CHE-303-MJ-T: ORGANIC CHEMISTRY II

Course Type: Major Theory **Credits: 2**

A. Course Objectives:

1. To provide knowledge of electrophilic aromatic substitution and aromatic reactivity.
2. To familiarize students with heterocyclic compounds and their chemical behavior.
3. To introduce important named reactions and molecular rearrangements.
4. To develop understanding of stereochemical concepts and molecular chirality.
5. To build insight into retrosynthetic analysis and synthetic planning.

B. Course Outcomes (COs):

CO No.	Course Outcome Statement (COs) *After learning the course, the students are able to -*
CO-1	Recall concepts of aromatic substitution, heterocyclic chemistry, named reactions, stereochemistry, and retrosynthesis.
CO-2	Explain mechanisms, reactivity, and stereochemical aspects of organic compounds.
CO-3	Apply principles to predict products and plan synthetic routes.
CO-4	Analyze reaction pathways, stereochemical outcomes, and synthetic strategies.
CO-5	Evaluate reaction efficiency, selectivity, and applicability in organic synthesis.
CO-6	Illustrate mechanisms, stereochemical relationships, and retrosynthetic disconnections.

C. Contents:

Prerequisites	
Students should have basic knowledge of organic reaction mechanisms, functional groups, and chemical bonding. Familiarity with electronic effects (inductive, resonance), stereochemistry basics, and reaction intermediates is required.	
Chapter 1: Electrophilic Aromatic Substitution Reactions	**06 Hours**
Introduction to aromaticity and stability of aromatic systems, General mechanism of electrophilic aromatic substitution (formation of σ-complex/arenium ion). Nitration, sulfonation, halogenation, Friedel-Crafts alkylation and acylation reactions. Orientation and reactivity in monosubstituted benzenes: activating and deactivating groups, ortho/para and meta directing effects, Multiple substitutions, steric and electronic effects, Electrophilic substitution in polycyclic aromatic hydrocarbons (naphthalene: α and β orientation)	

Chapter 2: Heterocyclic Chemistry	06 Hours
Introduction and classification of heterocyclic compounds. Aromaticity in heterocycles. Structure, aromatic character and reactivity of five-membered heterocycles: pyrrole, furan and thiophene. Paal–Knorr synthesis. Electrophilic substitution reactions of pyrrole, furan and thiophene: reactivity and orientation, Structure of pyridine: basicity, effect of nitrogen on reactivity, Electrophilic and nucleophilic substitution reactions of pyridine.	
Chapter 3: Named Reactions and Rearrangements	**08 Hours**
Aldol condensation, Cannizzaro reaction, Perkin reaction, Reformatsky reaction, Diels-Alder reaction, Wittig reaction, Pinacol-pinacolone rearrangement, Beckmann rearrangement, Hofmann rearrangement, Baeyer-Villiger oxidation, Benzil-Benzillic acid rearrangement, Curtius and Schmidt rearrangements	
Chapter 4: Stereochemistry	**05 Hours**
Optical isomerism in compounds with and without stereocenters; optical isomerism without a classical stereogenic center; axial chirality and its origin; optical isomerism in allenes; optical isomerism in substituted biphenyls; restricted rotation and atropisomerism; helical and planar chirality (introductory). Polycyclic systems: structural features of fused ring systems; conformation of cis-decalin and trans-decalin	
Chapter 5: Retrosynthetic Analysis	**05 Hours**
Introduction to retrosynthesis and synthetic planning. Concepts and terminology: target molecule (TM), retrosynthetic analysis, disconnection approach, functional group interconversion (FGI), functional group addition (FGA), synthon and synthetic equivalent, One-group and two-group disconnections. Retrosynthetic analysis of acetophenone, ethyl acetoacetate, 1,3-diphenyl-2-propen-1-one, cinnamic acid, 1-(4-methoxy-3-nitrophenyl)ethan-1-one	

References:

1. Organic Chemistry, Jonathan Clayden, Nick Greeves, Stuart Warren, Oxford University Press, 2nd Edition, 2012.
2. Organic Chemistry, R. T. Morrison, R. N. Boyd, Pearson Education, 7th Edition, 2010.
3. Organic Chemistry, T. W. G. Solomons, Craig B. Fryhle, Scott A. Snyder, Wiley, 12th Edition, 2016.
4. Organic Chemistry, Paula Yurkanis Bruice, Pearson Education, 8th Edition, 2016.
5. Heterocyclic Chemistry, J. A. Joule, K. Mills, Wiley-Blackwell, 5th Edition, 2010.
6. A Textbook of Heterocyclic Chemistry, V. K. Ahluwalia, Renu Aggarwal, CRC Press,

2nd Edition, 2016.
7. Advanced Organic Chemistry, I. L. Finar, Volume I, Pearson Education, 6th Edition, 2009.
8. Strategic Applications of Named Reactions in Organic Synthesis, László Kürti, Barbara Czakó, Elsevier, 1st Edition, 2005.
9. Stereochemistry of Organic Compounds, Ernest L. Eliel, Samuel H. Wilen, Wiley, 1st Edition, 1994.
10. Organic Chemistry, Francis A. Carey, Richard J. Sundberg, Springer, 5th Edition, 2007.
11. Organic Synthesis, Michael B. Smith, Wiley, 3rd Edition, 2010.
12. Designing Organic Syntheses, Stuart Warren, Paul Wyatt, Wiley, 2nd Edition, 2008.