

SEMESTER -4 (Organic Chemistry)

CHE(O) 507

Advanced Organic Chemistry

Unit I : Pericyclic reactions

Introduction, classification of pericyclic reactions, stereochemistry, molecular orbital symmetry, frontier orbitals of ethylene, 1,3-butadiene, 1,3,5-hexatriene and allyl system, F.M.O. and PMO approach to cycloaddition and electrocyclic reactions: Generalisation of Woodward-Hoffmann rule, sigmatropic rearrangement-suprafacial and antarafacial shifts of H. Stereoselectivity in sigmatropic rearrangement, enantioselectivity in pericyclic reactions.

Unit II : Conformational analysis

Conformation at cyclic systems: Confirmation of cyclohexane, mono and disubstituted cyclohexane, heterocyclic compounds, five and six membered heterocycles, stereoelectronic effects, fused bicyclic system, decalin, dodecalin, polycyclic system, perhydrophenanthrene, bridged systems-conformation of sugars, steric strains due to unavoidable crowding, stereochemistry of the compounds containing nitrogen, sulphur and phosphorus.

Unit III : Oxidation

Introduction, different oxidation processes, hydrocarbons-alkenes, aromatic rings, saturated C-H group (activated and unactivated), alcohols, diols, aldehydes, ketones, amines, hydrazine and sulphides.

Unit IV: Reduction

Introduction, different reductive processes, hydrocarbons-alkanes, alkenes, alkynes and aromatic rings
Carbonyl compounds- aldehydes, ketones, acids and their derivatives, epoxides, nitro, nitroso, azo and oxime groups,

Preparation and properties and application of Pd and Ti compounds as organometallic agents

Reference books

1. *Advance organic chemistry by Jerry March*
2. *Advance organic chemistry by Carey and Sundberg,*
3. *Advance organic chemistry by Francis A. Carey*

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Advanced Organic Synthesis

Unit I : Protection of groups

Principle of protection of hydroxyl, amino, carbonyl, carboxylic acid with different reagents and their deprotection, synthetic equivalent groups, synthetic analysis and planning, control of stereochemistry.

Unit II : Disconnection approach

An introduction to synthesis, and synthetic equivalents, disconnection approach, functional group inter-conversions, the importance of the order of events in organic synthesis one group C-X and two group C-X disconnections, chemo-selectivity, reversal and polarity.

Unit III : One group C-C disconnections

Alcohols and carbonyl compounds, region-selectivity, alkene synthesis, use of acetylenes and aliphatic nitro compounds in organic synthesis.

Unit IV: Ring synthesis

Saturated heterocycles, synthesis of 3, 4, 5, and 6-membered rings, aromatic heterocycles in organic synthesis

Reference books

1. *Organic synthesis : the disconnection approach by stuart Warren (wiley student edition)*
2. *Organic chemistry- clayden, greeves, warren and wothers, (oxford press)*

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Bio organic Chemistry

Unit I : Water and vitamins

Water –interaction among biomolecules in aqueous systems, buffering against pH changes, in biological systems, participation of water in biological reactions.

Vitamins-classification, introduction, chemistry, absorption transport, mobilization and biochemical functions of Vitamins A, D, E, K, C, B, B2, B6, H and folic acid

Unit II : Proteins and enzymes

Proteins: properties and conventions of common amino acids, stereoisomerism in α -amino acid, peptides: formation, compositions and sizes of protein separation, purification and characterization, sequencing of peptides, sanger's method, edman degradation, outline of other methods, protein sequences and evolution. Oxygen binding proteins, haemoglobin and myoglobin in oxygen transport and storage.

Enzymes: classification, nomenclature and extraction factors affecting catalytic activity and specificity in action, regulation of enzyme activity, enzyme inhibition, illustrative enzymatic reactions using chymotrypsin, hexokinase, enolase and lysozyme

Unit III: Carbohydrates and nucleic acid

Carbohydrates: classification and stereochemistry, biologically important hexose derivatives, nomenclature of disaccharides, structure and role of some homo and hetero polysaccharides, glucoconjugates : proteoglycans, glycoproteins and glycolipids

Nucleic acid: compounds of nucleic acids, nomenclature of nucleotides, nucleosides, structure of DNA and structure of RNA

Unit IV: Lipids

Nomenclature, structure and physical properties of some naturally occurring fatty acids, triacylglycerol and waxes as sources of stored energy, insulation of water repellants, types of membrane lipids, introduction to glycerophospho lipids, galactolipids, sphingo lipids, phospholipids and sterols, bile acids.

Reference books:

1. *Principles of biochemistry –Donald J.Voet, Judith G.Voet, charlotte w. pratt (John willey and sons)*
2. *Lehninger principles of biochemistry- David L.Nelson and Michael M.wx (Palgrave Macmillan / w.h. freeman company new york)*
3. *Biochemistry – U.Satyanarayana Baro and allied P.Ltd., kolkata*

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Selected topics in Medicinal Chemistry

Unit I : Drug design:

Introduction, naming of organic medicinal compounds, literature of medicinal chemistry, development of new drugs, procedure followed in drug design, concept of lead compound and lead modification, pro drugs, soft drugs, phase I, II and III clinical trials, structure activity relationship, theories of drug activity : occupational theory, rate theory, induced fit theory, quantitative structure activity relationship, history and development of QSAR. Concept of drug receptors, elementary treatment of drug receptor interactions, physio chemical parameters lipophilicity, partition coefficient, electronic ionization constant, concept of 3-D QSAR.

Unit II : Pharmacokinetic and pharmacodynamics

Pharmacokinetics : introduction to drug absorption, distribution, metabolism, elimination. important pharmacokinetic parameters in defining drug deposition and in therapeutics, uses of pharmaceuticals in drug development process

Pharmacodynamics: Introduction, elementary treatment of enzyme stimulation, enzyme inhibition, drug metabolism, biotransformation, significance of drug metabolism in medicinal chemistry.

Unit III :

A. Dosage forms, Quality control and application of computers in chemistry

Dosage forms, types of dosages, different routes of administration, quality control of drugs pharmacopias, modern methods of pharmaceutical analysis.

B. Computer in chemistry

Use of computer in chemistry and industry

Important websites for data search chemistry

Information about online journals for chemistry

Unit IV:Medicine

Overview, Medicinal use of nanomaterials-Drug delivery

Protein and peptide delivery –cancer, surgery, visualization, nanoparticle targeting

Medical application of molecular nanotechnology-nanorobots, cell repair machines, nanonephrology.

References Books:

1. *Burger's Medicinal Chemistry and Drug Discovery (5/e), 1997, Vol. 1, 2, 3, 4,5, Edited by ManFred E. Wolff (John Wiley & Sons, inc., New York).*
2. *Wilson and Gisvold's Text-book of Organic Medicinal and Pharmaceutical Chemistry (5/e, 1982) by Robert F. Doerge (J. B. Lippincott Company, Philadelphia/Toppan Co. Ltd., Tokyo).*
3. *Principles of Medicinal Chemistry, Vol. I & II (5/e), by S. S. Kadam, K. R. Mahadik, K. G. Bothra (Nirali Prakashan).*
4. *QSAR: quantitative structure-activity relationships in drug design by Jean-Luc Fauchère. ISBN:084515141X, 9780845151419*
5. *QSAR : Hansch analysis and related approaches By Hugo Kubinyi*

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dissertation/industrial training