Devrukh Shikshan Prasarak Mandal's

Nya. Tatyasaheb Athalye Arts, Ved. S.R. Sapre Commerce and Vid. Dadasaheb Pitre Science College

(Autonomous)

Late Kakasaheb Pandit Educational Campus,

Devrukh, Dist: Ratnagiri- 415 804, Maharashtra

NAAC Accredited 'A' Grade (Third Cycle), Mumbai University Best College Award 2009-10

Syllabus

Programme: T. Y. B. Sc.

Course- Organic Chemistry

w.e.f. Academic Year 2021-22

Choice Based Credit System
T. Y. B. Sc.
Chemistry Syllabus
To be implemented from the Academic year 2021-22

Course Content

Semester VI

Course Code	Unit	Topics	Credits	L/Week
USCHT61	I	Chemical Thermodynamics & Chemical Kinetics		
	II	Polymers & Renewable Sources		
	III	Quantum Chemistry & Applied Electrochemistry		
	IV	NMR & ESR Spectroscopy		
USCHT62	I	Coordination Chemistry		
	II	Properties of Coordination Compounds		
	III	Organometallic Chemistry		
	IV	Some Selected Topics		
USCHT63	I	Stereochemistry & Biomolecules		
	II	Molecular Rearrangements & Carbohydrates		
	III	Spectroscopy-II		
	IV	Polymers; Catalysts & Reagents		
USCHT64	I	Electro Analytical Techniques		
	II	Methods of Separation-II & Introduction to Quality		
	III	Food and Cosmetics Analysis		
	IV	Thermal Methods and Analytical Method Validation		
USCHP61		Chemistry Practicals I		
USCHP62		Chemistry Practicals II		
USCHP63		Chemistry Practicals III		
USCHP64		Chemistry Practicals IV		

T.Y.B.Sc. Syllabus Chemistry Paper-III
Organic Chemistry

Semester VI

Unit I: STEREOCHEMISTRY & BIOMOLECULES (15L)

1.1 Stereochemistry II (8L)

1.1.1 Stereoselectivity and stereospecificity: Idea of enantioselectivity (ee) and diastereoselectivity (de), Topicity: enantiotopic and diasterotopic atoms, groups and faces.

1.1.2 Stereochemistry of– i) Elimination reactions: E2–Base induced dehydrohalogenation of 1-bromo-1,2- diphenylpropane. ii) Addition reactions to olefins: a) bromination (electrophilic anti addition) b) syn hydroxylation with $KMnO_4$ c) epoxidation followed by hydrolysis.

1.2 Amino acids, Proteins & Nucleic Acids (7L)

1.2.1 α-Amino acids: General Structure, configuration, and classification based on structure and nutrition. Properties: pH dependency of ionic structure, isoelectric point and zwitter ion. Methods of preparations: Strecker synthesis, Gabriel phthalamide synthesis.

1.2.2 Polypeptides and Proteins: nature of peptide bond. Nomenclature and representation of polypeptides (di-and tri-peptides) with examples Merrifield solid phase polypeptide synthesis.

Proteins: general idea of primary, secondary, tertiary & quaternary structure

1.2.3. Nucleic acids: Controlled hydrolysis of nucleic acids, Sugars and bases in nucleic acids. Structures of nucleosides and nucleotides in DNA and RNA. Structures of nucleic acids (DNA and RNA) including base pairing.

Unit II: MOLECULAR REARRANGEMENTS & CARBOHYDRATES (15L)

2.1 Molecular Rearrangements (5L)

Mechanism of the following rearrangements with examples and stereochemistry wherever applicable.

2.1.1 Migration to the electron deficient carbon: Pinacol-pinacolone rearrangement.

2.1.2 Migration to the electron deficient nitrogen: Beckmann rearrangement.

2.1.3 Migration involving a carbanion: Favorski rearrangement.

2.1.4 Name reactions: Michael addition, Wittig reaction.

2.2 Carbohydrates (10L)

2.2.1 Introduction: classification, reducing and non-reducing sugars, DL notation

2.2.2 Structures of monosaccharides: Fischer projection (4-6 carbon monosaccharides) and Haworth formula (furanose and pyranose forms of pentoses and hexoses) Interconversion: open chain and Haworth forms of monosaccharides with 5 and 6 carbons. Chair conformation with stereochemistry of D-glucose, Stability of chair form of D-glucose

