

# Paper II

## Organic Chemistry

Time-3 Hrs.

M.M. 50

**NOTE :** The paper will be divided into **THREE** sections.

Section-A Ten questions (short type answer) two from each Unit will be asked. Each question will be of half mark and the candidates are required to attempt all questions.

**Total 5 marks**

Section-B Five questions (answer not exceeding 250 words) one from each Unit with internal choice will be asked and the candidates are required to attempt all questions. Each question will be of 5 marks.

**Total 25 marks**

Section-C Four questions may be in parts covering all the five Units (answer not exceeding 500 words) will be asked. The candidates are required to attempt any **TWO** questions. Each question will be of 10 marks.

**Total 20 marks**

### UNIT-I

**Structure and Bonding** - Localized and delocalized chemical bond, Van der Waals interaction, charge transfer complexes, resonance, hyperconjugation, aromaticity, electromeric, inductive and field effects, hydrogen bonding.

**Mechanism of Organic Reactions** - Curved arrow notation, drawing electron movements with arrows, half-headed and double-headed arrows, types of organic reactions, energy considerations.

**Reactive Intermediates** - Carbocations, carbanions, free radicals, carbenes, arynes and nitrenes, their formation and stabilities.

Methods of determination of reaction mechanism (product analysis, intermediates, isotope effects, kinetic and stereochemical studies).

## UNIT-II

**Stereochemistry of Organic Compounds** - Concept of isomerism, types of isomerism.

Optical Isomerism- Elements of symmetry, molecular chirality, enantiomers, stereogenic centre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centers, diastereomers, threo and erythro diastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization.

Relative and absolute configuration, sequence rules, D and L, R and S systems of nomenclature.

Geometric isomerism- determination of configuration of geometric isomers. E and Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds.

Conformational isomerism- conformational analysis of ethane and n-butane; conformations of cyclohexane, axial and equatorial bonds, conformation of mono substituted cyclohexane derivatives. Newman projection and Sawhorse formulae, Fischer and Flying Wedge formulae.

Difference between configuration and conformation.

### UNIT-III

**Alkanes:** General methods of formation, physical & chemical properties. Mechanism of free radical substitution in alkanes with reference to halogenation, orientation, reactivity and selectivity.

**Cycloalkanes** - Nomenclature, methods of formation, chemical reactions, Baeyer's strain theory and its limitation, ring strain in small rings (cyclopropane and cyclobutane), theory of strainless rings, the case of cyclopropane ring : banana bond.

**Alkenes, Dienes and Alkynes** - Brief introduction of alkenes, their formation with reference to mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regioselectivity in alcohol dehydration The Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes.

Chemical reactions of alkenes- mechanisms involved in hydrogenation, electrophilic and free radical additions, Markownikoff's rule, hydroboration- oxidation, oxymercuration-reduction, epoxidation, ozonolysis, hydration, hydroxylation and oxidation with  $\text{KMnO}_4$ .

polymerization of alkenes, substitution at the allylic and vinylic positions of alkenes, industrial applications of ethylene and propene.

Nomenclature and classification of dienes: isolated, conjugated and cumulated dienes, structure of allenes and butadiene, methods of formation, polymerization, chemical reactions - 1,2 and 1,4 - additions, Diels - Alder reaction.

**Alkynes:** Acidity of alkynes, mechanism of electrophilic and nucleophilic addition reactions, hydroboration, metal - ammonia reductions, oxidation and polymerization.

#### Unit - IV

**Arenes and Aromaticity** - Nomenclature of benzene derivatives, the aryl group, aromatic nucleus and side chain, structure of benzene, molecular formula and Kekule structure, stability and carbon - carbon bond lengths of benzene, resonance structure and M. O. picture.

Aromaticity: The Huckel rule, aromatic ions. Aromatic electrophilic substitution: General pattern of the mechanism, role of  $\sigma$  and  $\pi$  complexes. Mechanism of nitration, halogenation, sulphonation, mercuration and Friedel - Craft reaction. Energy profile diagrams. Activating and deactivating substituents, orientation and ortho-para ratio. Side chain reactions of benzene derivatives. Birch reduction, Methods of formation and



chemical reactions of alkylbenzenes, alkynylbenzene and biphenyl.

## UNIT -V

**Alkyl and Aryl Halides** - Nomenclature and classes of alkyl halides, methods of formation, chemical reactions, mechanism of nucleophilic substitution reactions of alkyl halides,  $S_N^2$  and  $S_N^1$  reactions with energy profile diagrams, factors affecting  $S_N^2$  and  $S_N^1$  reactions.

Haloform reaction, Freons:

Methods of formation of aryl halides, nuclear and side chain reactions, the addition - elimination and elimination - addition reaction, mechanisms of nucleophilic aromatic substitution reactions.

Relative reactivities of alkyl halides v/s allyl, vinyl and aryl halides. synthesis and uses of DDT and BHC.

### Books Recommended

1. A Text Book of Organic Chemistry: K. S. Tiwari, S. N. Mehrotra and N. K. Vishnoi.
2. Modern Principles of Organic Chemistry: M. K. Jain and S.C. Sharma
3. A Text Book of Organic Chemistry: (Vol. I & II) O. P. Agarwal,

4. A Text Book of Organic Chemistry: B. S. Bahl and Arun Bahl.
5. A Text Book of Organic Chemistry: P. L. Soni.
6. Organic Chemistry: (Vol. I, II & III) S. M. Mukherji, S. P. Singh and R.P.Kapoor, Wiley Eastern Ltd. (New Age International)
7. Organic Chemistry, Morrison & Boyd, Prentice Hall.
8. Organic Chemistry (Hindi Ed.):Suresh Ameta, P. B. Punjabi and B. K Sharma, Himanshu Pub.