



Established Under Gujarat Private Universities Act No. 9 of 2016

## Syllabus for Master of Science

### Analytical Chemistry-I

**Subject Code: 02CY0404**

**Subject Name: Analytical Chemistry-I**

**M.Sc. Sem - I**

#### Objectives:

To understand the scope and principle of Analytical Chemistry and various electroanalytical methods (polarographic, voltammetric, electrogravimetry, coulometry, stripping techniques) including radio scattering methods and thermal analysis (TGA, DTA, DSC, Turbidimetry and Nephelometry). The emphasis is placed on physico-chemical principles of these methods and their application in chemical analysis.

**Credits Earned:** 6 Credits

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

- To develop an understanding of the range and theories of instrumental methods available in analytical chemistry.
- To develop knowledge pertaining to the appropriate selection of instruments for the successful analysis of complex mixtures.
- To develop an understanding of the role of the chemist in measurement and problem solving in chemical analysis.
- To provide practical experience in selected instrumental methods of analysis.
- To extend skills in procedures and instrumental methods applied in analytical tasks.
- To expand skills in the scientific method of planning, developing, conducting, reviewing and reporting experiments.

**Pre-requisite of course:** NA.

#### Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	Mid Sem (M)	Internal (I)	Viva (V)	Term work (TW)	
4	0	3	6	60	30	10	25	25	150

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**Contents:**

Unit	Topics	Contact Hours
1	<b>Basics of Analytical chemistry:</b> Introduction, The role of analytical chemistry, Classification of analytical methods based on their physical property measurement (classical and instrumental), Difference between classical Analytical methods and instrumental Analytical methods, Advantages and disadvantages of classical and instrumental methods, Key factors for the selection of Analytical methods, Statistics in Analysis, Types of errors Accuracy, Precision, Mean or average, Mean deviation or average deviation, Standard deviation, Variance, Coefficient of variance, Spread or range, Confidence interval and limit, Rejection of result or Q-Test, Confidence interval tests of significance or Student T-Test, Chi-square test, F-test, Minimisation of errors, Significant figure and computation statistical evaluation of data, Computation rules-method for reporting analytical data, Numericals.	15
2	<b>Radiation scattering methods of analysis:</b> Introduction, Reflection, Refraction, Scattering, Transmission, Electromagnetic radiation, Refractive index, Principle and Instrumentation of Turbidimetry and Nephelometry, Choice between Turbidimetry and Nephelometry analysis, Factor affecting to measurement of turbidimetry and Nephelometry. Turbidimetric titration. Application and advantages of radio scattering method.	15
3	<b>Colorimetry, Amperometry, Polarimetry and Karl Fischer:</b> Introduction, Plane polarized light, Optical activity, Specific rotation, Optical rotation, Circularly polarized light, Reference electrode, Indicator electrode, Amperometry, Amperometric titration, Equivalence point, Principle and theory of Karl Fischer technique, Principle and theory of colorimetry and Polarimetry, Advantages and application of Colorimetry, Amperometry, Polarimetry and Karl Fischer.	15
4	<b>Flame Photometry and Atomic Absorption Spectroscopy:</b> Introduction, Principle and theory of Flame photometry and AAS, Instrumentation of Flame Photometry and AAS, Types of burners used in Flame Photometry and AAS, Important characteristics and requirements of Flame, Factor affecting and Interferences in Flame photometry and AAS, Limitations, advantages and application of Flame photometry and AAS.	15
	<b>Total Hours</b>	<b>60</b>

**References:**

1. Introduction to instrumental analysis –R.D.Broun, Mc Graw Hill (1987)
2. Instrumental methods of chemical analysis – H. willard, L.Merrit, J.A. Dean and F.A. Settle. Sixth edition CBS (1986)
3. Thermal analysis –W.W. Wendlandt, John Wiley, (1986)



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4. Fundamentals of analytical chemistry – D.A.Skoog, D.M. West and H.J. Holler sixth edition (1992)
5. Cyclic Voltammetry and frontiers of electrochemistry – N.Noel and K.I. Vasu IBH, New delhi (1990)
6. Nuclear Analytical Chemistry – J. Tolgyessy and S. Verga vol. 2, university Park press, (1972)
7. Radiochemistry and Nuclear methods – W.D. Ehmann and D.E. Vance, John Wiley and Sons.
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 determination of tannin content in the given sample of tea leaves.
- 2) Starch concentration determination in the given sample of turmeric powder.
- 3) Find out the amount of  $\text{Fe}^{+3}$  In the given solution by colorimetry method.
- 4) Analysis of waste water with respect to alkalinity/T.D.S. /sulphate /dissolved chlorine.
- 5) To study the oxidation of Ferrocene and reduction of  $\text{K}_3 [\text{Fe} (\text{CN})_6]$  by cyclic voltammetry.
- 6) To determine the % purity of Phthalic anhydride.
- 7) To determine the total solid and total amount of protein in the given sample of milk.
- 8) Total amount of reducing sugar determination in the given sample of Honey.
- 9) Determination of lead with standard potassium dichromate solution.
- 10) To determine the amount of benzyl benzoate in the given sample.
- 11) Determination of sulphate with standard lead nitrate solution.
- 12) Analysis of dolomite with respect to: a) Calcium b) Magnesium.
- 13) Analysis of bauxite ore with respect to: a) Mixed oxide b) Iron c) Aluminium.
- 14) To determine the amount of  $\text{Ni}^{+2}$  in given sample.
- 15) Colorimetric determination of aluminum.

#### 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.



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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)