

**Books Recommended :**

1. Advanced Inorganic Chemistry, F.A.Cotton and Wilkinson, John Wiley.
2. Inorganic Chemistry, J.E Huhey, Harpes & Row
3. Chemistry of the Elements, N.N. Greenwood and A. Earnshaw, Pergamon
4. Inorganic Electronic Spectroscopy, ABP Lever, Elsevier
5. Magnetochemistry, R.L. Carlin, Springer Verlag
6. Comprehensive Coordination Chemistry (Eds.) G. Wilkinson, R.D Gillars and J.A McCleverty, Pergamon.

**PAPER-II  
ORGANIC CHEMISTRY**

**Time : 3 Hrs.**

**M.M. 100**

**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 one mark and the candidates are required to attempt all questions. **Total 10 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 10 marks. **Total 50 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 20 marks. **Total 40 marks**

**UNIT-I**

**Nature of bonding in organic molecules -** Delocalized chemical bonding-conjugation, cross conjugation,, bonding in fullerenes, aromaticity in benzenoid and non-benzenoid compounds, annulenes, ferrocenes and helicenes, alternant and non-alternant hydrocarbons, Huckel's rule, energy level of  $\pi$ -molecular orbitals, anti-aromaticity,  $\psi$ -aromaticity, homo-aromaticity, PMO approach.



**Stereochemistry** - Conformational analysis of cycloalkanes, decalins, effect of conformation on reactivity, conformation of sugars, steric strain., chirality, molecules with more than one chiral center, threo and erythro isomers, methods of resolution, optical purity, enantiotopic and diastereotopic atoms, groups and faces, stereospecific and stereoselective synthesis, asymmetric synthesis, optical activity in the absence of chiral carbon (biphenyls, allenes and spirane), chirality due to helical shape.

#### UNIT-II

**Reaction mechanism, structure and reactivity** - Kinetic and thermodynamic control, Hammond's postulate, Curtin-Hammett principle, potential energy diagrams, transition states and intermediates, methods of determining mechanisms, isotope effects, effect of structure on reactivity-resonance and field effects, steric effect, steric inhibition to resonance, substituent and reaction constants, Taft equation.

**Aliphatic nucleophilic substitution** - The  $S_N2$ ,  $S_N1$ , mixed  $S_N1$  &  $S_N2$ ,  $S_Ni$  and SET mechanisms, neighbouring group participation.

Classical and nonclassical carbocations, phenonium ions, norbornyl system, common carbocation, rearrangements, nucleophilic substitution at an allylic, aliphatic trigonal and a vinylic carbon, reactivity-effects of substrate structure, attacking nucleophile, leaving group and reaction medium, ambient nucleophile, regioselectivity.

**Aliphatic electrophilic substitution** -  $S_E2$  and  $S_E1$  mechanisms, electrophilic substitution accompanied by double bond shifts, effect of substrates, leaving group and the solvent polarity on the reactivity.

#### UNIT-III

**Aromatic electrophilic substitution** - The arenium ion mechanism, orientation and reactivity, energy profile diagrams, the ortho/para ratio, ipso attack, orientation in other ring systems, diazonium coupling, Vilsmeier - Haack reaction, Bischler-Napieralske reaction, Pechmann reaction.

**Aromatic nucleophilic substitution** - The  $S_{NAr}$ ,  $S_{N1}$ , benzyne and  $S_{RN}1$  mechanisms, reactivity - effect of substrate structure, leaving group and attacking nucleophile. The Von Richter, Sommetet-Hauser and Smiles rearrangements.

**Free radical reaction** - Types of free radical reactions, free radical substitution mechanism, neighboring group assistance, reactivity for aliphatic and aromatic substrate at a bridgehead, reactivity in the attacking radicals, the effect of solvents on reactivity, allylic halogenation (NBS), oxidation of aldehydes to carboxylic acids, autooxidation, coupling of alkynes and arylation of aromatic compounds by diazonium salts, Sandmeyer reaction, free radical rearrangement, Husdiecker reaction.

#### UNIT-IV

**Addition to carbon-carbon multiple bonds** - Mechanistic and stereochemical aspects of addition



reaction involving electrophiles, nucleophiles and free radicals, regio and chemoselectivity, orientation and reactivity, addition to cyclopropane ring, hydrogenation of double bond, triple bonds and aromatic rings, hydroboration, cyanoethylation.

**Addition to carbon-hetero multiple bonds** - Mechanism of metal hydride reduction of saturated and unsaturated carbonyl compounds, addition of Grignard reagents, organozinc and organolithium reagents to carbonyl and unsaturated carbonyl compounds, Wittig reaction, mechanism of condensation reaction involving enolates, Mannich, Benzoin, Perkin and Stobbe reactions, hydrolysis of esters and amides ammonolysis of esters.

**Elimination reaction** - The E2, E1, E1cB and E2c mechanisms and their spectrum, orientation of the double bond, reactivity-effect of substrate structures, attacking base, the leaving group and the medium, stereochemistry, elimination v/s substitutions, pyrolytic eliminations.

#### UNIT-V

**Reagents in organic synthesis** - Use of the following reagents in organic synthesis and functional group transformation, Gilman's reagent, lithium dimethyl cuprate LDA, dicyclohexylcarbodiimide, trimethyl silyl iodide, tributyltin hydride, DDQ, Baker yeast, Petersons synthesis, Merrifield resins, 1,3 - dithiane, selenium oxide, osmium tetroxide.

#### Books Recommended :

1. Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry March, John Wiley.
2. Advanced Organic Chemistry, F.A. Carey and R.J. Sundberg, Plenum
3. A Guide book of Mechanism in Organic Chemistry, Peter Sykes, Longman
4. Structure and Mechanism in Organic Chemistry, Peter Sykes, Longman
5. Modern Organic Reactions, H.O. House, Benjamin
6. Principles of Organic Synthesis, R.O.C. Norman and J.M. Coxon, Blackie Academic & Professional
7. Reaction Mechanism in Organic Chemistry, S.M. Mukherji and S.P. Singh Macmillan.
8. Stereochemistry of Organic Compounds, D. Nasipuri, New Age International.
9. Stereochemistry of Organic Compounds, P.S Kalsi, New age International.
10. Organic Reaction and Their Mechanisms, P.S. Kalsi, New Age International.
11. Organic Reaction Mechanism, V.K. Ahluwalia and R.K. Parshar, New Age International.
12. Stereochemistry of Organic Compounds, E.L. Eliel.