Interdisciplinary Course in Chemistry

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

(Credit : Theory -02, Tutorial – 01)

If chosen in 1st SEM or in 2nd SEM

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.

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-H-IDC1-1-Tu or PAPER:CHEM-H-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.

Interdisciplinary Course in Chemistry

Paper: CHEM-H-IDC3-3-Th

Theory: (30 Lectures)

(Credit : Theory -02, Tutorial – 01)

If chosen in 3rd SEM

CHEMISTRY IN DAILY LIFE

Module : I

(10 Lectures)

Dairy Products:
Composition of milk and milk products. Analysis of fat content, minerals in milk and butter. Estimation of added water in milk.
Beverages: Analysis of caffeine in coffee and tea, detection of chicory in coffee, chloral hydrate in toddy, determination of methyl alcohol in alcoholic beverages.

Food additives, adulterants, and contaminants:
Food preservatives like benzoates, propionates, sorbates, disulphites. Artificial sweeteners: Aspartame, saccharin, dulcin, sucralose, and sodium cyclamate. Flavors: Vanillin, alkyl esters (fruit flavors), and monosodium glutamate.

Artificial food colorants:
Coal tar dyes and non-permitted colors and metallic salts. Analysis of pesticide residues in food.

Module : II

(10 Lectures)

Vitamins:
Classification and Nomenclature. Sources, deficiency diseases, and structures of Vitamin A1, Vitamin B1, Vitamin C, Vitamin D, Vitamin E & Vitamin K1.

Oils and fats:
Composition of edible oils, detection of purity, rancidity of fats and oil. Tests for adulterants like argemone oil and mineral oils. Halphen test.

Soaps & Detergents:
Definition, classification, manufacturing of soaps and detergents, composition and uses

Module : III

(10 Lectures)

Chemical and Renewable Energy Sources:
Principles and applications of primary & secondary batteries and fuel cells. Basics of solar energy, future energy storer.

Polymers:
Basic concept of polymers, classification and characteristics of polymers. Applications of polymers as plastics in electronics, automobile components, medical fields and aerospace materials. Problems of plastic waste management. Strategies for the development of environment-friendly polymers.

Recommended Text Books:

1. **B. K. Sharma: Introduction to Industrial Chemistry, Goel Publishing, Meerut (1998)**
2. **Ashtoush Kar. Medicinal Chemistry (Two Colour Edition), New Age International Pvt Ltd, 2022**
3. **Edward Cox Henry , The Chemical analysis of Foods , Hardcover , Hassell Street Press , 2021**
4. **Fred Billmeyer : Textbook of polymer science; Wiley 3rd addition.**

Tutorial: (15 hours)

PAPER : CHEM-H-IDC3-3-Tu

1. Estimation of Vitamin C
2. Determination of Iodine number of oil.
3. Determination of saponification number of oil.
4. Determination of methyl alcohol in alcoholic beverages.