Course Code				**23CHMIL231**			
Title of the Course				**FUNDAMENTALS IN ORGANIC CHEMISTRY**			
Offered to: (Programme/s)				**B.Sc. Hons Botany & Zoology**			
L	**4**	**T**	**0**	**P**	**0**	**C**	**3**
Year of Introduction:	**2024-25**			**Semester:**			**3**
Course Category:	**MINOR**			**Course Relates to:**	**GLOBAL**		
Year of Revision:	**2024**			**Percentage:**	**NA**		
Type of the Course:				Employability			
Crosscutting Issues of the Course :				Environment and Sustainability			
Pre-requisites, if any				**23CHMIL121**			

Course Description:

Organic chemistry primarily deals with the structure, properties, composition, reactions, and synthesis of carbon-based compounds. While carbon can form compounds with many elements, organic chemistry traditionally focuses on compounds containing carbon and hydrogen, and may also include elements like oxygen, nitrogen, sulfur, phosphorus, and halogens. Organic chemistry is a vast and dynamic field that underpins many aspects of science and industry, including pharmaceuticals, petrochemicals, polymers, and more. Mastery of its fundamentals provides a solid foundation for further study and application in various scientific and practical contexts.

Course Aims and Objectives:

S.NO	COURSE OBJECTIVES
1	Studying structural theory in organic chemistry aim is to provide students with a deep understanding of how the structure of organic molecules influences their properties, reactivity, and behavior.
2	Comprehensive understanding of alkanes and cycloalkanes, focusing on their structures, properties, reactions, and real-world applications.
3	Understanding of alkenes and alkynes, focusing on their structures, physical and chemical properties, reactions, and applications.
4	Comprehensive understanding of benzene and its reactivity, focusing on its structure, properties, reactions, and applications.
5	Thorough understanding of the orientation of aromatic substitution, focusing on how different substituent's influence the reactivity and regioselectivity of the aromatic ring in electrophilic aromatic substitution reactions.

Course Outcomes

At the end of the course, the student will be able to…

CO NO	COURSE OUTCOME	BTL	PO	PSO
CO1	Remember the structure of organic molecules influences their properties, reactivity, and behavior.	K1	PO2	PSO2
CO2	Remember alkenes and alkynes, focusing on their structures, physical and chemical properties, reactions, and applications	K1	PO2	PSO2
CO3	Understand chemical reactions ,alkanes ,alkens, alkynes, bezene and its orientation of aromatic substitution	K2	PO2	PSO1
CO4	Understand different substituent's influence the reactivity and regioselectivity of the aromatic ring .	K2	PO7	PSO1
CO5	Apply fundamental chemical reactions on different compounds in organic chemistry	K3	PO1	PSO3

For BTL: K1: Remember; K2: Understand; K3: Apply; K4: Analyze; K5: Evaluate; K6: Create

CO-PO MATRIX										
CO NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1		2							1	
CO2		2							2	
CO3		1						2		
CO4							1	2		
CO5	2									3

Use the codes 3,2,1 for High, Moderate and Low correlation Between CO-PO-PSO respectively

SYLLABUS

Unit 1. Structural theory in Organic Chemistry (9 h)

Types of bond fission and organic reagents (Electrophilic, Nucleophilic, and free radical reagents). Reaction intermediates – Carbocations, carbanions & free radicals. Bond polarization: Factors influencing the polarization of covalent bonds, inductive effect - Application of inductive effect (a) Basicity of amines (b) Acidity of carboxylic acids (c) Stability of carbonium ions. Resonance or Mesomeric effect, application to (a) acidity of phenol, and (b) acidity of carboxylic acids. Hyper conjugation and its application to stability of carbonium ions, Free radicals and alkenes.

Unit II Saturated Hydrocarbons (Alkanes and Cycloalkanes) (9 h)

General methods of preparation of alkanes- Wurtz and Wurtz Fittig reaction, Corey House synthesis, physical and chemical properties of alkanes, Conformational analysis of alkanes

(Conformations, relative stability and energy diagrams of Ethane, Propane and butane). General molecular formulae of cycloalkanes and relative stability, Baeyer strain theory, Cyclohexane conformations with energy diagram, Conformations of mono substituted cyclohexane.

UNIT-III Unsaturated Hydrocarbons (Alkenes and Alkynes) (9h)

General methods of preparation, physical and chemical properties, Saytzeff and Hoffmann eliminations (with mechanism), Electrophilic Additions, (H2, HX) mechanism (Markownikoff/ Antimarkownikoff addition) with suitable examples-syn and anti-addition; addition of X2, HX. Oxymercuration demercuration, ozonolysis, hydroxylation, Diels Alder reaction, 1,2- and1,4-addition reactions in conjugated dienes. Reactions of alkynes; acidity, electrophilic and nucleophilic additions, hydration to form carbonyl compounds, Alkylationof terminal alkynes.

