

## Organic and Hydrocarbon Chemistry

- 1.1 Course Number: CY 121
- 1.2 Contact Hours: 3-1-0 Credits: 11
- 1.3 Semester-offered: 1<sup>st</sup> Year-Odd
- 1.4 Prerequisite: Nil
- 1.5 Syllabus Committee Member: Dr. A. K. Choubey, Dr. U. P. Ojha, Dr. D. Panda & Dr. Arshad Aijaz

**2. Objective:** To teach students various mechanisms of organic reactions and role of stereochemistry and reaction conditions on the reaction rate along with effect of substituent with particular reference to various well-known name reactions. The students are also taught about various synthetic procedures available to synthesize ring compounds (heterocyclic reactions) with mechanism and factors affecting the stereochemistry, rate of reaction and yield. The course offers comprehensive account of synthetic strategies utilized currently to synthesize heterocyclic compounds, drugs, polymers and other useful organic materials.

### 3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-topic	Lectures
1	Reaction Mechanism	Mechanism of Nucleophilic & electrophilic substitution reactions, Elimination and addition reactions. Effect of stereochemistry, solvent, and reaction conditions on the reaction rate and product selectivity. Demonstration of the above concept with well-known name reactions Examples of well-known oxidation and reduction reactions with mechanisms.	7
2	Reaction Umpolung	Reaction umpolung cases; classification, mechanism and utilization of the same to form C-C, C-N & C-O bonds. Examples: Stetter Reaction, Benzoin condensation via Breslow mechanism, Umpolung of enals, isomerization of conjugated alkynes, Trost's umpolung, Rauhut-Currier dimerization and Morita-Baylis-Hillman reaction, etc.	8
3		Electrocyclic reaction, cycloaddition reaction and sigma tropic reaction, mechanism and stereochemistry of the	8

	Pericyclic Reactions	production, feasibility criteria based on Molecular orbital theory, Woodward-Hoffmann Rule, Longuet-Higgins model, Examples	
4	Heterocyclic Compounds	Introduction and Preparation of Heterocyclic compounds Five membered heterocyclic compounds: Preparation, Chemical Reactions and Properties of Pyrrole, Furan, Thiophenes, Pyrazole, Imidazole, Thiazole, etc. Six membered heterocyclic compounds: Preparation and Properties of Pyridines.	8
5	Hydrocarbon Chemistry	Petroleum: Composition, classification and properties of crude oil, Processing of crude oil, Sweetening and cracking (basic concepts), Octane number, Cetane number. Additives to improve the quality of diesel and petrol.  Petroleum Analysis and Evaluation: Definitions, ASTM evaluation, etc.	9
		Total	40

#### 4. Readings

##### 4.1 Textbook:

- Organic Synthesis, Theory, Reactivity and Mechanism in Modern Synthesis, Pierre Vogel Kendall N. Houk
- Organic Synthesis Strategy and Control Paul Wyatt & Stuart Warren
- Principles of Organic Synthesis R.O.C Norman & J. M. Coxon
- March's Advanced Organic Chemistry: M. B. Smith
- Heterocyclic Chemistry - T. L. Gilchrist
- Speight, J. G., Petroleum Chemistry and Refining, Taylor and Francis, New York, 1998.

##### 4.2 Reference books:

- Organic Synthesis: The Disconnection Approach Stuart Warren
- Advanced Organic Chemistry: F.A. Carey, R. J. Saundberg

#### 5. Outcome of the Course:

The students will receive an in-depth knowledge in various aspects of organic synthesis and learn about strategies those shall be adopted to synthesize various organic compound. This will aid the aptitude of the students in designing of various organic compounds targeting various applications. The course will also provide idea about the strategies those may be adopted to control the product type from a particular set of reactants.