# University of Management & Technology
## School of Science
### Department of Chemistry

# CH 602 Advanced Organic Chemistry

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| **Resource person** | Dr Ayesha Mohyuddin | **Contact** | ayesha.mohyuddin@umt.edu.pk |
| **Office** | 2nd Floor, South Block,<br>3S-32 | **Credit Hours** | 3 |
| **Course Description** | Modern organic chemistry is often viewed as involving hundreds of individual reactions. Each of these reactions has its own particular advantages and disadvantages. At first glance it would appear to be an impossible task to grasp even a fraction of the information known about these reactions, especially in a one-semester class. Fortunately, however, many of these reactions can be understood in the context of a few fundamental principles. An understanding of these principles can allow the chemist to develop methods for what kinds of transformations can be done, for how chemical reactions can be controlled, and for how chemistry can be used to selectively piece together molecules with a wide range of architectural diversity. In this course, the synthesis of several complex organic molecules will be examined. These molecules will provide a backdrop for exploring the factors that govern particular transformations within a synthetic sequence, as well as the choice of the overall synthetic route itself. | | |
| **Expected Outcomes** | This course will develop the students' ability to perform a wide variety of organic reactions with an emphasis on theory and reaction mechanisms. After completing this course students will be able to:<br>✓ To understand how different experimental techniques are used to elucidate organic reaction mechanisms<br>✓ To become more familiar with the three main mechanistic classes (polar, radical, pericyclic) of organic reactions.<br>✓ To understand the key issues involved in organic synthesis<br>✓ Employ the knowledge of organic syntheses for research<br>✓ Utilize their skills to understand the mechanisms involving preparation of various types of pharmaceutical and industrial products regarding their career perspective | | |
| **Reference book(s)** | ➢ Smith, M. B., "March's Advanced Organic Chemistry: Reactions, Mechanisms, and Structure", 7th ed., John-Wiley & Sons, Inc., (2018).<br>➢ Solomons, T. W. G. and Fryhle, C. B., "Organic Chemistry", 12th ed., John-Wiley & Sons, Inc., (2017)<br>➢ Morrison, R.T. and Boyd, R. N., "Organic Chemistry", 6th ed., Prentice Hall, New Jersey, (1992).<br>➢ Sykes, P., A Guide Book to Mechanism in Organic Chemistry, 6th ed., Pearson Education, (1986).<br>➢ Carey, F. A. and Giuliano, R. M., *Organic Chemistry*, 9th ed., McGraw-Hill Education, (2013) | | |
| **Grading Policy** | • Quizzes & Assignments: 20% (15+5)<br>• Case study 5%<br>• Presentation 5% | • Midterm: 25%<br>• Final Exam: 45%<br>• 75% attendance is mandatory to give final exam | |

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## Lecture plan

| Week | TOPICS |
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| 1 | Mechanism & Reactions: Reduction |
| 2 | Mechanism & Reactions: Oxidation<br>Activity: Significance of Oxidation and Reduction in real life |
| 3 | Conformational isomerism: In open chain system, In six membered rings, Ring strain and reaction mechanism |
| 4 | Stereochemistry: Nomenclature and Configuration of Chiral compounds, , Molecules with more than one stereocenters, Method of resolution, Asymmetric synthesis |
| 5 | Geometric Isomerism: In double bond, In monocyclic Compounds, In fused and bridged ring structure, stereospecific and stereoselective syntheses<br>Activity: Significance of Stereochemistry in real life |
| 6 | Carbocations & Carbanions: Naming, Stability, Structure, Generation & Reactions |
| 7 | Free radicals & Carbenes: Stability, Structure, Generation & Reactions<br>Activity: Examples of Organic Reaction Intermediates |
| 8 | Nucleophilic Rearrangements: Wagner-Meerwein; Pinacol; Semipinacol; Tiffeneau-Demjanov; Benzil-Benzilic Acid; Beckmann; Baeyer-Villiger<br>Activity: Applications of Nucleophilic Rearrangements in real life |
| 9 | MID TERM |
| 10 | Electrophilic Rearrangements: Favorskii; Stevens; Sommelet–Hauser; Wittig; Fries.<br>Activity: Applications of Electrophilic Rearrangements in real life |
| 11 | Free Radical Rearrangements: Hunsdiecker; Barton Decarboxylation; Sandmeyer; Kolbe electrolysis; Gomberg–Bachmann.<br>Activity: Applications of Free Radical Rearrangements in real life |
| 12 | Aliphatic and Aromatic Nucleophilic Substitution reactions: Mechanism, $S_N2$, $S_N1$, $S_Ni$, Ion pairs, Allylic Rearangements |
| 13 | Aromatic Electrophilic Substitution reactions: Mechanism, $S_E1$, Ortho/Para ratio |
| 14 | Aromatic Electrophilic Substitution reactions: Ipso Attack, Orientation in ring system |
| 15 | Aliphatic Electrophilic Substitution reactions: Mechanism, $S_E2$, $S_Ei$, Reactivity |
| 16 | Elimination reactions: Mechanism, E2, E1, E1cB, E2C, Regiochemistry of Double bond<br>Activity: Significance of Substitution and Elimination reactions |

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| 17 | Overview of the Elimination and Substitution Reactions |
| 18 | FINAL EXAM |