

<u>Course Title</u>	<u>Fundamentals of Analytical Chemistry</u>
<u>Course Code</u>	CH-111
<u>Credit Hours</u>	3-1
<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.

### Recommended Books

2. Fundamentals of Analytical Chemistry by Douglas A. Skoog, Donald M. West, F. James Holler and Stanley R. Crouch, Mary Finch Publications USA. 9<sup>th</sup> Ed. 2014, ISBN-13: 978-0-495-55828-6
3. Analytical Chemistry by Gary D. Christian, Wiley Publisher, 6<sup>th</sup> Ed. 2014.

### Detail Contents

4. 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.
5. Chemicals, Apparatus and Unit Operations of Analytical Chemistry; Selecting and handling reagents and other chemicals, Cleaning and marking of laboratory ware, 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.
6. 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.
7. Errors in Chemical Analyses: Some important terms, Systematic errors, Random errors in chemical analysis, The nature of random errors, Flipping coins: a student activity to illustrate a normal distribution, 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.
8. Statistical Data Treatment and Evaluation: Confidence intervals, Statistical aids to hypothesis testing, Analysis of variance, Detection of gross errors.  
Sampling, Standardization, and Calibration: Analytical sampling methods, Automated sample handling, Standardization and calibration, Lab-on-a-chip, A comparison method for aflatoxins, Multivariate calibration, Figures of merit for analytical methods, quality control and quality assurance

### Course Outcomes

9. 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.

10. Detail of Lab Work, workshop practice (if applicable)
- a. Calibration of volume measuring glassware (pipette, burette and flask)
  - b. Calibration of electronic analytical balance
  - c. Calibration of pH meter and determination of pH of various acidic and basic solution
  - d. Calibration of conductivity meter and determination of conductance of tap water, distilled water and electrolyte solution
  - e. Calibration of potentiometer
  - f. Calibration of a UV-visible spectrophotometer as per requirements of British Pharmacopoeia
  - g. Experimental determination of limits of detection and quantitation by use of spectrophotometry.
  - h. Experimental determination of precision, accuracy and specificity
  - i. 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.