

  
**BMS COLLEGE OF ENGINEERING, BENGALURU-19**  
 Autonomous Institute, Affiliated to VTU

**INSTITUTIONAL ELECTIVE OFFERED BY THE DEPARTMENT OF CHEMISTRY**

<b>Course Name</b>	<b>ANALYTICAL TECHNIQUES</b>	<b>Course Code</b>	<b>17CY8IEATE</b>
<b>Credits</b>	<b>03</b>	<b>L-T-P-S</b>	<b>3- 0 -0-0</b>
<b>Contact hours</b>	<b>40</b>	<b>Faculty Handling</b>	<b>Dr. Madhu G</b>

**Course Objectives:** The fundamental goals of the course is to:

- (a) Provide basic principles governing chemical data analysis
- (b) Impart knowledge of sampling and separation techniques
- (c) Promote awareness in spectroscopic and modern chromatographic techniques
- (d) Teach importance of automation and reinforce the principles of quality assurance

<b>A</b>	<b>Course Outcomes: <i>At the end of the course the student will have</i></b>
<b>CO1</b>	An ability to understand and explain the concepts of handling the chemical data, sampling, given absorption, emission, chromatographic techniques and quality assurance
<b>CO2</b>	An ability to apply the learnt knowledge and choose appropriate choice of technique for a given analytical sample
<b>CO3</b>	An ability solve the given problem sets of analytical chemistry

**Unit I. Statistical Evaluation of Analytical Data**

**8hrs**

Introduction: Flow diagram for analytical approach (a) Determination of errors - Accuracy and Precision, Sensitivity, selectivity, Robustness, Ruggedness, Scale of operation, developing the procedure - compensating for interferences, calibration and standardization. (b) Evaluation of data - Measures of central tendency-mean and median, Measures of spread - Range, standard deviation and variance, Propagation of errors-Relative and absolute variance, The confidence limit, Tests of significance, Rejection of a result The Q Test, Statistics for small data sets, Linear least squares, Correlation coefficient and coefficient of determination, Detection limits, Statistics of sampling, Power analysis, Use of spreadsheets in analytical chemistry, Problems

**Unit-II. Equilibrium chemistry and Sampling**

**8hrs**

Ladder diagrams: Acid-base equilibria, complexation equilibria, oxidation-reduction (redox) equilibria. Preparation of samples-coning and quartering, separating analyte from interferants, Theory of separation efficiency, Classification of separation techniques: size, mass and density, complex formation, change in physical state, change in chemical state and partitioning, Separation techniques employed for each classification as above. Liquid-Liquid extractions: partition coefficients and distribution ratios, types-no secondary reactions, acid-base equilibria, metal chelators, Problems

**Unit III. Spectroscopic Methods of Analysis**

**8hrs**

Atomic absorption spectroscopy: Introduction, Principle(Beer-lamberts law), instrumentation and applications, Atomic Emission Spectroscopy: Principles, Limitations of Flame Emission spectroscopy, Instrumentation of Inductively coupled Plasma Instrumentation (ICP) and comparison

of AFS, AAS and ICP-AES. Spectroscopy based on Scattering: origin of scattering, Turbidimetry and Nephelometry. Principle, Instrumentation and applications

#### **Unit IV. Chromatographic Techniques of Analysis**

**8hrs**

Principles, classification, Fundamentals, Techniques and Dynamics of Chromatography, Van Deemter's equation, Introduction, instrumentation and applications of (a) High performance liquid chromatography(HPLC) (b) Size-Exclusion chromatography (c) Supercritical fluid chromatography (d) Capillary electrophoresis.

#### **Unit V. Automation and Quality Assurance in Analysis**

**8hrs**

Classification of automated methods, Automated Analysis, Flow Injection Analysis: Theory and Applications. Developing a standard method - verifying and validating the methods. Quality control, Quality Assessment-Internal and external methods, Evaluating quality assurance data-prescriptive approach, performance approach, Problems

#### **Text Books:**

1. Basic Concepts of Analytical Chemistry by S M Khopkar, New Age International, 3<sup>rd</sup> Edition (Reprint), 2017, 604 pages
2. Fundamentals of Analytical Chemistry by Douglas A. Skoog, Donald M. West, F. Jame Holler and Stanley R. Crouch, 9<sup>th</sup> Edition, Cengage Learning, 2013, 1072 pages

#### **Reference books:**

1. Analytical Chemistry by Gary D. Christian, Purnendu H. Dasgupta and Hevin A. Schug, 7<sup>th</sup> Edition, Wiley publications, 2014, 826 pages
2. Undergraduate Instrumental Analysis by James W Robinson, Eileen S Kelly Frane, George M Frame III, CRC Press, 7<sup>th</sup> edition 2014, 1264 pages
3. Modern Analytical Chemistry by David T Harvey, Mc-Graw Hill Higher Education, 1999, 816 pages

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<http://www.freebookcentre.net/chemistry-books-download/Analytical-Chemistry-2.0-by-David-Harvey.html>

#### **MOOCS:**

<http://nptel.ac.in/syllabus/104104066/>