

INSTITUTE	FACULTY OF SCIENCE
PROGRAM	MASTER OF SCIENCE (CHEMISTRY)
SEMESTER	1
COURSE TITLE	ORGANIC CHEMISTRY-CONCEPTS AND FUNDAMENTALS
COURSE CODE	02CY0406
COURSE CREDITS	6

Course Outcomes: After completion of this course, student will be able to:

- 1 Generalize the basic concepts of organic chemistry, reaction intermediates and reaction pathways
- 2 Basic Understanding of aromatic nucleophilic substitution reaction and its applications
- 3 Understand the importance of electrophilic substitution reaction and its applications
- 4 Predict the conformational preferences of common organic structures based on steric and electronic interactions and describe stereochemical and conformational structure on the chemical reactivity and on the mechanisms of organic reactions.

Pre-requisite of course: To understand basics of organic chemistry and its advanced application

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
5	0	2	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	Reactive intermediates and reaction pathways Homolytic bond fission, Heterolytic bond fission, Nucleophiles and electrophiles, Introduction, stability, generation, reactions and applications of carbocations, carbanions, free radicals, carbenes, nitrenes, benzyne, ylides and enamines.	12
2	Aromatic Nucleophilic Substitution reactions Nucleophilic substitution reactions, SN1, SN2, SNi and neighbouring group mechanisms, nucleophilic substitutions at allylic, aliphatic trigonal and vinyl carbons, effect of substrate, nucleophile, leaving group, and medium, stereochemistry of nucleophilic substitution, ambident nucleophiles, aromatic nucleophilic substitutions, SNAr, SN1, Sommelet-Hauser, Von Richter and Smiles rearrangement and Rosenmund reactions.	18

Contents : Unit	Topics	Contact Hours
3	Aromatic Electrophilic substitution reactions Aromatic electrophilic substitution, mechanism and reactivity, selectivity and orientation, applications of the Hammett and Taft equations, the effect of leaving group, linear free energy relationships, nitration, diazonium coupling, sulphonation, chlorination, bromination, Friedel-Crafts alkylation, acylation and arylation, aliphatic substitution mechanisms, S _N 2, S _N i and S _N 1, addition-elimination and cyclic mechanisms, hydrogen exchange, keto-enol tautomerism, halogenations of ketones, aldehydes and carboxylic acids, Stork enamines, carbene and nitrene insertions, Kolbe-Schmidt reaction.	18
4	Stereochemistry Stereochemistry: conformational analysis of acyclic and cyclic systems, enantiomers and diastereomers, prochiral faces, enantio and diastereotopicity, absolute and relative configuration, configuration descriptors R/S and E/Z notations, optical purity, enantio/diastereomeric excess., elements of symmetry, chirality, molecules with more than one chiral center, projection formulae (i) Fischer (ii) Sawhorse (iii) Newman (iv) Flying Wedge, threo and erythro isomers, methods of resolution, optical purity, enantiotopic and diastereotopic atoms, groups and faces, stereospecific and stereoselective reactions, optical activity in the absence of chiral carbon, CIP rule, Cram's rule	12
Total Hours		60

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	Experiments Experiment-1, Experiment-2, Experiment-3, Experiment-4, Experiment-5, Experiment-6, Experiment-7, Experiment-8	
Total Hours		

References:

- Organic Chemistry, Organic Chemistry, Finar, Pearson, 2002
- Named Organic Reactions, Named Organic Reactions, Thomas Laue, Wiley, 2005
- Modern Methods in Organic Synthesis, Modern Methods in Organic Synthesis, W. Carruthers and Iain Coldham, Cambridge University Press, 2004
- Principles of Organic synthesis, Principles of Organic synthesis, R.O.C. Norman, J. M. Coxon, CRC Press, 1993
- Organic Synthesis: Strategy and Control, Organic Synthesis: Strategy and Control, Stuart Warrens, Wiley, 2007
- Stereochemistry of Organic Compounds, Stereochemistry of Organic Compounds, E. Eliel & S. H. Wilen, Wiley, 1994

References:

- 7 Stereochemistry, Stereochemistry, D. Nasipuri, New Age International Private Limited, 2020
- 8 Stereochemistry of Organic Compounds, Stereochemistry of Organic Compounds, P.S. Kalsi, New Age International Private Limited, 2022

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking
10.00	20.00	25.00	25.00	10.00	10.00

Instructional Method:

- 1 The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
- 2 The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
- 3 Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
- 4 Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.
- 5 Use of hazardous/toxic chemicals should be avoided as far as possible in laboratory.
- 6 All students in the laboratory must wear safety goggles and lab coats during lab session.

Supplementary Resources:

- 1 <https://www.youtube.com/watch?v=tzpStGaLjSE>
- 2 <https://www.youtube.com/watch?v=IaplvqRjL1I>
- 3 <https://www.youtube.com/watch?v=d0p3Zx5gZSY>
- 4 <https://www.youtube.com/watch?v=BK09xpyA3vY>
- 5 <http://www.nptel.ac.in/courses/104103069/#>
- 6 <http://ocw.mit.edu/courses/chemistry/>
- 7 <http://vlab.amrita.edu/index.php?sub=2>
- 8 http://www.vlab.co.in/ba_labs_all.php?id=9