

SIDDAGANGA INSTITUTE OF TECHNOLOGY, TUMKUR-572 103.
(An Autonomous Institution affiliated to VTU, Belgaum)
III Sem. B.E. (Chemical)
Syllabus from the academic year 2019-20 onwards
Subject: Organic Chemistry

Contact Hours/Week	: 3	Credits	: 3
Total Lecture Hours	: 40	CIE Marks	: 50
Course Code	: 3CH01	SEE Marks	: 50

Course Learning Objectives (CLO): (Based on Bloom's Taxonomy)

CO1: To teach students the basic concepts of reactive intermediates, attacking reagents and various electron displacement effects.

CO2: To educate the students about the various organic reactions and their mechanisms that organic molecules undergo such as addition, substitution, elimination and rearrangement.

CO3: To understand the properties of carbohydrates, peptides and enzymes and their importance and applications in daily life.

CO4: To coach the students about manufacture and properties of soaps and detergents, chemotherapy of drugs and the importance of food preservatives.

CO5: To learn new approach for synthetic work like retrosynthesis analysis, microwave assisted organic synthesis and solid support synthesis and combinatorial synthesis.

Course Outcomes / Programme Outcomes (POs):

On successful completion of this course, the student will be able to:

- Explain the different kinds of reactive intermediates, attacking reagents, various electronic displacement effects and their importance.
- Gain awareness on various types of reactions and their mechanisms.
- Explain the preparations, properties, structural elucidation and applications of carbohydrates, proteins and enzymes.
- Know about the synthesis and applications of soaps, detergents, dyes and drugs.
- Explain the retrosynthesis analysis microwave assisted organic synthesis and solid support synthesis and combinatorial synthesis.

Mapping of Course Outcomes with Program outcomes

1. Ability to apply knowledge of chemical reactions and their mechanisms in synthetic chemistry.
2. Ability to analyze the problems in manufacturing process using the basic concepts of organic chemistry.

Program Articulation Matrix:

POs												
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	✓											
CO2	✓											
CO3		✓										
CO4		✓										
CO5		✓										

Course Articulation Matrix:

POs												
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	1											
CO2	1											
CO3	2											
CO4	2											
CO5	2											

¹High association, ²Moderate association, ³Low association

UNIT - I

1. REACTION MECHANISM -I

i) Bond cleavage

Homolytic and heterolytic bond cleavage. Attacking reagents – electrophiles and nucleophiles. Reactive intermediates- carbocations, carbanions and free radicals, their types, structure, formation, and stability.

ii) Electron displacements in molecules

Inductive effect, electromeric effect, resonance effect, conjugation effect and hyper conjugation effect—explanation with examples.

iii) Nucleophilic aliphatic substitution reactions

Meaning of S_N1 and S_N2 reaction. Mechanism of hydrolysis of alkyl halides of S_N1 and S_N2 reactions, S_N2 versus S_N1 reactions. Effect of nature of alkyl groups, leaving groups, nucleophiles and solvents on S_N1 and S_N2 mechanisms.

8 Hours

UNIT - II

2. REACTION MECHANISM –II

i) Elimination reactions

Meaning of E₁ and E₂ reactions. Mechanism of dehydrohalogenation of alkyl halides of E₁ and E₂ reactions. E₁ versus E₂ mechanism. Order of reactivity – Saytzeff's and Hofmann's type, elimination versus substitution with examples.

ii) Electrophilic addition reactions

Meaning of Electrophilic addition reactions. Reactions at C-C double bond, hydrogenation, Markovnikov's rule - addition of hydrogen halides to unsymmetrical alkenes. Peroxide effect. Electrophilic addition mechanism - Diels-Alder reaction.

iii) Electrophilic aromatic substitution reactions

Meaning of Electrophilic aromatic substitution reactions. Mechanism of nitration, sulphonation, halogenation, Friedel-Craft alkyl and acylation reactions of benzene.

iv) Orientation influence

Definition, reactivity and orientation in mono substituted benzene – activating and deactivating groups (ortho, para and meta orienting groups). Orienting influences of electrophilic substitution of substituents in toluene, chlorobenzene, phenol and nitrobenzene.

