Syllabus for Master of Science

Organic Chemistry-I

Subject Code: 02CY0403

Subject Name: Organic Chemistry-I

M.Sc. Sem - I

Objectives:

- To provide students with a systematic approach to think about and plan the synthesis of complex and polyfunctional molecular targets using the tools of retro synthesis and multistep organic synthesis methods.
- Providing the knowledge and in depth understanding between the stereochemistry and conformation of organic molecules, their properties and behavior.
- Studying the consequences of different stereochemical and conformations on the chemical reactivity, mechanisms of organic reactions and modern methods of stereochemical and conformational analysis.
- To outline the role of heterocycles in organic, pharmaceutical and biological chemistry.

Credits Earned: 5 Credits

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

- Recognise and comment on different synthetic strategies and methods for stereocontrol when faced with a synthetic scheme.
- 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.
- Able to draw mechanisms for reactions involving heterocycles as starting materials, intermediates and products, and to propose syntheses of heterocycles from the major classes.
- Understand the importance heterocycles in biological systems and in pharmaceuticals.

Pre-requisite of course: NA.

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	Mid Sem (M)	Internal (I)	Viva (V)	Term work (TW)	
4	0	3	6	50	30	20	25	25	150

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Contents:

Unit	Topics	Contact Hours
1	**Synthetic methodology and Control** Disconnection approach towards synthesis of bifunctional molecules (both cyclic and acyclic): concepts of synthons, synthetic equivalents (ethyl acetoacetate, ethyl cyano acetate and diethyl malonate as examples). Functional group interconversion (FGI). Protection and deprotection of common functional groups (-OH, carbonyl, -NH_2, -CO_2H) in synthetic route, activation of synthetic equivalents. Umpolung: Illogical electrophiles and nucleophiles. Disconnection and synthesis of 1,3; 1,4 and 1,5-dioxygenated compounds. Robinson ring annulation, applications of Claisen rearrangement, Favorskii rearrangement and Demjanov rearrangements involving electron deficient C, O, N. Large ring synthesis: High dilution techniques.	20
2	**Stereochemistry:** Chirality of organic molecules with or without chiral centres. Specification of configuration in compounds having one or more stereogenic centres. Configurational and conformational isomerism in acyclic and cyclic compounds. Stereoselectivity, enantioselectivity, diastereoselectivity and asymmetric induction. Enantiotopic and diastereotopic atoms, groups and faces. Stereoselective and stereospecific synthesis. Conformational analysis of acyclic and cyclic compounds. Geometrical isomerism. Configurational and conformational effects on reactivity and selectivity/specificity.	20
3	**Aromaticity:** Concept of aromaticity, non-aromaticity and anti-aromaticity, Huckel's rule and its applications to simple and non-benzenoid aromatic compounds, cyclopentadiene, azulene, tropolone system, annulenes, hetero annulenes, and fullerenes (C60).	20
	Total Hours	**60**

References:

1. W. Carruthers and Iain Coldham, Some Modern Methods in Organic Synthesis, 4th Edition, Cambridge University Press.

2. R.O.C. Norman and J.M.Coxon, Principles of Organic Synthesis, Springer.

3. Stuart Warren, Paul Wyatt, Organic Synthesis: The Disconnection Approach, 2nd edition, Wiley.

4. Stuart Warren, Paul Wyatt, Organic Synthesis: Strategy and Control, Wiley.

5. E. Eliel & S. H. Wilen, Stereochemistry of Organic Compounds, Wiley.

6. D. Nasipuri, Stereochemistry, 2nd Edition, New Age International.
7. P. Kalsi, Stereochemistry of Organic Compounds, 6th Edition, New Age International.
8. J. A. Joule and K. Mills: Heterocyclic Chemistry (4 th Edition)

Suggested Theory distribution:

The suggested theory distribution as per Bloom's taxonomy is as per 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	Understand	Apply	Analyze	Evaluate	Create
20%	25%	20%	15%	10%	10%

Suggested List of Experiments:

Synthesis:

1. To prepare acetanilide from aniline. (Acetylation)
2. To prepare p-nitro acetanilide from acetanilide. (Nitration)
3. To prepare benzoic acid from benzaldehyde. (Oxidation)
4. Synthesis of diazoaminobenzene from aniline. (Diazotisation)

Qualitative Organic Analysis of Bifunctional Compounds:

1. Anthranilic acid
2. p-amino benzoic acid
3. m-nitro benzoic acid
4. Resorcinol
5. o/m/p-nitro aniline
6. o-chloro benzoic acid

At least FOUR unknown samples to be performed during lab session.

- **Reference Books:**

1. An Introduction to Experimental Organic Chemistry- Robert, Gilbert, Rodewaid & Wingrove.

2. Systematic Qualitative Organic Analysis-H. Middleton.
3. Hand Book of Organic Analysis- H. T. Clarke.
4. Text Book of Practical Organic Chemistry-A.I. Vogel.

Instructional Method:

a. 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.

b. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.

c. Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

d. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.

e. Use of hazardous/toxic chemicals should be avoided as far as possible in laboratory.

f. All students in the laboratory must wear safety goggles and lab coats during lab session.

Supplementary Resources:

1. http://www.nptel.ac.in/courses/104103069/#
2. http://ocw.mit.edu/courses/chemistry/
3. http://vlab.amrita.edu/index.php?sub=2
4. http://www.vlab.co.in/ba_labs_all.php?id=9