

RTM NAGPUR UNIVERSITY NAGPUR

SEMESTER PATTERN SYLLABUS

SUBJECT CHEMISTRY

B.Sc. –I, Semester - II

CH-201: Paper- I (Organic Chemistry)

Unit - I

(7.5 Hrs)

(A) Structure and Bonding: Hybridization in case of Methane, Ethane, Ethylene and Acetylene. Bond lengths, bond angles and bond energies. Elementary ideas of Inductive effect, Electromeric effect, Resonance effect, Hyperconjugation (definition and examples). Hydrogen bonding in organic compounds (with reference to alcohol and carboxylic acid) and its consequences.

(B) Mechanism of Organic Reactions: Homolytic and heterolytic bond fission with examples. Electrophiles and nucleophiles: Definition and example both neutral and charged. Types of organic reactions: Addition, substitution, elimination and rearrangement (Definition and examples). Reactive intermediates: Carbocations, carbanions, free radicals and carbenes (Definition, formation, geometry, stability).

Unit - II

(7.5Hrs)

(A) Stereochemistry of Organic Compounds: Concept of isomerism. Types of isomerism with examples. Optical isomerism: Elements of symmetry, molecular chirality, enantiomers, stereogenic centre (lactic acid as example). Optical activity, chiral and achiral molecules with two stereogenic centres (Tartaric acid as example), diastereo-isomers, meso-compound. Resolution of enantiomers: Biological and chemical methods. Inversion, retention, racemisation and asymmetric synthesis. Relative and absolute configuration. Sequence rules - D & L and R & S system of nomenclature.

(B) Geometrical isomerism: E and Z system of nomenclature, geometric isomerism in maleic acid, fumaric acid and 2-butene. **Conformational isomerism:** Conformational analysis of ethane and n-butane. Newman's projection and sawhorse formulae. Difference between Configuration and Conformation.

Unit - III

(7.5 Hrs)

(A) Alkanes: IUPAC nomenclature of alkanes (branched and unbranched). Alkyl group (definition and examples), methods of formation (Ethane and Propane): Wurtz reaction, Kolbe's reaction and decarboxylation of carboxylic acid. Physical properties and Chemical reactions of alkanes (Ethane and Propane): Halogenation, nitration, sulphonation, isomerization, cyclization, aromatization, and pyrolysis, cracking and oxidation. L. P. G., Octane number. Mechanism of free radical chlorination of methane.

Cycloalkanes: Nomenclature Introduction, Baeyer's strain theory and its limitations. Ring strain in small rings cyclopropane and cyclobutane. Theory of strainless rings. Conformational analysis of cyclohexane, axial and equatorial bonds.

(B) Alkenes: IUPAC nomenclature of alkenes, methods of formation (ethylene and propylene): Dehydrogenation of alkanes, dehydrohalogenation of alkyl halides, dehydration of alcohols and dehalogenation of dihalides. Chemical reactions of alkenes (ethylene and propylene): Hydroboration, oxidation KMnO_4 , HIO_4 , Epoxidation, Ozonolysis, Hydroxylation, Polymerization. Substitution in allylic position of alkenes. Markownikoff's rule and Peroxide effect. Ionic Mechanism of addition of Br_2 to ethene and HBr to propene, Free radical mechanism of addition of HBr to propene.

Unit - IV

(7.5 Hrs)

(A) Dienes: Nomenclature and classification of dienes. Methods of formation of 1,3-butadiene. Chemical reactions of butadiene: 1,2- and 1,4-additions. Diels-Alder reaction.

Alkynes: Nomenclature, structure and bonding in Alkynes. Methods of formation of acetylene from: Calcium carbide and dehydrohalogenation of dihalides. Chemical reaction: Hydroboration, oxidation, metal ammonia reduction and polymerization. Oxyacetylene flame and Acidity of alkynes.

(B) Aromatic Compounds and Aromaticity: Nomenclature of Benzene derivatives. Introduction, Structure of benzene - Molecular formula, Kekule structure, Resonance structure, MO picture, Huckel rule and aromaticity. Aromatic ions (cyclopentadienyl anion and cycloheptatrienyl cation). Aromatic electrophilic substitution mechanism with energy profile diagram (e.g. nitration and sulphonation).

Fuel Chemistry: LPG, CNG, LNG, and Bio-Gas (definition, calorific value, composition, properties and uses). Octane number. Lubricants: Definition, classification (solid, semisolid, liquid with example), properties (viscosity index, cloud point, pour point, acid value, saponification value) and applications of lubricants.