2.2.3 Stereoisomers of D-glucose: enantiomer, diastereomers, anomers, epimers.

2.2.4 Mutarotation in D-glucose with mechanism

2.2.5 Chain lengthening & shortening reactions: Modified Kiliani-Fischer synthesis (D-arabinose to D-glucose and D-mannose), Wohl method (D-glucose to D-arabinose)

2.2.6 Reactions of D-glucose and D-fructose: (a) Osazone formation (b) reduction: Hi/Ni, $NaBH_4$ (c) oxidation: bromine water, HNO_3, HIO_4 (d) acetylation (e) methylation:(d) and (e) with cyclic pyranose forms

Unit III: SPECTRIOSCOPY-II (15L)

3.1.1 IR Spectroscopy: Basic theory, nature of IR spectrum, selection rule, fingerprint region.
3.1.2 PMR Spectroscopy: Basic theory of PMR, nature of PMR spectrum, chemical shift (δ unit), standard for PMR, solvents used. Factors affecting chemical shift: (1) inductive effect (2) anisotropic effect (with reference to C=C, C≡C, C=O and benzene ring). Spin- spin coupling and coupling constant, application of deuterium exchange technique, application of PMR in structure determination.
3.1.3 Spectral characteristics of following classes of organic compounds, including benzene and monosubstituted benzenes, with respect to IR and PMR:
(1) alkanes (2) alkenes (3) alkynes (4) haloalkanes (5) alcohols (6) carbonyl compounds (7) ethers (8) amines (broad regions characteristic of different groups are expected). Problems of structure elucidation of simple organic compounds using individual or combined use of UV-Vis, IR, Mass and NMR spectroscopic technique are expected. (Index of hydrogen deficiency should be the first step in solving the problems).

Unit IV: POLYMERS; CATALYSTS & REAGENTS (15L)

4.1 Polymer (8L)
4.1.1 Introduction: terms monomer, polymer, homopolymer, copolymer, thermo plastics and thermosets.
4.1.2 Addition polymers: polyethylene, polypropylene, Teflon, polystyrene, PVC, Uses.
4.1.3 Condensation polymers: polyesters, polyamides, polyurethanes, polycarbonates, phenol formaldehyde resins. Uses
4.1.4 Stereochemistry of polymers: Tacticity, mechanism of stereochemical control of polymerization using Ziegler Natta catalysts.
4.1.5 Natural and synthetic rubbers: Polymerization of isoprene: 1,2 and 1,4 addition (cis and trans), Styrene butadiene copolymer.
4.1.6 Additives to polymers: Plasticizers, stabilizers and fillers.
4.1.7 Biodegradable polymers: Classification and uses. polylactic acid structure, properties and use for packaging and medical purposes.
(Note: Identification of monomer in a given polymer & structure of polymer for a given monomer is expected. condition for polymerization is not expected)

4.2 Catalysts and Reagents (7L)
Study of the following catalysts and reagents with respect to functional group transformations and selectivity (no mechanism).
4.2.1 Catalysts: Catalysts for hydrogenation: a. Raney Nickel b. Pt and PtO_2 (C=C, CN, NO_2, aromatic ring) c. Pd/C : C=C, COCl→CHO (Rosenmund) d. Lindlar catalyst: alkynes
4.2.2 Reagents: a. $LiAlH_4$ (reduction of CO, COOR, CN,NO_2) b. $NaBH_4$ (reduction of CO) c. SeO_2 (Oxidation of CH_2 alpha to CO) d. mCPBA (epoxidation of C=C) e. NBS (allylic and benzylic bromination)

Reference Books:

Organic Chemistry

1. Organic Chemistry, Francis A Carey, Pearson Education, 6th Edition, Special Indian Edition 2008.
2. Organic Chemistry, R.T. Morrison and R.N. Boyd, 6th Edition, Pearson Edition.
3. Organic Chemistry, T.W.G. Solomon and C.B. Fryhle, 8th Edition, John Wiley & Sons, 2004.
4. Organic Chemistry Baula Y. Bruice, Pearson Edition, 2008.
5. Organic Chemistry, J.G. Smith, 2nd Edition Special Indian Edition, Tata. McGraw Hill.
6. Stereochemistry, P.S. Kalsi, New Age International Ltd. 4th Edition,2006
7. Organic Spectroscopy by Jag Mohan
8. Furniss, B. S.; Hannaford, A. J.; Rogers, V.; Smith, P. W. G.; Tatchell, A. R. Vogel's Textbook of Practical Organic Chemistry, ELBS.