UNIT-IV Benzene and its reactivity (9 h)

Concept of aromaticity, Huckel's rule - application to Benzenoid (Benzene, Naphthalene) and Non - Benzenoid compounds (cyclopropenylcation, cyclopentadienyl anion and tropylium cation)

Structure of Benzene – Preparation - polymerisation of acetylene and decarboxylation- Properties -mechanism of electrophilic aromatic substitution of Friedel- Craft's alkylation and acylation. halogenation and nitration,

UNIT-V Orientation of aromatic substitution (9 h)

Orientation of aromatic substitution - ortho, para and meta directing groups. Ring activating and deactivating groups with examples (Electronic interpretation of various groups like NO2 and Phenolic). Orientation of (i) Amino, methoxy and methyl groups (ii) Carboxy, nitro, nitrile, carbonyl and sulphonic acid groups (iii) Halogens.

II. List of Reference Books

1. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Guide book to Mechanism in Organic Chemistry by Peter Sykes 6th edition,1985.

References-weblinks

1. https://chem.libretexts.org/Bookshelves/Organic_Chemistry/Basic_Principles_of_Organic_Chemistry_(Roberts_and_Caserio)/02%3A_Structural_Organic_Chemistry

2. https://chem.libretexts.org/Bookshelves/General_Chemistry/Map%3A_Chemistry_(Zumdahl_and_Decoste)/21%3A_Organic_and_Biological_Chemistry/21.1%3A_Alkanes%3A_Saturated_Hydrocarbons

3. http://www.chem.latech.edu/~deddy/chem121/Alkene_Alkyne_Aromatic.htm

4. https://www2.chemistry.msu.edu/faculty/reusch/virttxtjml/benzrx2.htm

5. https://chem.libretexts.org/Bookshelves/Organic_Chemistry/Basic_Principles_of_Organic_Chemistry_(Roberts_and_Caserio)/22%3A_Arenes_Electrophilic_Aromatic_Substitution/22.05%3A_Effect_of_Substituent

SEMESTER -END QUESTION PAPER

Course Code & Title of the Course:	**23CHMIL231 FUNDAMENTALS IN ORGANIC CHEMISTRY**
Offered to:	**B.Sc. Hons Botany & Zoology**
Category:	**SEMESTER: III**
Max. Marks	**70**
Max.Time	**3 Hrs**

Section A: Short Answer Questions (20 Marks)

Answer all questions. Each question carries 4 Marks.

Q1 (a) Explain generation and any two reactions of Carbanion. K2

OR

(b) Describe different Types of bond fissions. K2

Q2 (a) Outline the Conformations, relative stability and energy diagrams of Ethane K1

OR

(b) List the methods of preparation of alkanes. K1

Q3 (A) Describe Diels alder reaction K2

OR

(b) Explain the acidity of alkynes. K2

Q4 (a) Explain the aromaticity of benzenoid compounds with two examples. K2

OR

(b) Explain the methods for preparation of benzene K2

Q5 (a) Illustrate meta directing groups. K3

OR

(b) Illustrate Ring activating and deactivating groups . K3

Section B: Long Answer Questions (50 Marks)

Answer all questions. Each question carries 10 Marks.

Q6 (a) Describe mesomeric effect and its application in acidity of phenol and acidity of carboxylic acids K2

OR

(b) Explain Hyper conjugation and its application to stability of carbonium ions, Free radicals and alkenes. K2

Q7 (a) Discuss Conformations, relative stability and energy diagrams of Propane and butane K2

OR

(b) Explain the following

i) Baeyer strain theory ii) Conformations of mono substituted cyclohexane. K2

Q8 (a) Interpret Markownikoff and Antimarkownikoff rules addition reactions with suitable examples K3

OR

(b) Apply Saytzeff and Hoffmann eliminations reactions with mechanism for preparation of alkenes. K3

Q9 (a) Discuss Concept of aromaticity and explain aromaticity of non benzenoid compounds with suitable examples K2

OR

(b) Explain the mechanism of Friedel- Craft's alkylation andacylation. halogenation and nitration reactons on benzene K2

Q10 (a) Interpret the ortho and para diierecting groups. K3

OR

(b) Explain orentation of Carboxy, nitro, nitrile, carbonyl and sulphonic acid group on benzene ring K2