian.

4. Fundamentals of analytical chemistry – D.A.Skoog, D.M. West and H.J. Holler sixth edition (1992)
5. Environmental Chemistry – A. K. De
6. Industry, Environment and Pollution – Arvind Kumar and P. K. Goel.
7. Manual on water & waste water analysis – Neeri
8. Water Pollution - Dr. V. P. Kudesia
9. Basic concepts of Environmental Chemistry - Des W. Connel.
8. Instrumental methods of chemical analysis, In; Introduction to Analytical chemistry: Sharma BK. Goel Publishing House Meerut, 23thedition; 2004

**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
30%	25%	15%	15%	10%	5%

**Suggested List of Experiments: (Any six)**

1. To determine the amount of calcium gluconate in the given sample.
2. To determine the amount of ascorbic acid in the given sample.
3. To determine the purity of zinc oxide by residual titration method.
4. To determine the amount of aspirin in the given sample.
5. To determine the amount of benzyl benzoate in the given sample.
6. To determine the saponification value of oil.
7. To determine total solid and total amount of protein contain in the given sample of milk.
8. To determine the amount of Ca and Zn in the given sample.
9. To determine the tannin content in the given sample.
10. To determine the concentration of starch in turmeric powder.
11. Estimation of amount of Fe<sup>+2</sup> and Fe<sup>+3</sup> ions in the given sample.
12. To determine the % purity of maleic anhydride.
13. Estimation of Ca and Mg in the given sample.

**Reference Books:**

1. Vogel's Textbook of Quantitative Chemical Analysis 6<sup>th</sup> edition, Pearsons Education.
2. Practical clinical Biochemistry, Harold Varley (4th Edition), CBS publishers and Distributers. New Delhi -110002.
3. R. Ikan; natural products.
4. Peach and Tracy; Methods of Plant analysis Vol- VII.

5. Pavia and others; Organic Laboratory Techniques, (Second Edition, 1995), Saunders Series (Harcourt Brace).

**Instructional Method:**

- a. 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.
- b. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
- c. Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
- d. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.
- e. Use of hazardous/toxic chemicals should be avoided as far as possible in laboratory.
- f. All students in the laboratory must wear safety goggles and lab coats during lab session.

**Supplementary Resources:**

1. <http://www.nptel.ac.in/courses/104103069/#>
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](http://www.vlab.co.in/ba_labs_all.php?id=9)