v) Nucleophilic addition mechanism across C=O and rearrangement reactions

Meaning and mechanism with examples-Aldol condensation, Claisen condensation, Cannizzaro reaction, Benzoin condensation and Reimer-Tiemann reaction. Pinacol-pinacolone rearrangement and Beckmann rearrangement

8 Hours

UNIT – III

3. BIOMOLECULES

i) Carbohydrates

Classification – aldoses and ketoses, monosaccharides – glucose and fructose - properties, structural elucidation of glucose and mutual transformations of monosaccharides. Oligosaccharides – sucrose, lactose and maltose – glucoside linkage, structure and applications. Polysaccharides – starch and cellulose – structure and their applications. Properties and applications of nano cellulose and starch. Test for carbohydrates.

ii) Peptides and proteins

Classification and nomenclature of peptides. Sanger and Edman methods of sequencing. Cleavage of peptide bond by chemical and enzymatic methods. Peptide bond formation. Peptide synthesis – protection of amino group (Boc-, Z and Fmoc-) and carboxyl group as alkyl and aryl esters. Use of HOBt, active esters and anhydrides in peptide bond formation reactions. Deprotection of protecting groups in peptide synthesis (Boc-, Z and Fmoc-). Physical and chemical properties of proteins; Composition and classification of proteins; Colour reactions of proteins; Natural proteins-applications.

iii) Enzymes

Definition and classification, chemical nature of enzymes. Factors affecting the rate of enzyme action, specificity of enzyme action. Applications of enzymes.

8 Hours

UNIT– IV

4. CHEMICALS IN DAY TO DAY LIFE

i) Oils, Soaps and detergents

Analysis of Oils - Saponification value, Iodine and acid value of oils, Solvent extraction of oils, refining of oils, Hydrogenation of oils.

Manufacture of soap by hot process; Types of soaps - Liquid soaps, Toilet soaps-opaque and transparent; Mechanism of cleansing action of soap. Synthetic detergents – Ionic detergents-anionic and cationic; Non ionic detergents with examples. Difference between soaps and detergents.

ii) Dyes

Colour and constitution – chromophore and auxochrome theory. Modern theory of colour, classification of dyes - by structure and methods of application. Synthesis and uses of Methyl orange, Malachite green, Indigo and Alizarin.

iii) Drugs

Chemotherapy, synthesis and uses of paracetamol, sulphanilamide and chloroamphenicol. Antihistamines – their meaning and examples.

8 Hours

UNIT – V

5. NEW SYNTHETIC APPROACHES

Retrosynthesis analysis by disconnection approach - Development of organic synthesis, retrosynthesis. Mono-functional disconnection - disconnection of carboxylic acids and their derivatives, alkanes and amines. Bi-functional disconnection.

Microwave assisted organic synthesis – Introduction, advantages and limitations, few examples (Suzuki-Miyaura, Buchwald, heck and Negishi coupling reactions)

Solid support synthesis and combinatorial synthesis – Introduction, advantages and limitations, few examples.

8 Hours

TEXT BOOKS

1. Organic Chemistry, Morrison B.R. and Boyd L.L., 6th Edition, ELBS, New Delhi, 1999.
2. Modern Synthetic Reactions, House, H.O., ULBS Publishers, New Delhi.
3. Organic Chemistry of Natural Products (Vol. I & II) Gurdeep R. Chatwal, Himalaya Publishing House

REFERENCE BOOKS

1. Organic Reactions Mechanism, Peter Sykes, ULBS Publishers, New Delhi.
2. Organic Chemistry Vol I and II, I L Finar, ULBS Publishers, New Delhi.
3. Organic Chemistry, Tiwari Melhrotra and Vishnoi, 7th edition, Chand S. and Co., New Delhi, 1996.
4. A Text Book of Organic Chemistry, Arun Bahl and Bahl B.S., 15th Edition. S. Chand and Company, New Delhi, 1998.
5. Amino acids and Peptides:
 - i) Peptides Chemistry: A practical text book, M. Bodansky, Springer-Verlag NY, 1988.
 - ii) Peptides: Chemistry and Biology, N Selwad and H.-D Jakubke, Wiley-VCH, 2002.
6. Organic Synthesis – The Disconnection Approach, Stuart warren, Wiley student edition, new Delhi, India, 2007

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