Lecture Plan

Name of the college: Government College of Arts, Science & Commerce, Sanquelim, Goa		
Name of Faculty: Dr. Dipesh Sakharam Harmalkar	**Subject: Advanced Organic Chemistry I**	
Paper code: CHC-304	**Program/Course: T.Y.BSc.**	**Division:**
Academic year: 2025 - 2026	**Semester: VI**	**Total Lectures: 15**
Credits: 3		

Course Objectives:

- To acquire knowledge of natural product chemistry and heterocyclic chemistry.
- To understand NMR spectroscopy and solve problems on structure elucidation.
- To understand mechanism of name reaction and rearrangements.

Expected Course Outcome:

At the end of the course students will be able to:

CO1. Recall and describe the fundamental concepts, definitions, structures, classifications, and basic reactions of heterocyclic compounds, principles of NMR spectroscopy, chemistry of natural products and important name reactions and rearrangements

CO2. Explain the structural features and reactivity patterns of heterocyclic compounds; interpret the basic concepts of ^{1}H and ^{13}C NMR spectroscopy for simple organic molecules; describe the structural elucidation, synthesis, and chemical significance of selected natural products; and summarize the mechanisms and synthetic importance of selected organic name reactions and rearrangements.

CO3. Apply the fundamental principles of heterocyclic chemistry, spectroscopic techniques, and the chemistry of natural products to analyze, interpret, and predict the structure, reactivity, and synthesis of organic compounds, including heterocycles, terpenes, alkaloids, vitamins, and key rearrangements used in pharmaceutical and industrial applications.

CO4. Analyse the structural features, reactivity patterns, reaction mechanism and deduce the structure using spectroscopic techniques (^{1}H NMR, ^{13}C NMR) of heterocyclic and natural organic compounds.

Learning Outcome:

At the end of the course students will be able:

LO1: Recall and describe the basic concepts, structures, reactions, and principles of heterocyclic chemistry, NMR spectroscopy, natural products, and key name reactions.

LO2: Explain the structural features, reactivity patterns, NMR concepts, and chemical significance of heterocycles, natural products, and important rearrangements.
LO3: Apply concepts of heterocyclic chemistry, spectroscopy, and natural product chemistry to interpret structures, predict reactions, and design simple synthetic routes.
LO4: Analyze reaction mechanisms and deduce the structures of heterocyclic and natural organic compounds using ^{1}H and ^{13}C NMR data.

Month	Lectures From	Lectures To	No. of lectures allotted	Topic, Subtopic to be covered	Exercise/Assignment	ICT Tools	Reference books
December	01-12-2025	23-12-2025	03	**1. Chemistry of Heterocyclic compounds:** Definition of heterocyclic compounds: Organic compounds containing oxygen, sulphur, nitrogen. Classification with examples for three, four, five and six membered heterocycles. Structure, resonance, stability and industrial source of furan, pyrrole, thiophene and pyridine.		Smart board, Power point presentation, Google classroom.	[1-5]
January	02-01-2026	31-01-2026	03	**1. Chemistry of Heterocyclic compounds:** Preparation of furan, pyrrole and thiophene using Paal Knorr Synthesis. Reactivity of furan, pyrrole and thiophene: Electrophilic substitution at 2/5 position. (Nitration, Friedel-Crafts acylation, Sulphonation, Halogenation).	ISA I: Assignment	Smart board, Power point presentation, Google classroom, Google quiz	[1-5]
February	01-02-2026	28-02-2026	04	**1. Chemistry of Heterocyclic compounds:** Reactivity of furan, pyrrole and thiophene: Electrophilic substitution at 2/5 position. (Nitration, Friedel-Crafts acylation, Sulphonation, Halogenation). Preparation of pyridine using Hantzsch synthesis. Reactivity of pyridine: Basicity order of pyrrole, pyridine and piperidine. Electrophilic substitution at 3 position. Nucleophilic substitution at 2/4 position.	ISA II: Written test	Smart board, Power point presentation, Google classroom, Google quiz	[1-5]
March	01-03-2026	31-03-2026	05	**1. Chemistry of Heterocyclic compounds:** Definition of bicyclic heterocycles with examples. Structure, resonance, stability and industrial source of indole, quinoline, isoquinoline. Preparation of indole using Fischer	ISA III: Quiz	Smart board, Power point presentation, Google classroom	[1-5]

				indole synthesis. Reactivity of Indole: Electrophilic substitution at 3 position. Skraup synthesis of quinoline and Bischler Napieralski synthesis of isoquinoline. Electrophilic substitution at 5 and 8 positions.			

References:

[1] Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson, 2010.
[2] Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.
[3] Carey, F., Organic Chemistry, 4th ed., McGraw Hill, New York, USA, 2000.
[4] Bruice, P. Y., Organic Chemistry, 3rd ed., Pearson Education, Asia, 2014.
[5] Joule, J. A. and Mills, K., Heterocyclic chemistry, 5th ed., Wiley-Blackwell, New Jersey, USA, 2010.

*** Assessment Rubrics**

Component	Max Marks
ISA	15
Semester End Exam	60
Practical	25
Total	100