20CY107 ANALYTICAL CHEMISTRY

Hours Per Week :

L	T	P	C
4	-	-	4

Course Description and Objectives:

The aim of this course is to provide students with a broad understanding of the principles and applications of analytical chemistry. Students are first provided with an introduction into sample collection and preparation, analytical measurements and statistical treatment of data that can be obtained from a variety of analytical methods. This course will cover important titrimetric, gravimetric and colorimetric methods, as these techniques still play an important role in the modern analytical laboratories. Students could also learn about chromatographic separation techniques and electroanalytical methods, which are used in analytical laboratories.

Course Outcomes:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
1	Understand the basic principles, instrumentation, data collection and interpretation of a variety of analytical methods and analyse effect of errors on analytical data and results.
2	Apply and analyse various volumetric, gravimetric and colorimetric analytical methods.
3	Analyse various electroanalytical techniques and identify the appropriate electroanalytical technique for a specific analysis.
4	Evaluate strengths and limitations of various chromatographic separation methods with respect their data collection and interpretation of the result analysis.
5	Apply the knowledge of HPLC, LC-MS and GC-MS techniques to the industrial products for the separation, purification, validation and identification etc.

Unit – I: Principles of Analytical Chemistry

Elementary concepts: Sampling, Preparation of samples for analysis, Calibration standards, Significance of calibration; Evaluation of Analytical data: Errors, Accuracy and Precision, Law of distribution in case of indeterminate errors; Criteria for rejection of analytical data; Chemical equilibria.

Unit – II: Classical Methods of Analysis:

Titrimetric analysis: Acid-base, redox, complexometric, role of indicators; **Gravimetric analysis**: theory of crystal formation, co-precipitation, elementary gravimetry, precipitation reactions; **Colorimetry**: Spectrophotometric reagents, spectrophotometric titrations, turbidimetric methods.

Unit – III: Electroanalytical Techniques

Electroanalytical methods – **Electrogravimetry** with controlled potential and without potential control; **Voltammetry**, cyclic-voltammetry; **Polarography**, pulse-polarography, amperometric titrations.

Unit – IV: Chromatographic Techniques

Principle and classification of chromatographic techniques; Principle, instrumentation and applications of Gas chromatography (GC), Gas-Liquid chromatography, Gas-Solid chromatography, High-Performance Liquid chromatography (HPLC); Partition chromatography; Ion-exchange chromatography (IEC); Size-exclusion chromatography (SEC).

Unit – V: Importance of Analytical Chemistry to Industrial Research:

Importance of qualitative and quantitative analysis in R & D, industries and other branches of Sciences; Design of experiments for analytical method development and validation based on HPLC, LC-MS and GC-MS techniques

Text Books:

1. Skoog, Douglas A.; West, Donald M.; Holler, F. James; Crouch, Stanley R. Fundamentals of Analytical Chemistry. Belmont: Brooks/Cole, 2014.
2. Skoog, Douglas A.; Holler, F. James; Crouch, Stanley R. Principles of Instrumental Analysis. Belmont, CA: Brooks/Cole, 2007.
3. Christian G. D., Dasgupta P. K. and Schug K. A., “Analytical Chemistry” Wiley Publishers, 7th edition, 2014.
4. Bard, A.J., and Faulkner, L.R. Electrochemical Methods: Fundamentals and Applications. New York: John Wiley & Sons, 2nd Edition, 2000.
5. F. Scholz and Z. Stojek, Electroanalytical Methods, Springer-Verlag Berlin Heidelberg 2010.
6. Day and Underwood, Quantitative Analysis, 6th Edition, PHI, 2009.
7. Basic Gas Chromatography by Harold M. McNair, James M. Miller, John Wiley and Sons, 2008.
8. Modern HPLC for practicing scientists by Michael W. Dong, Wiley Inter science, 2006.