

| Course Code | Course Name          | Credits |
|-------------|----------------------|---------|
| 26CH504     | ANALYTICAL CHEMISTRY | 04      |

### Course Objectives

- This course on analytical chemistry intends to enlighten the students on the various methods involved in analytical techniques
- To learn about the statistical analysis, and applies knowledge of electrochemistry in practical applications
- To learn the separation processes using various chromatographic techniques.

### Learning Outcomes

Upon successful completion of this course it is intended that a student will be able to:

- Interpret the results of the quantitative and qualitative measurements.
- Evolve the verification strategy in the error analysis.
- Expertise in the detection and quantitative analysis by using various chromatographic methods.

### Unit 1 - Role of analytical chemistry (12 Hrs.)

Classification of Analytical Methods (Classical and Instrumental); Types of Instrumental Analysis; Redox Titrations (Redox Potentials, Theory and Feasibility, Calculation of Potentials, Redox Indicators and Applications); Precipitation Titrations (Theory, Mohr, Volhard and Fajan's Methods); Adsorption Indicators (Theory, Choice and Applications); Complexometric Titrations (Theory, Stepwise and Overall Formation Constants, EDTA Titrations); Metallochromic Indicators (Theory and Choice); Masking and Demasking Methods and Applications

### Unit 2- Data Analysis (12 Hrs.)

Mean and Median; Precision (Standard Deviation, Relative Standard Deviation); Accuracy (Absolute Error, Relative Error); Types of Errors (Systematic, Random, Gross); Sources of Errors and Their Effects; Reporting of Analytical Data; Statistical Evaluation of Data; Uses of Statistics

### Unit 3 - Techniques in Inorganic Chemistry (12 Hrs.)

Colorimetric Analysis (Theory and Practice); Atomic Spectroscopy (Flame Emission and Atomic Absorption); Types of Atomic Spectroscopy (Emission, Absorption, Fluorescence); Sources and Atomizers (Flame and Electrothermal); Principle and Applications of Atomic Absorption Spectroscopy; Advantages over Flame Photometry

### Unit 4 – Electrochemical Methods of Analysis (12 Hrs.)

Cyclic Voltammetry; Coulometry; Amperometry (Principles and Applications); Thermal Analysis Techniques (DTA, DSC, TGA – Principles and Applications); Thermometric Titration

### Unit 5 - Chromatographic methods (12 Hrs.)

Solvent Extraction; Ion Exchange Chromatography; Paper Chromatography; Thin-Layer Chromatography; Column Chromatography (Columns, Adsorbents, Methods); R<sub>f</sub> Values and McReynolds Constants; HPTLC; HPLC (Adsorbents, Columns, Detection Methods, Estimations, Preparative Column); GC-MS Techniques (Methods, Principles and Uses)

### Reference Books:

1. D.A. Skoog, D.M. West, F.J. Holler, S.R. Crouch, Fundamentals of Analytical Chemistry, 8<sup>th</sup>Edn., 2007, Saunders College Pub.
2. J.C. Miller, J.N. Miller, Statistics for Analytical Chemistry – Ellis Horwood. 1988, Chichester.
3. U.A. Bakshi, A.V. Bakshi, Electronic Instrumentation, 2008, Technical Publications, Pune, India.
4. A.T. Vogel, A text book of Quantitative Inorganic Analysis,
5. G.D. Christian, Analytical Chemistry H.H. Willard, L.L. Merit, J.A. Dean, F.L. Seattle, Instrumental Methods of Analysis, 2004, CBS publishing and Distribution.

### Websites and eLearning Sources:

1. <https://www.youtube.com/watch?v=93O0PXba0hI&list=PLdZcCa6mtW23cvplUz2IloqBDvI24pK82b>
2. <https://www.youtube.com/watch?v=qS8crojMoBg>
3. [https://www.youtube.com/watch?v=W\\_KO3ahVu4s](https://www.youtube.com/watch?v=W_KO3ahVu4s)

**COs and Bloom's Taxonomy Mapping – 26CH504**

| <b>Course Outcomes</b> | <b>On completing P.G. program the students will be able to</b>                                                                 | <b>BTL</b> |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>CO1</b>             | Recall and explain key concepts in analytical chemistry, including titrations, data analysis, colorimetry, and chromatography. | K1, K2,    |
| <b>CO2</b>             | Apply analytical techniques and tools such as titrations, spectroscopy, and chromatography in chemical analysis.               | K3         |
| <b>CO3</b>             | Analyze instrumental methods and titration techniques, including error impact and advanced chromatographic applications.       | K4         |
| <b>CO4</b>             | Evaluate analytical and electrochemical methods, including GC-MS, for their principles, accuracy, and applications.            | K5         |
| <b>CO5</b>             | Design analytical procedures and develop advanced titration, statistical, thermal, and chromatographic methods.                | K6         |

**BTL K1 and K2 – remembering and understanding, K3- Applying, K4 – Analyse, K5- Evaluate and K6- Create**

**Relationship Matrix – 26CH504**

| <b>Course Outcomes</b> | <b>Programme Outcomes (POs)</b> |            |            |            |            |            | <b>Programme Specific Outcomes (PSOs)</b> |             |             |             |             | <b>Mean Score of Cos</b> |
|------------------------|---------------------------------|------------|------------|------------|------------|------------|-------------------------------------------|-------------|-------------|-------------|-------------|--------------------------|
|                        | <b>PO1</b>                      | <b>PO2</b> | <b>PO3</b> | <b>PO4</b> | <b>PO5</b> | <b>PO6</b> | <b>PSO1</b>                               | <b>PSO2</b> | <b>PSO3</b> | <b>PSO4</b> | <b>PSO5</b> |                          |
| <b>CO1</b>             | 3                               | 3          | 3          | 1          | 1          | 1          | 3                                         | 3           | 2           | 1           | 1           | 2.0                      |
| <b>CO2</b>             | 3                               | 3          | 3          | 3          | 1          | 1          | 3                                         | 3           | 2           | 2           | 1           | 2.0                      |
| <b>CO3</b>             | 3                               | 3          | 3          | 2          | 1          | 1          | 3                                         | 3           | 3           | 3           | 2           | 2.2                      |
| <b>CO4</b>             | 3                               | 3          | 3          | 2          | 2          | 1          | 3                                         | 3           | 3           | 3           | 3           | 2.6                      |
| <b>CO5</b>             | 3                               | 3          | 3          | 3          | 3          | 2          | 3                                         | 3           | 3           | 3           | 3           | 2.9                      |
| <b>Total</b>           |                                 |            |            |            |            |            |                                           |             |             |             |             | <b>2.3</b>               |

Mean Score: 3- High, 2- Medium/Moderate, 1-Low