CHEMISTRY COMPONENT

DISCIPLINE SPECIFIC CORE COURSE (DSC 03)

Credit distribution, Eligibility and Pre-requisites of the Course

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Organic Chemistry; ALS CHEM DSC 03	4	2	0	2	XII pass with Science with Biology/ Biotechnology	NIL

Learning Objectives:

The Learning Objectives of this course are as follows:

- To teach the fundamentals of organic chemistry.
- To introduce the basic concepts of stereochemistry of organic molecules.
- To familiarize students to different types of organic reactions.
- To inculcate the basics of reaction mechanism through different reactive intermediates.

Learning Outcomes:

By studying this course, students will be able to:

- Explain the relative behavior of organic compounds based on fundamental concepts learnt.
- Illustrate the mechanism of organic reactions by recalling and correlating the fundamental properties of the reactants involved.
- Differentiate between various types of organic reactions possible on the basis of reaction conditions.

Unit 1: Basic Concepts **(6 Hours)**

Electronic displacements and their applications: Inductive, electromeric, resonance (mesomeric) effects and hyperconjugation. Dipole moment, acidic and basic behaviour of organic molecules.

Homolytic and heterolytic fission. Types, shape and relative stability of carbocations, carbanions and free radicals. Electrophiles and nucleophiles.

Unit 2: Stereochemistry **(10 Hours)**

Stereoisomerism: Concept of asymmetry and Optical activity, Chirality in molecules with one and two stereocentres. Fischer projection, enantiomers, diastereomers and meso structures. Specific rotation.

Configuration: CIP rules: Erythro/Threo, D/L and R/S designations.
Geometrical isomerism: *cis-trans, syn-anti* and *E/Z* notations.
Conformational Isomerism: Newmann, Sawhorse, Fischer and their interconversion.
Conformations, relative stability and energy diagrams of Ethane, Propane and butane. Relative stability of cycloalkanes (Baeyer strain theory), Cyclohexane conformations with energy diagram. Conformations of monosubstituted cyclohexanes.

Unit 3: Types of Organic Reactions (10 Hours)

Introduction to substitution, addition, elimination, rearrangement, oxidation and reduction reactions.
Nucleophilic substitution reactions-SN1 and SN2 mechanisms with stereochemical aspects and effect of solvent.
Elimination reactions: E1 and E2 mechanisms, Saytzeff, Hoffmann eliminations and Cope elimination. nucleophilic substitution vs. elimination.
Free radical substitutions: Halogenation of alkanes and concept of relative reactivity and selectivity.
Electrophilic addition reactions of alkenes and alkynes: mechanism with suitable examples, (Markownikov's/anti-Markownikov's addition), syn and anti-addition; addition of hydrogen, halogens, hydroboration-oxidation, ozonolysis and hydroxylation.

Unit 4: Aromaticity (4 Hours)

Concept of Aromaticity: Electrophilic aromatic substitutions (with their mechanism): halogenation, nitration, Friedel Crafts alkylation/ acylation, sulphonation. Orientation and reactivity in mono-substituted aromatic compounds.

PRACTICAL (Credit: 02)

(Laboratory practical- 15 classes of 4 hours each)

1. Purification of organic compounds by crystallization (from water and alcohol) and distillation.
2. Calibration of thermometer.
3. Criteria of purity: Determination of melting point.
4. Effect of impurity on the melting point.
5. Determination of boiling point of liquid compounds (boiling point lower than and more than 100 °C by distillation and inverse capillary method).
6. Detection of extra elements.

7. Separation of a mixture of two amino acids/sugars by radial/ascending paper chromatography.
8. Preparations (Mechanism of various reactions involved to be discussed):
    a. Bromination of phenol/aniline
    b. Benzoylation of phenol/aniline
    c. Nitration of nitrobenzene/toluene

The above derivatives should be prepared using 0.5-1 g of the organic compound. The solid samples must be collected and may be used for recrystallization and melting point.

Essential/Recommended readings

1. Mehta Bhupinder; Mehta Manju (2015), *Organic Chemistry***,** Second Edition, ISBN-978-81-203-5126-4, PHI Learning Pvt. Ltd. New Delhi.
2. Sykes, P.(2003), *A Guide Book to Mechanism in Organic Chemistry***,** 6th Edition Pearson Education.
3. Eliel, E. L. (2001), *Stereochemistry of Carbon Compounds*, Tata McGraw Hill.
4. Morrison, R. N.; Boyd, R. N., Bhattacharjee, S.K. (2010), *Organic Chemistry*, 7th Edition, Pearson Education.
5. Bahl, A; Bahl, B. S. (2019), *Advanced Organic Chemistry*, 22nd Edition, S. Chand.

Suggestive readings

1. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. (2012), *Vogel's Textbook of Practical Organic Chemistry*, Pearson.
2. Mann, F.G.; Saunders, B.C. (2009), *Practical Organic Chemistry*, Pearson Education.
3. Dhingra, S; Ahluwalia V.K., (2017), *Advanced Experimental Organic Chemistry*, Manakin Press.
4. Pasricha, S.; Chaudhary, A. (2021), *Practical Organic Chemistry: Volume I*, I K International Publishing House Pvt. Ltd., New Delhi.
5. Singh, J.; Awasthi, S. K.; Singh, Jaya. (2023) *Fundamentals of Organic Chemistry-III*, Pragati Prakashan.

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.