

Approval: 9th Senate Meeting

Course Name: Heterocyclic Chemistry

Course Number: CY504

Credits: 2-0-0-2

Prerequisites: CY501

Intended for: UG/PG

Distribution: Core course for M.Sc Chemistry

Semester: Even

Preamble:

This course will provide a concise introduction to heterocyclic chemistry. Emphasis will be given on the most important heterocyclic systems particularly five, and six-membered heterocyclic systems as well as fused heterocyclic systems. Chemical synthesis, properties and characteristics of those systems will be discussed in details. In addition to their importance in biology, heterocyclic compounds also find wide applications in diverse areas such as in dyes, photosensitizers, coordination compounds, polymeric materials and many more to mention. This course will also discuss some of the key applications of various heterocyclic compounds in diverse fields.

Learning Outcome:

This course aims at providing theoretical understanding of heterocyclic chemistry which includes various methods for ring synthesis and application of those methods for the preparation of specific groups of heterocyclic systems. The students will be made familiar with particular properties, reactions, and applications of the most important as well as less common heterocycles.

Course Outline:

This course is comprised of five different modules. Whereas the first module will discuss about mono heteroatomic five membered heterocyclic systems, the second module is devoted to five membered heterocycles with two or more heteroatoms. The third module includes six membered heterocycles with one heteroatom, and the fourth module is comprised of fused heterocycles. The fifth module is designed for two or more heteroatomic six membered heterocycles.

Modules:

Module 1: Nomenclature, Classification of heterocycles; Common synthesis strategies for aromatic heterocycles; Furan, Pyrrole and Thiophene (five membered heterocycles with one heteroatom) – general methods and strategies for their synthesis; their properties, structure and reactivity; their electrophilic substitution and metalation. (7 lectures)

Module 2: Five membered heterocycles with two heteroatoms- Pyrazole, Imidazoles, Thiazole, Isothiazole; Isoxazole and Oxazole - Brief introduction, synthetic approaches and chemical reactions. (5 lectures)

Module 3: Six membered heterocycles with one heteroatom. Pyridines – general properties, structure, synthesis strategies, electrophilic and nucleophilic substitution reactions in pyridines, metalation of pyridines; Pyridine derivatives such as oxy-pyridines, alkyl pyridines, pyridinium salts, and pyridine N-oxides (5 lectures)

Module 4: Fused heterocyclic systems. Indole - electronic structure and reactivity of indoles, Fisher and Bischler indole syntheses, reaction of indole with electrophiles, Mannich reaction of Indoles; Quinoline and Isoquinoline - General properties and reactivity, synthesis strategies, electrophilic and nucleophilic substitution reactions in quinolones and Isoquinolines. (7 lectures).

Brief on the modern methods and applications.

Module 5: Six membered heterocycles with two heteroatoms. Pyridazine, Pyrimidine, Pyrazine, and Oxazines – brief introduction, synthesis strategies and reactions. (4 lectures)

Books Recommended:

Text Books:

1. **Heterocyclic Chemistry – (3rd Ed.) J. A. Joule, K. Mills and G. F. Smith**
2. **Heterocyclic Chemistry – (2nd Ed.) T. L. Gilchrist**

Reference Books:

1. **Aromatic Heterocyclic Chemistry - D. T. Davies**
2. **The Chemistry of Heterocycles' by T. Eicher and S. Hauptmann**
3. **Principles of Modern Heterocyclic Chemistry - Lee A. Paquette**
4. **Molecular Rearrangement – P-de-Mayo**