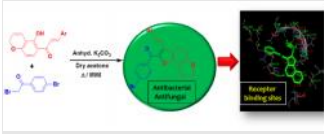
19HS121 ORGANIC CHEMISTRY



Source: Koya Prabhakara Rao. et al., Journa
of Heterocyclic Chemistry, **2019**, 56 (1), 73-8

Hours Per Week :

L	T	P	C
3	-	2	4

Total Hours :

L	T	P
45	-	30

WA/RA	SSH/HSH	CS	SA	S	BS
20	10	-	10	-	05

COURSE DESCRIPTION AND OBJECTIVES:

The course is aimed at offering fundamental concepts towards the synthetic methods of common organic compounds including polymers and pharmaceuticals. This course enlightens the students about the fundamentals of bonding, reaction intermediates and stereo-chemical aspects. It enables students understand advanced level mechanistic aspects of synthesis and characterization techniques for future prospects.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes	POs
1	Apply various types of reaction intermediates for a variety of organic reactions.	1,2
2	Evaluate the relationship between stereochemistry and biological activity of the optically active compounds.	1,2,3
3	Analyze various synthetic methods with feasible mechanisms for preparing drug molecules.	1,2,3
4	Apply the concept of 'Green chemistry" using organic and bio-catalysis for the synthesis of organic compounds.	1,2,3
5	Apply various instrumental techniques for determining the structures of organic compounds.	3,4,5

SKILLS:

- ✓ Analyze the reactivity of substrates.
- ✓ Write a plausible reaction mechanism for different reactions.
- ✓ Differentiate optically active and optically inactive compounds.
- ✓ Characterize organic compounds by various structural elucidation techniques.

UNIT - I **L-9**

CHEMICAL BONDING AND REACTION INTERMEDIATES:

Chemical Bonding - Introduction to VBT and VSEPR theory; Molecular orbital theory of diatomic molecules (O_2 and CO), Molecular orbital energy diagram of ethylene, 1, 3-butadiene and benzene.

Reaction Intermediates - Bond fissions; Formation and reactivity of carbanions; Formation and reactivity of carbenium ions; Formation and reactivity of free radicals; Formation and reactivity carbenes.

UNIT - II **L-9**

STEREOCHEMISTRY: Representations of 3 - dimensional structures, Structural isomers and stereo isomers; Symmetry and chirality; Optical isomerism - enantiomers, diastereomers (lactic acid and tartaric acid); Absolute configurations and conformational analysis – ethane and cyclohexane; Relevance of stereochemistry in biology Ex. Thalidomide, resolution and asymmetric synthesis.

UNIT - III **L-9**

ORGANIC REACTIONS AND SYNTHESIS OF A DRUG MOLECULES:

Introduction to reactions involving substitution, addition, elimination; C-C bond formation; Oxidation -Jones reagent; Reduction - $NaBH_4$ and LAH; Synthesis of aspirin.

Organometalic Chemistry - Introduction, Grignard & cross coupling reactions.

UNIT - IV **L-9**

GREEN CHEMISTRY: 12 Principles of green chemistry; Catalysis including transition metal catalysis (catalytic hydrogenation and wilkinson's catalyst); Organocatalysis and bio-catalysis.

UNIT - V **L-9**

STRUCTURAL ELUCIDATION OF ORGANIC COMPOUNDS: IR Spectroscopy - principle, identification of functional groups; NMR spectroscopy - principle, chemical shift, ^{1}H-NMR- ethyl alcohol, *cis-trans* isomers; Mass spectroscopy - principle, fragmentation (nitrogen rule); Introduction to XRD.

LABORATORY EXPERIMENTS

LIST OF EXPERIMENTS **TOTAL HOURS: 30**

1. Determination of melting point organic compounds.
2. Determination of boiling point organic compounds.

   Analysis of functional groups of organic compounds (5 functional groups, listed below).
3. Carboxylic Acids.
4. Phenols.
5. Aldehydes.
6. Ketones.
7. Amines.
8. Preparation and characterization of aspirin.

9. Separation of organic compounds by thin layer chromatography (TLC).
10. Preparation of paracetamol.
11. Synthesis of organic compounds by solvent free methods.
12. Henry (Nitro Aldol) reaction of benzaldehyde and nitromethane.
13. Reduction of aldehydes using sodium borohydride ($NaBH_4$).
14. Oxidation using potassium permanaganate ($KMnO_4$).

ACTIVITIES:

- *Synthesis, purification and Characterization of drugs.*
- *Freidal-Crafts Acylation and Alkylation reactions.*
- *Synthesis of Organic compounds by catalytic Method eg. Proline.*

TEXT BOOKS:

1. Arun Bahl and B.S. Bahl, "Text Book to Organic Chemistry", 8th edition, S.Chand & Co, 2009.
2. R.T.Morrison and R.M.Boyd, "Organic Chemistry", 6th edition, Pearson Publications, 2008.
3. Graham Patrick, "A Very Short Introduction to Organic Chemistry", Oxford Publishers, 2017.

REFERENCE BOOKS:

1. Silverstein, Robert M. Bassler, G. Clayton Morrill and C.Terence, "Spectroscopic Identification of Organic Compounds", Wiley publishers, 1981.
2. O.P. Agarwal, "Reactions and Reagents", 46th edition, Goel Publications, 2005.
3 I.L.Finar, "Organic Chemistry", Vol – I, 6th edition, Longman Scientific Publications, 2006.
4. Jerry March,"Advanced Organic Chemistry", 4th edition, Wiley India Pvt. Ltd, 2007.
5. J. David Rawn and Robert Ouellette, "Organic Chemistry: Structure, Mechanism, Synthesis", 2nd edition, Academic Press, 2018.

LABORATORY MANUALS:

1. J.Mendham, R.C.Denney, J.D. Bares, M.Thomas and B.Siva Sankar, "Vogel's Text book of Qualitative Chemical Analysis", Pearson Publications - Volume I, 2009.
2. Brian S. Furniss, Antony J. Hannaford, Peter W.G. Smith and Austin R. Tatchell "Vogel's text book of Practical Organic Chemistry", 5th edition, Longman Scientific & Technical, 1989.