

CH-222 Principles of Analytical Chemistry

<u>Credit Hours</u>	2-1
<u>Prerequisite</u>	Nil

Course Objectives

1. To acquaint students with basic concepts of analytical chemistry techniques, details of steps involved in the preparation and analysis of a sample, statistical methods used to determine the precision and accuracy of experimental results and to develop skills needed to solve analytical problems in a quantitative manner, particularly with the aid of the spreadsheet tools.

Course Contents

2. Introduction to Analytical Chemistry: The role of analytical chemistry, quantitative analytical methods, A typical quantitative analysis, An integral role for chemical analysis: feedback control systems.
3. Chemicals, Apparatus and Unit Operations of Analytical Chemistry: Selecting and handling reagents and other chemicals, Cleaning and marking of laboratory ware,
4. Evaporating liquids, Measuring mass, Equipment and manipulations associated with weighing, Filtration and ignition of solids, measuring volume, Calibrating volumetric glassware, The laboratory notebook, Safety in the laboratory.
5. Calculations in Analytical Chemistry: Some important units of measurement, Unified atomic mass units and the mole, Solutions and their concentrations (Percentage compositions, Molarity), Molality, Normality, Mole Fraction, Parts Per Million, Chemical stoichiometry, aqueous solutions and chemical equilibria, Using Spreadsheets in Analytical Chemistry, keeping records and making calculations.
6. Errors in Chemical Analyses: Systematic errors, Random errors in chemical analysis, The nature of random errors, Statistical treatment of random errors, Calculating the areas under the

Gaussian curve, the significance of the number of degrees of freedom, Equation for calculating the pooled standard deviation, Standard deviation of calculated results, Reporting computed data.

7. Sampling, Standardization, and Calibration: Analytical sampling methods, Automated sample handling, Standardization, and calibration.

Course Outcomes

8. After successful completion of this course students will be able to do sampling, their handling, preparation, results calculation and data reporting. In addition, they will also learn and develop understanding about the classical techniques of analytical chemistry and quality control and quality assurance.

Relevant Experiments:

1. Calibration of volume measuring glassware (pipette, burette and flask)
2. Calibration of electronic analytical balance
3. Calibration of pH meter and determination of pH of various acidic and basic solution
4. Calibration of conductivity meter and determination of conductance of tap water, distilled water and electrolyte solution
5. Calibration of potentiometer
6. Calibration of a UV-visible spectrophotometer as per requirements of British Pharmacopoeia
7. Experimental determination of limits of detection and quantitation by use of spectrophotometry.
8. Experimental determination of precision, accuracy and specificity
9. Different 07 exercises to solve analytical problems in a statistical manner, particularly with the aid of spreadsheet software tools, involving calculation of variance, mean, median, coefficient of variance of the data, linear regression analysis and constructing a calibration curve from a given analytical data.

Recommended Books

1. Fundamentals of Analytical Chemistry by Douglas A. Skoog, Donald M. West, F. James Holler and Stanley R. Crouch, Mary Finch Publications USA. 9th Ed. 2014, ISBN-13: 978-0-495-55828-6
2. Analytical Chemistry by Gary D. Christian, Wiley Publisher, 6th Ed. 2014.
3. Christian, G. D., Dasgupta, P. K. (Sandy). & Schug, K. A. (2014). Analytical Chemistry. (9th ed.). John-Wiley & Sons, New York. ISBN 978-0-470-88757-8.
4. Harris. D. C. (2019). Quantitative Chemical Analysis, (10th ed.) W. H. Freeman and Company, New York. ISBN-13: 978-1-4292-7503-3.
5. David H. (2000). Modern Analytical Chemistry, McGraw-Hill Companies, Inc. ISBN 0-07-237547-7
6. Skoog. D. A., West, D. M., Holler, F. J. & Crouch, S. R. (2021). Fundamentals of Analytical Chemistry. (10th ed.), (Int.), Cengage Learning. ISBN-13: 978-0-495-55828-6
7. Current publications and Literature and Review.