

SEMESTER – II

Course II – (Organic & General Chemistry) 60 hrs (4h/w)

Course outcomes:

At the end of the course, the student will be able to;

1. Understand and explain the differential behavior of organic compounds based on fundamental concepts learnt.
2. Formulate the mechanism of organic reactions by recalling and correlating the fundamental properties of the reactants involved.
3. Learn and identify many organic reaction mechanisms including Free Radical Substitution, Electrophilic Addition and Electrophilic Aromatic Substitution.
4. Correlate and describe the stereochemical properties of organic compounds and reactions.

ORGANIC CHEMISTRY

36h UNIT-I

Recapitulation of Basics of Organic Chemistry Carbon-Carbon sigma bonds (Alkanes and Cycloalkanes) 12h

General methods of preparation of alkanes- Wurtz and WurtzFittig reaction, Corey House synthesis, physical and chemical properties of alkanes, Isomerism and its effect on properties, Free radical substitutions; Halogenation, concept of relative reactivity v/s selectivity. Conformational analysis of alkanes (Conformations, relative stability and energy diagrams of Ethane, Propane and butane). General molecular formulae of cycloalkanes and relative stability, Baeyer strain theory, Cyclohexane conformations with energy diagram, Conformations of monosubstituted cyclohexane.

UNIT-II

Carbon-Carbon pi Bonds (Alkenes and Alkynes)

12h

General methods of preparation, physical and chemical properties. Mechanism of E1, E2, E1c_b reactions, Saytzeff and Hoffmann eliminations, Electrophilic Additions, mechanism (Markownikoff/Antimarkownikoff addition) with suitable examples, *syn* and *anti*-addition; addition of H₂, X₂, HX. oxymercuration demercuration, hydroboration-oxidation, ozonolysis, hydroxylation, Diels Alder reaction, 1,2 and 1,4-addition reactions in conjugated dienes.

Reactions of alkynes; acidity, electrophilic and nucleophilic additions, hydration to form carbonyl compounds, Alkylation of terminal alkynes.

UNIT-III

Benzene and its reactivity

12h

Concept of aromaticity, Huckel's rule - application to Benzenoid (Benzene, Naphthalene) and Non - Benzenoid compounds (cyclopropenylcation, cyclopentadienyl anion and tropyliumcation)

Reactions - General mechanism of electrophilic aromatic substitution, mechanism of nitration, Friedel- Craft's alkylation and acylation. Orientation of aromatic substitution - ortho, para and meta directing groups. Ring activating and deactivating groups with examples (Electronic interpretation of various groups like NO₂ and Phenolic). Orientation of (i) Amino, methoxy and methyl groups (ii) Carboxy, nitro, nitrile, carbonyl and sulphonic acid groups (iii) Halogens (Explanation by taking minimum of one example from each type)

GENERAL CHEMISTRY

24 h UNIT-IV

1. Surface chemistry and chemical bonding chemistry

Surface

6h

Colloids- Coagulation of colloids- Hardy-Schulze rule. Stability of colloids, Protection of Colloids, Gold number.

Adsorption-Physical and chemical adsorption, Langmuir adsorption isotherm, applications of adsorption.

2. Chemical Bonding

6h

Valence bond theory, hybridization, VB theory as applied to ClF₃, Ni(CO)₄, Molecular orbital theory -LCAO method, construction of M.O. diagrams for homo-nuclear and hetero-nuclear diatomic molecules (N₂, O₂, CO and NO).

3. HSAB

2h

Pearson's concept, HSAB principle & its importance, bonding in Hard-Hard and Soft-Soft combinations.

UNIT-V

Stereochemistry of carbon compounds

10h

Molecular representations- Wedge, Fischer, Newman and Saw-Horse formulae.

Optical isomerism: Optical activity- wave nature of light, plane polarised light, optical rotation and specific rotation.

Chiral molecules- definition and criteria (Symmetry elements)- Definition of enantiomers and diastereomers – Explanation of optical isomerism with examples- Glyceraldehyde, Lactic acid, Alanine, Tartaric acid, 2,3-dibromopentane.

D,L, R,S and E,Z- configuration with examples.

Definition of Racemic mixture – Resolution of racemic mixtures (any 3 techniques)

Co-curricular activities and Assessment Methods

Continuous Evaluation: Monitoring the progress of student's learning

Class Tests, Worksheets and Quizzes

Presentations, Projects and Assignments and Group Discussions: Enhance critical thinking skills and personality

Semester-end Examination: critical indicator of student's learning and teaching methods adopted by teachers throughout the semester.

List of Reference Books Theory:

Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

Eliel, E. L. & Wilen, S. H. Stereochemistry of Organic Compounds; Wiley: London, 1994.

Kalsi, P. S. Stereochemistry Conformation and Mechanism; New Age International, 2005.

Practical:

Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press (2000).

Ahluwalia, V.K. & Dhingra, S. Comprehensive Practical Organic Chemistry: Qualitative Analysis, University Press (2000).

Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. Practical Organic Chemistry, 5th Ed., Pearson (2012)

Additional Resources:

Solomons, T. W. G.; Fryhle, C. B. & Snyder, S. A. Organic Chemistry, 12th Edition, Wiley.

Bruice, P. Y. Organic Chemistry, Eighth Edition, Pearson.

Clayden, J.; Greeves, N. & Warren, S. Organic Chemistry, Oxford.

Nasipuri, D. Stereochemistry of Organic Compounds: Principles and Applications, Third Edition, New Age International.

Gunstone, F. D. Guidebook to Stereochemistry, Prentice Hall Press, 1975.

LABORATORY COURSE-II

30hrs (2 h / w)

Practical-II Volumetric Analysis

(At the end of Semester-II)

Course outcomes:

At the end of the course, the student will be able to;

1. Use glassware, equipment and chemicals and follow experimental procedures in the laboratory
2. Understand and explain the volumetric analysis based on fundamental concepts learnt in ionic equilibria
3. Learn and identify the concepts of a standard solutions, primary and secondary standards
4. Facilitate the learner to make solutions of various molar concentrations. This may include: The concept of the mole; Converting moles to grams; Converting grams to moles; Defining concentration; Dilution of Solutions; Making different molar concentrations.

Volumetric analysis

50 M

1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
2. Determination of Fe (II) using KMnO_4 with oxalic acid as primary standard.
3. Determination of Cu (II) using $\text{Na}_2\text{S}_2\text{O}_3$ with $\text{K}_2\text{Cr}_2\text{O}_7$ as primary standard.

Estimation of water of crystallization in Mohr's salt by titrating with KMnO_4