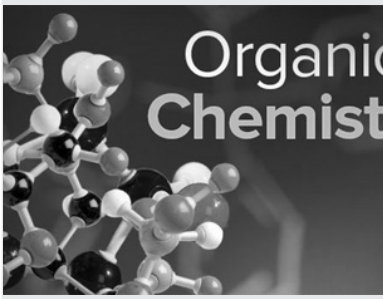
22CT104 ORGANIC CHEMISTRY



source: https://grasptutorials.com/subjects/jee.html

Hours Per Week :

L	T	P	C
2	0	2	3

PREREQUISITE KNOWLEDGE: Intermediate level knowledge of chemistry

COURSE DESCRIPTION AND OBJECTIVES:

This course is aimed at offering fundamental concepts of organic chemistry which will help to design and synthesize organic compounds and understand their properties. This course will make the student familiar with basic concepts of bonding, reaction intermediates and stereochemical aspects applicable in synthetic organic chemistry and organic materials. As a first-level course for B. Tech. students with biology background, it will be a strong basis to understand advanced level mechanistic aspects of biochemical reactions and also synthesis of organic molecules with medicinal value.

MODULE-1

UNIT-1 **9L+0T+6P=15 Hours**

CHEMICAL BONDING AND REACTION INTERMEDIATES

Chemical Bonding: Introduction to VBT and VSEPR theory, Molecular Orbital (MO) energy diagram of Ethylene, 1,3-Butadiene.

Reaction Intermediates: Bond fissions and arrow-pushing, formation, and reactivity of carbanions, carbocations, free radicals, carbenes.

UNIT-2 **15L+0T+10P=25 Hours**

STEREOCHEMISTRY

Representations of 3 Dimensional structures, Structural isomers and Stereoisomers, Chirality, optical isomerism - Enantiomers and Diastereomers (Lactic acid and Tartaric acid), Absolute configurations (R/S), Conformational analysis – Ethane.

PRACTICES:

- Comparison MO diagrams of 1,3,5 hexatriene and Benzene.
- Determination of melting point and boiling point of organic compounds.
- Separation of organic compounds by thin layer chromatography(TLC).
- Drawing of chemical structures (Vitamin A, B1, C, D/Amino acids/Sugars/Carbohydrates/ Flavonoids/Terpenoids).
- Analysis of functional groups.
- Carboxylic acids.
- Carbonyl compounds.
- Amines.
- Construction of organic molecules (Tartaric acid (meso, RR and SS) using ball stick models.
- Relevance of stereochemistry in biology eg. Thalidomide.
- Stability of carbocation by rearrangement.

SKILLS:

- ✓ *Design a scheme for an organic reaction.*
- ✓ *Identify the stereochemical feature of a molecules based on the structure.*
- ✓ *Apply the R&D scale to Gram scale reaction.*
- ✓ *Choose the desired green solvent required for a reaction.*
- ✓ *Analyse the desired product, side product and impurities formed during the course of the reaction pathway.*

MODULE-2

UNIT-1 **9L+0T+6P=15 Hours**

ORGANIC REACTIONS AND GREEN CHEMISTRY

Organic reactions: Introduction to reactions involving substitution (SN1 vs SN2), addition (Electrophilic and Nucleophilic), Elimination (E1 and E2), Oxidation (Jones reagent) and reduction (LiAlH4).

Green chemistry 12 Principles of Green chemistry and introduction to catalysis with example.

UNIT-2 **15L+0T+10P=25 Hours**

STRUCTURAL ELUCIDATION OF ORGANIC COMPOUNDS

IR Spectroscopy: Introduction, principle, identification of functional groups.

NMR spectroscopy: Introduction, principle, chemical shift, 1H-NMR (Ethyl alcohol and other simple molecules), cis-trans isomers (J values).

Mass spectroscopy: Introduction, principle, fragmentation (nitrogen rule), Radioisotopes in biology.

PRACTICES:

- Preparation and characterization of Aspirin.
- Paper Chromatography for Identification of Amino acids from the mixture.
- Reduction of Nitro group to amino group using metal catalysis and characterization by IR and NMR
- Characterisation (IR) of functional groups.
  Carboxylic acids.
  Carbonyl compounds.
  Amines.
- Oxidation and of an Organic compound using Potassium Permanganate (KMnO4).
- Reduction and of Aldehydes using Sodium Borohydride (NaBH4).
- Preparation and characterization of Paracetamol using IR.
- Synthesis of BINOL using solvent free methods.
- Qualitative analysis of Phytochemicals.
  Alkaloid.
  Flavonoids.
- Synthesis and characterisation of Friedel-Craft acylation and alkylation product using β-naphthol.
- Demonstration of C-C bond formation reaction using L-Proline catalyst.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Apply the theories of bonding to predict the formation and reactivity of different reaction intermediates in organic reactions.	Apply	1	1, 2, 9, 10, 11, 12
2	Identify the stereochemical features of organic molecules and their the importance of chirality with relevance to biological activity.	Analyse	1,	1, 2, 6, 9, 10, 11, 12
3	Analyse various synthetic reactions for preparation of drug molecules by implementing the concept of Green Chemistry.	Analyse	1, 2	1, 2, 6, 7, 9, 10, 11, 12
4	Verify the structure of organic compound using the principles of instrumental techniques for structure determination.	Evaluate	2	1, 2, 4, 5, 9, 10, 11,12

TEXT BOOKS:

1. A. Bahl and B.S. Bahl, “Text Book to Organic Chemistry”, S.Chand & Co, 8th Edition, 2009.
2. R.T. Morrison, R.M. Boyd and S.K. Bhattacharjee, “Organic Chemistry”, Pearson Publications, 7th Edition, 2018.

REFERENCE BOOKS:

1. I. L. Finar, “Organic Chemistry”, Vol. 1, Longman Scientific Publications, 6th Edition,2006.
2. P. Bruice, “Organic Chemistry”, Pearson Scientific Publications, 8th Edition, 2020.
3. R. M. Silverstein, G. Bassler, M. Clayton, C.Terence, “Spectroscopic Identification of Organic Compounds”, Wiley-VCH, 8th Edition, 2014.
4. J. Mendham, R. C. Denney, J.D. Bares, M. Thomas, B. Siva Sankar, “Vogel’s Text Book of Qualitative Chemical Analysis”, Pearson Publications - Volume I, 2009.
5. D.L. Pavia, G.M. Lampman, G.S. Kriz, R.G. Engel, “A microscale approach to Organic Laboratory Techniques”, Cengage Learning Brooks/Cole Cengage, 5th Edition, 2012.