



**FIRST SEMESTER 2022-2023**  
**Course Handout (Part II)**

Date: 29-08-2022

In addition to part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. : **CHEM F415**  
Course Title : **Frontiers in Organic Synthesis**  
Instructor-in-Charge : **TANMAY CHATTERJEE**

**Scope and Objective of the Course:** This course is designed to give understanding of traditional organic reactions and synthesis up through modern synthetic reactions with concurrent development of strategies for synthesis design. An emphasis will be placed on assembling the most important reaction methodologies in the context of complex molecule synthesis.

**Textbooks:**

1. Paul Wyatt & Stuart Warren, Organic Synthesis: Strategy and Control, Wiley (2008).

**Reference books:**

1. **R1.** J. Clayden, N. Greeves, S. Warren, P. Wothers, Organic Chemistry, Oxford Univ. Press (Second South Asia Edition, 2012).
2. **R2.** W. Carruthers, I. Coldham, Modern Methods of Organic Synthesis, Cambridge Univ. Press, 4<sup>th</sup> ed. (2004).
3. **R3.** B. D. Gupta and A. J. Elias, Basic Organometallic Chemistry: Concepts, Syntheses and Applications, Universities Press, 1<sup>st</sup> ed., 2010.

**Course Plan:**

Lecture No.	Learning objectives	Topics to be covered	Chapter in the Text Book
1-9	To learn selectivity concept in design and synthesis of complex and optically active molecules	Background of Chemo-, Regio- and Stereo-Selectivity with relevant examples	<b>TB:</b> Ch 2,3,4
10-17	To have mechanistic knowledge of carbon-carbon bond forming reactions in organic synthesis	Introduction and selective examples on metal-catalyzed sp, sp <sup>2</sup> and sp <sup>3</sup> C-C formation and C-X (X = heteroatom) couplings.	<b>TB:</b> Ch 18, <b>R1:</b> Ch 40, <b>R2:</b> Ch 1.2.4, <b>R3:</b> Ch 16 Class notes
18-22	To understand the roles of transition metals in constructing carbon-carbon and carbon-heteroatom bonds	Metal-catalyzed carbocyclization: From Ru and Rh-mediated cycloadditions to Pt and Au chemistry; Ring closing metathesis. Baldwin rules for cyclization reactions	<b>R1:</b> Ch 40, <b>R3:</b> Ch 15 Class notes



23-26	To learn the use of cross-coupling reactions in multi-step synthesis	Direct functionalization of olefins, including hydroamination, hydrogenation, hydrosilylation, hydroformylation.	<b>R3:</b> Ch 12-13 Class notes
27-32	To gain knowledge on different methods to form radicals and their potential applications in C-C and C-X bond formation	Introduction, generation of radicals using different methods and potential application for C-C and C-X bond formation.	<b>R2:</b> Ch 4.1, Class notes
33-37	To have knowledge on multi-bond forming processes and impact on diversity-oriented synthesis; use of advanced concepts in complex organic syntheses leading to bioactive and natural compounds	Introduction and emphasis on Ugi, Mannich, Biginelli reaction, Pauson–Khand reaction, Passerini reaction. Introduction and selective examples of Tandem reactions.	<b>TB:</b> Ch. 36, Class notes
38-42	To understand the importance of metal free catalysis and their usefulness in organic synthesis	Need of metal free catalysis, introduction to the development of organocatalysis: amine catalysis (enamine and iminium ion); towards metal-free catalysis, phase transfer catalysis.	Class notes

#### Evaluation Scheme:

Component	Duration	Weightage (%)	Date & Time	Nature of Component
Mid-Semester Examination	90 min	30	31/10 11.00 - 12.30PM -	Closed book
Class tests/Quizzes	-	20	Continuous/TBA	Closed book
Seminar	10 min	10	Continuous/TBA	Open book
Comprehensive Examination	180 min	40	17/12, AN	Open book (15%) + Closed book (25%)

**Learning Outcomes:** The learning outcomes of this course are the understanding of the concept of selectivity in organic synthesis and having the knowledge about the applications of the following topics in modern organic synthesis: (i) C-C cross-coupling reactions, (ii) metal-catalyzed or metal-mediated cyclization and cycloaddition reactions, (iii) hydroamination, (iv) hydrogenation, (v) hydroformylation, (vi) radical chemistry, (vii) multicomponent reactions, (viii) metal-free synthesis, and (ix) organocatalysis.

**Academic Honesty and Integrity Policy:** Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

**Chamber Consultation Hour:** To be announced in the class.

**Notices:** All the notices will be uploaded in CMS and/or will be displayed in Chemistry Department Notice Board.

**Make-up Policy:** Make-up(s) will be granted only for genuine reasons according to BITS guidelines.

**INSTRUCTOR-IN-CHARGE**

