Interdisciplinary Course in Chemistry

Paper: CHEM-II-IDC1-1-Th
or
CHEM-II-IDC2-2-Th

(Credit : Theory -02, Tutorial – 01)

Quantitative Analysis and Basic Laboratory Practices

Theory: (30 Lectures)

Module : I

(10 Lectures)

Introduction to Quantitative analysis and its interdisciplinary nature:
Definitions of analysis, determination, measurement, techniques and methods. Classification of analytical techniques. Choice of an analytical method -accuracy, precision, sensitivity . Errors. Determinate and indeterminate errors, absolute error, relative error, minimization of errors. Statistical treatment of finite samples - mean, median, range, standard deviation and variance. External standard calibration -regression equation (least squares method), correlation coefficient (R^2). Presentation of experimental data and results from the point of view of significant figures.

Module : II

(10 Lectures)

Titrimetric analysis:
Principle, classification, normality, molarity, molality, mole fraction, ppm, ppb etc. Standard solutions, preparation and dilution of reagents/ solutions using $[N_1 V_1 = N_2 V_2]$, preparation of ppm level solutions from source materials (salts).

Acid-base titrimetry:
Titration curves for strong acid vs strong base, weak acid vs strong base and weak base vs strong acid titrations.

Redox titrimetry:
Theory, balancing redox equations, titration curves.

Precipitation titrimetry:
Theory, titration curves, indicators for precipitation titrations.

Complexometric titrimetry:
Theory, titration methods employing EDTA (direct, back, displacement and indirect determinations). Indicators for EDTA titrations . Determination of hardness of water.

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Module : III

(10 Lectures)

Water analysis:
Water availability, requirement of water. Quality of surface water and ground water. Impurities in water. Standards of water quality for potable, domestic, industrial and agricultural purpose (color, pH, alkalinity, hardness, TDS, sulphate, fluoride, chloride etc.)

Water treatment technologies:
House hold water treatment, municipal water treatment and industrial treatment (primary and secondary treatment of industrial effluent).Softening of water. Disinfection of water. Definition and determinations of DO, BOD and COD, and their significance.

Basic laboratory practices:
Basic laboratory practices, calibration of glassware (pipette, burette and volumetric flask), Sampling(solids and liquids), weighing, drying, dissolving, Acid treatment, Rules of work in analytical laboratory, General rule for performing quantitative determinations (volumetric and gravimetric), Safety in Chemical laboratory, Rules of fire prevention and accidents, First aid. Precautions to be taken while
handling toxic chemicals, concentrated/fuming acids and organic solvents.

Recommended Text

1. Douglas A. Skoog, D.M. West , F. james Holler , Stanely R. Crouch, Fundamentals of Analytical Chemistry , Cengage learning India Pvt Ltd. 10th Edition , 2022
2. Daniel C. Harris , Quantitative Chemical Analysis , 10th Edition , W.H. Freeman , 2020

Tutorial: (15 hours)

PAPER: CHEM-II-IDC1-1-Tu or PAPER:CHEM-II-IDC2-2-Tu

1. Safety Practices in the Chemistry Laboratory, knowledge about common toxic chemicals and safety measures in their handling, cleaning and drying of glass wares.
2. Calibration of glassware, pipette, burette and volumetric flask.
3. Preparation of TLC plates and separation of amino acids
4. Calibration of instruments like colorimeter, pH-meter, conductivity meter, spectrophotometer using reference standards or reference materials.
5. Determination of alkali present in soaps/detergents.