Name of the Programme: M.Sc. Part-II (Organic Chemistry)

Course Code: CHO-602 **Title of the course:** Retrosynthesis and Heterocyclic Chemistry

Number of Credits: 4

Effective from AY: 2023-24

Prerequisites for the course	Students should have studied Organic Chemistry courses at M.Sc. Part-I level.	
Course Objective:	1. To apply the knowledge gained in organic synthesis for making new molecules. 2. To understand various strategies involved in retrosynthesis of organic molecules 3. To understand the concepts in heterocyclic chemistry and its applications 4. To be able to propose routes for synthesis of heterocycles	
Content	**1. Disconnection approach – Introduction, types of disconnection** a. One-group disconnection b. Disconnection of simple alcohols and compounds derived from alcohols, disconnections of simple olefins, simple/aryl ketones and carboxylic acids c. Two-group disconnection d. Disconnection of 1,3-dioxygenated skeletons, *β*-hydroxy carbonyl compounds, α,β-unsaturated carbonyl compounds, 1,5-dicarbonyl compounds, Mannich reaction e. 'Illogical' Two-group disconnection f. Disconnection of the 1,2-dioxygenated skeleton, *α*-hydroxy carbonyl compounds, 1,2-diols, 'Illogical' electrophiles, disconnection for the 1,4-dioxygenated pattern in 1,4-dicarbonyl compounds, γ-hydroxy carbonyl compounds, Other 'Illogical' synthons, disconnection for the 1,6-dicarbonyl compounds, synthesis of lactones (*General review problems to be discussed for above approaches*)	No of hours 15
	2. Disconnection strategies a. Disconnection of heteroatom and heterocyclic compounds such as ethers, amines, heterocycles, amino acids b. Disconnection strategies of few pericyclic reactions c. Convergent and divergent synthesis d. Strategic devices for carbon-heteroatom bonds, polycyclic compounds: the common atom approach e. Considering all possible disconnections f. Alternative FGI's before disconnection- the cost of synthesis g. Features which dominate strategy, functional group addition and molecules with unrelated functional groups	15

	3. Heterocyclic compounds a. Introduction, classification and nomenclature of mono- and bicyclic heteroaromatic molecules b. Physical properties, dipole moment, acidity-basicity, aromaticity, electron density distribution and reactivity of furan, thiophene, pyrrole, indole, pyridine, pyridine-N-oxide, quinoline, isoquinoline, diazines and triazines, 1,3- and 1,2-azoles	15
	4. Synthetic strategies for heterocycle synthesis General methods of synthesis of the following: furan, thiophene, pyrrole, indole, pyridine, quinoline, isoquinoline, chromones, imidazoles, oxazoles, thiazoles	15
Pedagogy	Mainly lectures and tutorials. Seminars / term papers /assignments / presentations / self-study or a combination of some of these can also be used. ICT mode should be preferred. Sessions should be interactive in nature to enable peer group learning.	
References / Readings	1. S. Warren, Designing Organic Synthesis, John Wiley & Sons, 2009. 2. G. S. Zweifel, M. H. Nantz, P. Somfai, Modern Organic Synthesis: An Introduction, 3rd Ed. W. H. Freeman and Company, New York, 2022. 3. J. Clayden, N. Greeves & S. Warren, Organic Chemistry, Oxford, 2016. 4. J. A. Joule, K. Mills & G. F. Smith, Heterocyclic Chemistry, 3rd Ed., 1995. 5. J. A. Joule & K. Mills, Heterocyclic Chemistry, Wiley-Blackwell, 5th Ed., 2010. 6. T. L. Gilchrist, Heterocyclic Chemistry, Pitman Publishing, 2005. 7. R. M. Acheson, An Introduction to Chemistry of Heterocyclic Compounds, John Wiley and Sons, 3rd Ed, 1977. 8. D. W. Young, Heterocyclic Chemistry, Longman Group Ltd., London, 1975. 9. R. O. C. Norman and J. M. Coxon. Principles of Organic Synthesis, CRC Press, 3rd Ed., 2009.	
Course Outcome:	1. Students will be in a position to understand how a carbon-carbon bond can be constructed and/or cleaved 2. Students will be in a position to understand how retrosynthesis can be used in finding out easily available chemical precursors for making organic molecules 3. Students will be in a position to apply retrosynthetic strategies and propose routes for synthesis of organic molecules and heterocycles 4. Students will be able to understand and apply the concepts of the reactivity of heterocycles towards electrophilic, nucleophilic, reducing and oxidizing reagents.	