



**Birla Institute of Technology & Science, Pilani**  
Hyderabad Campus

**FIRST SEMESTER 2023-2024**

**Course Handout (Part II)**

Date:

11.08.2023

Course No: CHEM F212  
Course Title: **ORGANIC CHEMISTRY -I**  
Instructor-in-charge: Anupam Bhattacharya  
Instructor: Manab Chakravarty

**1. Scope and objective of the course:** To familiarize the students with basic mechanistic aspects of organic reactions, including mechanistic types, thermodynamics and kinetics, the important intermediates involved in organic reactions, and functional group chemistry.

**2. Text Book:** R. T. Morrison, R. Boyd and S. K. Bhattacharjee, Organic Chemistry, 7<sup>th</sup> edition. **(T1)**

**Reference Books:** J. Clayden, N. Greeves, S. Warren, P. Wothers, Organic Chemistry, OUP, 1<sup>st</sup> ed., 2000. **(R1)**

Jerry March, Advanced Organic Chemistry, John Wiley & Sons, 4<sup>th</sup> ed., 1992. **(R2)**

G Marc Loudon, Organic Chemistry, Oxford, 4<sup>th</sup> Edition, 2002.

Francis A Carey, Organic Chemistry, Tata McGraw-Hill, 7<sup>th</sup> edition, 2008.

### 3. Course Plan:

Lec. No.	Learning objectives	Topics to be Covered	Learning Outcomes	Chap(s). No(s).
1-2	Basic terminology and representation of organic	Homolytic, heterolytic fission of bonds, the concept of electrophiles and nucleophiles; how to write organic reaction mechanisms;	Understanding of basic organic reactions and drawing reactions realistically towards creative organic chemistry; Representing the movement of electrons in reactions by curly arrows	<b>T1:</b> Ch. 4, pg. 55-59 <b>R1:</b> Ch. 5, pg. 116-131. Lecture notes

	reactions	movement of arrows; curved and fish-hook arrows; examples		
3-4	Reactive intermediates: carbocations	Carbocations: Structure & stability, generation and reactions	Detailed analysis on the generation, character, type and role of the useful intermediate carbocation in organic reactions, application in organic synthesis with stereochemical outcome	<b>T1:</b> Ch. 4, pg. 64-69. Lecture notes
5	Reactive intermediates: carbanions	Carbanions: Structure & stability, generation and reactions	Idea about another intermediate and difference between cation and anion intermediates in terms of the synthesis, behavior etc. Use of such intermediate in organic reactions	<b>T1:</b> Ch. 4, pg. 69-72. Lecture notes
6-7	Reactive intermediates: free radicals	Free radicals: Structure & stability, generation and reactions	Intermediate with a free electron and their reactions follow different rules than ionic intermediates, Idea of polymerization.	<b>T1:</b> Ch. 4, pg. 81-86. Lecture notes
8-10	Reactive intermediates: others	Carbenes; nitrenes: generation, stability, and fate	Substrate Conditions to generate carbenes, Carbenes are neutral species with only six electrons, electrophilic nature, insertion reaction and application in organic synthesis and modern development; How different these are from the ionic intermediates? The same information related to nitrene is expected to be gained as nitrenes are the nitrogen analogue of carbenes.	<b>T1:</b> Ch. 4, pg. 72-78. Lecture notes
11-13	Aromatic chemistry	Aromatic nucleophilic substitutions; Aromatic electrophilic substitutions; $S_NAr$ mechanism; benzyne mechanism;	Concept of aromaticity, Understanding the ways to functionalize the aromatic ring and its usefulness in generating medicines and functional materials	<b>T1:</b> Ch. 5C, pg. 262-283; Ch. 9, pg. 488-502. <b>R1:</b> Ch. 23 , pg. 589-604. Lecture notes
14-17	Thermodynamics and kinetics of reactions	Thermodynamic and kinetic control; Hammond postulate; methods to determine mechanisms (Hammett equation, kinetic isotopic effect); examples	Importance in proposing mechanism, how the thermodynamic and kinetic parameters help to determine the feasibility of reactions (the speed and energy), and how a reaction rate can vary with different substitutions.	<b>T1:</b> Ch. 4, pg. 97-102. <b>R1:</b> Ch. 13, pg.319-330. Ch. 22, pg. 554-556. Ch. 41, pg.1090-1101. <b>R2:</b> Ch. 6, pg. 208-215, 217-219, 226.

				Lecture notes
18-21	Alkyl and aryl halides	Synthesis and reactions of alkyl and aryl halides	How are these halides related to our daily needs and the chemistry behind the fact.	<b>T1:</b> Ch. 8, pg. 426-462. Ch. 9, pg. 482-485. Lecture notes
22-25	Alcohols, phenol and ethers	Synthesis, reactivity; applications of Grignard reagents for synthesis; diols, acid/base catalysed ring opening	The chemistry involved in the naturally occurring functional groups that contain polar C-O bond, the distinct reactivity of these functional groups will be understood.	<b>T1:</b> Ch. 10, pg. 507-537. Ch. 11, pg. 545-562. Lecture notes (epoxides)
26-28	Amines and nitro compounds	Synthesis, basicity and reactions	Many interesting natural products and widely used drugs are amines; hence such functional group chemistry will be learnt.	<b>T1:</b> Ch. 15, pg. 696-736. Lecture Notes (Nitro compounds)
29-37	Carbonyl compounds	Synthesis, reactivity, enolates, malonate and ethyl acetoacetate synthesis Aldol, Crossed Aldol and Claisen condensation; Conjugate addition reactions of $\alpha$ , $\beta$ -unsaturated carbonyl compounds with special reference to Michael addition, Mannich reaction, Wittig reaction	Concept about the most important functional group because its electron-deficient carbons and easily broken $\pi$ -bond. The important name reactions and their applications in organic synthesis to synthesize medicinally useful molecules.	<b>T1:</b> Ch. 12, pg. 571-611. <b>R1:</b> Ch. 21, pg. 524-541. Lecture notes (malonate & ethyl acetoacetate)
38-40	Carboxylic acid & derivatives	Synthesis, reactions, conversion for acid to other derivatives	Enrich with these interesting functional groups in terms of preparation, features important products such as aspirin.	<b>T1:</b> Ch. 13, pg. 624-648; Ch. 14, Pg. 657-685. Lecture notes
41-42	Carbohydrates	Introduction and their reactions	Concept on the largest group of organic molecules in nature, the basic structures and reactions of carbohydrates	<b>T1:</b> Ch. 26, pg. 1228-1236, 1244-1253. Lecture notes

--	--	--	--	--

**4. Evaluation:**

Component	Duration	Weightage (%)	Date and Time	Nature of Component
Mid Sem test	90 min.	25	09/10 - 9.30 - 11.00AM	<b>Closed Book</b>
Class tests*	Continuous	30		Open Book
Comprehensive Examination	180 min	45	06/12 FN	<b>Closed Book</b>

**\*Equal numbers of class tests will be conducted before and after the mid-semester examination.**

**All the class tests will be considered for the final total**

**5. Make-up(s) will be granted only for genuine reasons.**

**6. Consultation Hour:** To be announced.

**7. Notices** related to the course will be displayed on **CMS only**.

**8. Academic Integrity Policy:** It is expected that academic integrity should be adhered to in all the evaluation components. Students are responsible for their work and actions related to all academic endeavours. **Students should work alone on all the evaluation components unless otherwise directed by the instructor and follow the rules provided for all quizzes and examinations.**

**Malpractice in any form will have serious implications.**

**Instructor-in-charge**