

10. Palit, S.R., De, S. K. Practical Physical Chemistry Science Book Agency
11. University Hand Book of Undergraduate Chemistry Experiments, edited by
12. Mukherjee, G. N., University of Calcutta
13. Levitt, B. P. edited Findlay's Practical Physical Chemistry Longman Group Ltd.
14. Gurtu, J. N., Kapoor, R., Advanced Experimental Chemistry S. Chand & Co. Ltd.

SEMESTER-II

DS-2

(Credits: Theory-03, Practicals-02)

Theory: 45 Lectures

Marks: 50

All Units carry equal marks

Unit-1: Acid-Base reactions

(15 Lectures)

Acid-Base concept: Arrhenius concept, theory of solvent system (H_2O , NH_3 , SO_2 and HF), Bronsted-Lowry's concept, relative strength of acids, Pauling's rules. Lux-Flood concept, Lewis concept, group characteristics of Lewis acids, solvent levelling and differentiating effects. Superacids, proton affinity; HSAB principle. Acid-base equilibria in aqueous solution (Proton transfer equilibria in water), pH, buffer. Acid-base neutralization curves; indicator, choice of indicators. Solubility product, common ion effect and their application in analytical chemistry. (Gr. II A, B & Gr. III A, B).

Unit-2: Stereochemistry

(15 Lectures)

Stereochemistry of acyclic compounds: representation of molecules in Fischer, flying- wedge, Sawhorse and Newman formula and their translations, chirality, elements of symmetry, simple axis (C_n), plane of symmetry (σ), centre of symmetry (i), alternating axis of symmetry (S_n), asymmetry and dissymmetry, optical activity, specific rotation, molar rotation, specific rotation of mixture, Biot's law. Stereoisomerism: enantiomerism, diastereoisomerism, stereogenic centre, systems with chiral centres, stereogenic centres involving $\text{C}=\text{C}$, $\text{C}=\text{N}$, D/L, R/S, E/Z, syn/anti, cis/trans, meso/dl, threo/erythro nomenclature

Conformation: conformational nomenclature; eclipsed, staggered, gauche and anti, dihedral angle, torsional angle, Klyne-Prelog terminology, energy barrier of rotation, relative stability of conformers on the basis of steric effect, dipole-dipole interaction, hydrogen bonding, conformational analysis of ethane, propane, n-butane, 1,2-dihaloethane, 2-methylbutane, 1,2-glycols, invertomerism of trialkyl amines

Unit-3: Chemical kinetics

(15 Lectures)

Rate law, order and molecularity: Introduction of rate law, Extent of reaction; rate constants, order; Forms of rates of First, second and n-th order reactions; Pseudo first order reactions (example using acid catalyzed hydrolysis of methyl acetate); Determination of order of a reaction by half-life and differential method.

Role of T and theories of reaction rate: Temperature dependence of rate constant; Arrhenius equation, energy of activation; Rate-determining step and steady-state approximation – explanation with suitable examples; Collision theory; outline of Lindemann theory of unimolecular reaction; outline of Transition State theory (classical treatment)

Homogeneous catalysis: Homogeneous catalysis with reference to acid-base catalysis; Primary kinetic salt effect; Enzyme catalysis.

Practical

(60 Lectures/Contact hours)

Marks: 50

1. Acid-Base Titration:

- a) NaOH – Na₂CO₃ mixture
- b) Na₂CO₃ – NaHCO₃ mixture
- c) Oxalate – Oxalic Acid mixture

2. Qualitative Analysis of Single Solid Organic Compounds

- A. Detection of special elements (N, S, Cl, Br) by Lassaigne's test
- B. Solubility and classification (Solvents: water, 5% HCl, 5% NaOH, saturated NaHCO₃)
- C. Detection of the following functional groups by systematic chemical tests:
 - Whether aromatic or not ?
 - Hydrocarbon, aromatic amino (-NH₂), aromatic nitro (-NO₂), amido (-

CONH₂, including imide), anilido (CONHPh), phenolic -OH, carboxylic acid (-COOH), carbonyl (-CHO and >C=O), only one test for each functional group is to be reported.

D. Melting point of the given compound

E. Identification of the **Probable compound** through observed melting points and functional groups

3. Study of kinetics of simple chemical reactions

- a. Study of kinetics of acid-catalyzed hydrolysis of methyl acetate
- b. Study of kinetics of decomposition of H₂O₂

Reference Book:

1. Mendham, J., *A. I. Vogel's Quantitative Chemical Analysis* 6th Ed., Pearson, 2009
2. Practical Workbook Chemistry (Honours), UGBS, Chemistry, University of Calcutta, 2015.
3. Nad A. K., Mahapatra B. and Ghosal A. *An Advanced Course in Practical Chemistry*, New Central Book Agency (P) Ltd.
4. Ghosh S., Das Sharma M., Majumder D and Manna S. *Chemistry in Laboratory*, Santra Publication Pvt Ltd
5. Vogel, A. I. *Elementary Practical Organic Chemistry*, Part 2: Qualitative Organic
6. Analysis, CBS Publishers and Distributors.
7. Viswanathan, B., Raghavan, P.S. *Practical Physical Chemistry* Viva Books (2009)
8. Mendham, J., A. I. Vogel's *Quantitative Chemical Analysis* 6th Ed., Pearson
9. Harris, D. C. *Quantitative Chemical Analysis*. 6th Ed., Freeman (2007)
10. Palit, S.R., De, S. K. *Practical Physical Chemistry* Science Book Agency
11. *University Hand Book of Undergraduate Chemistry Experiments*, edited by
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