

Subject Code: 02CY0503**Subject Name: Heterocyclic Chemistry****M.Sc. Sem - III****Objectives:**

- To understand reaction mechanism in organic synthesis.
- To learn theories and principles related to heterocyclic chemistry.
- To learn various nucleophilic, substitution and electrophilic reactions in heterocyclic chemistry.
- To create an interest of students to learn organic chemistry.

Credits Earned: 6 Credits**Course Outcomes:** After completion of this course, student will be able to

- Organic reaction and mechanism pathways.
- Nucleophilic and electrophilic reaction mechanisms, catalyst and rearrangements reactions.
- Recognise and comment on different synthetic strategies and methods for stereocontrol when faced with a synthetic scheme.
- To draw mechanisms for reactions involving heterocycles as starting materials, intermediates and products, and to propose syntheses of heterocycles from the major classes.

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

Contents:

Unit	Topics	Contact Hours
1	Nomenclature of Heterocyclic compounds: Three membered Heterocyclic Compounds with one and two hetero atom Preparation, Chemical Reactions and properties of: Aziridine, Oxiranes, Thiiranes, Azirines, oxirane, diazirine and oxaziridine Four membered heterocyclic compounds with one hetero atoms Preparation, Chemical Reactions and properties Azetidines, Azetidines, Oxetanes, Thietanes, Azetidines, Oxetanones	12
2	Five membered heterocyclic compounds Preparation, Chemical Reactions and properties of Pyrrole, Furan, Thiophenes, Pyrazole, imidazole, thiazole, Oxazole Six membered heterocyclic compounds Preparation and properties of Pyridines, Pyrylium salts, α and γ -Pyrones	20
3	Bicyclic ring system Preparation, Chemical Reactions and properties of Indole, isoindoles, indolizines, Dibenzopyrroles, Benzofuran, Isobenzofuran, Benzthiophenes, Isobenzothiophenes, DibenzothiopheneQuinolines, isoquinolines, Acridines, Phenanthridines.	18
4	Miscellaneous heterocyclic compounds; Preparation, Chemical Reactions and properties of Pyridazines, Cinnolines, Phthalazine, Pyrimidine, Quinazolines, Pyrazine, Quinoxalines, Azepines, Oxepines, Thiopines, Benzimidazole, Benzpyrazoles, Benzoxazole,	10
	Total Hours	60

References:

1. Heterocyclic Chemistry-R.K. Bansal.
2. An introduction to the Chemistry of Heterocyclic Compounds - R.H.Acheson.
3. Chemistry of Heterocyclic compounds-J.J. Trivedi
4. Heterocyclic Chemistry-R.R. Gupta, M.Kumar and V. Gupta, Springer.
5. The Chemistry of Heterocycles - T. Eicher and S. Hauptmann.
6. Heterocyclic chemistry - J.A. Joule, K. Mills & G.F. Smith.
7. Comprehensive Heterocyclic Chemistry - A. R. Katritzky and C. W. Rees 69
8. Heterocyclic Chemistry - T. L. Gilchrist.
9. The Essence of Heterocyclic Chemistry, New Age International Publications, 2013.

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:**Multistep synthesis of Organic compounds:**

1. To prepare dihydropyridine derivative from benzaldehyde.[Hantzsch-Pyridine synthesis].
2. To prepare benzotriazole from o-phenylenediamine.
3. To prepare 2-methyl benzimidazole from o-phenylenediamine.
4. To prepare Acetanilide from acetophenone.
5. To prepare 2-phenyl indole from acetophenone.

Organic Qualitative Analysis of mixture of organic compounds (mixture of 2 and 3 organic compounds):

Identification of single solid organic compounds by chemical tests and preparation of a suitable solid derivative after consulting literature.

Tests include-

- a) Determination of m.p. of solid sample
- b) Detection of special Elements (Nitrogen, Halogens, Sulphur)
- c) Solubility in solvents at room temperature and classification
- d) Preliminary tests
- e) Test for functional group/s [aromatic 1°, 2°, 3° amino, anilido-, nitro-, amido-, phenolic-OH, carboxylic acid, carbonyl (keto, aldehyde), ester-, unsaturation, and hydrocarbon].
- f) Literature survey
- g) Preparation of at least one solid derivative including recrystallisation.
- h) Determination of m.p. of derivative.

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

Reference Books:

1. An Introduction to Experimental Organic Chemistry- Robert, Gilbert, Rodewald&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.organic-chemistry.org/reactions.htm>
2. <http://www.organic-chemistry.org/books/>
3. https://www.youtube.com/watch?v=Z_GWBW_GVGA
4. https://www.youtube.com/results?search_query=organic+rearrangements
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