

**FOUR-YEAR UNDER GRADUATE
PROGRAMME (FYUGP)**

BSc CHEMISTRY

Programme	B.Sc Chemistry				
Course Title	APPLIED ORGANIC CHEMISTRY				
Type of Course	MINOR				
Semester	III				
Academic Level	200-299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. Fundamental Concepts of organic chemistry- Nomenclature, isomerism, Functional groups, Homologous series 2. Basic concept of organic reaction mechanism, Chemistry of functional group				
Course Summary	This course explores organic spectroscopy, Chemistry of aromatic hydrocarbons, applications like medicinal chemistry and separation techniques				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	To understand the fundamental concept of various spectroscopic techniques	U	C	Exams/Assignment
CO2	To provide a comprehensive understanding of aromatic hydrocarbons	U	C	Exams/Assignment/ Group discussion
CO3	To provide basic knowledge of medicinal chemistry	U	C	Internal test/Seminar
CO4	To understand role of chemistry in human life	An	C	Seminar/Assignment/ /Qizes
CO5	To provide concepts various separation and purification techniques	U	P	Exams/Seminar
CO6	To empower students in various separation and purification techniques	Ap	P	Lab work/Viva

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C)
 # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P)
 Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs	Marks
I	Organic spectroscopy		15	30
	1	Origin of spectra - Interaction of electromagnetic radiation with matter. Different types of energy levels in molecules: Rotational, vibrational and electronic levels.	2	
	2	Statement of Born-Oppenheimer approximation - Fundamental laws of spectroscopy and selection rules (derivations not required).	1	
	3	<i>UV-Visible Spectroscopy</i> : Basic principle- Beer-Lambert's law - Electronic transitions in molecules ($\sigma \rightarrow \sigma^*$, $n \rightarrow \sigma^*$, $\pi \rightarrow \pi^*$ and $n \rightarrow \pi^*$)	2	
	4	Chromophore and auxochrome - Red shift and blue shift.	1	
	5	λ_{\max} calculation for dienes (substituted butadienes)	2	
	6	IR spectroscopy- basic principles, factors affecting absorption frequencies, fingerprint and functional group region.-Characteristic stretching frequencies of O-H, N-H, C-H, C=C, C=N and C=O functional groups	3	
	7	NMR Spectroscopy: Introduction - Chemical shift and spin-spin coupling -	2	
	8	Application in elucidating the structure of ethanol, propanal and acetone (detailed study not required).	2	
II	Chemistry of Aromatic hydrocarbons		12	27
	9	Nomenclature and isomerism in substituted benzene. Structure and stability of benzene: Kekule, resonance and molecular orbital description.	2	
	10	Mechanism of aromatic electrophilic substitution: Halogenation, nitration, sulphonation and Friedel-Craft's reactions	3	
	11	Orientating effect of common substituents in aromatic electrophilic substitution	2	
	12	Aromaticity and Huckel's rule	2	
	13	Application to benzenoid (benzene, naphthalene and anthracene) and nonbenzenoid (pyrrole, pyridine and indol) aromatic compounds.	3	

III	Medicinal Chemistry		10	23
	14	Drug: Chemical name, generic name and trade names with examples	2	
	15	Terminology: Prodrug, pharmacy, pharmacology, pharmacophore, pharmacognosy, pharmacodynamics and pharmacokinetics (elementary idea only).	2	
	16	Antipyretics, analgesics, antacids, antihistamines, antibiotics, antiseptics, disinfectants, anaesthetics(definition and examples).	3	
	17	tranquilizers, narcotics, antidepressants and psychedelic drugs (definition and examples).	2	
	18	Synthesis of aspirin and Paracetamol	1	
IV	Purification and Characterization Techniques		8	18
	19	Distillation- Simple, fractional, steam and vacuum distillations	2	
	20	recrystallisation, sublimation, solvent extraction	2	
	21	Chromatography, stationary phase, mobile phase, Rf values	2	
	22	TLC, Column chromatography, HPLC and GC (basic concepts only).		
V	PRACTICALS RELATED TO THE MODULE II and III		30	
	1	Introduction to organic lab	4	
	2	1. Distillation of Aniline, Limonene (from orange peels) 1. Purification of organic compounds by crystallization using the following solvents: a. Water b. Alcohol 2. Sublimation of a dicarboxylic acid/Naphthalene 3. Chromatographic separations – (any two) a) Separation of a mixture of two amino acids paper chromatography. b) Separation of a mixture of o-and p-nitrophenol or o-and p-aminophenol by thin layer chromatography (TLC) 4. TLC of Spinach	20	
	3	Open ended 1. Drawing structures using softwares. 2. Column Chromatography 3. Teacher can select preparation of organic compound related to the topics in the theory like synthesis of aspirin, sanitizer, drugs etc	6	

References

1. Morrison, R. N. & Boyd, R. N., Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

2. Bhal and Bhal, *Advanced Organic Chemistry*, 2nd Edition, S. Chand Publisher, 2012.
3. *Organic spectroscopy*, William Kemp
4. *Spectroscopy of organic compounds*, P S Kalsi
5. I. L. Finar, *Organic Chemistry*, Vol. I, 5th Edn., Pearson Education, New Delhi, 2013.
6. K. S. Tewari, N. K. Vishnoi, S. N. Mehrotra, *A Textbook of Organic Chemistry*, 2nd Edn., Vikas Publishing House, New Delhi, 2004.
7. *Chemistry for Pharmacy Students: General, Organic and Natural Product Chemistry*, Satyajit D. Sarker and Lutfun Nahar, Wiley
8. B. S. Furniss, A. J. Hannaford, P. W. G. Smith, A. R. Tatchell, *Vogel's Textbook of Practical Organic Chemistry*, 5th Edn., Pearson Education, Noida, 2014
9. Arthur I. Vogel, *Elementary Practical Organic Chemistry- Small Scale Preparations*, 2nd Edn., Pearson Education, Noida, 2013.
10. An Improved Method for the Extraction and Thin-Layer W Chromatography of Chlorophyll a and b from Spinach Hao T. Quach, Robert L. Steeper, and G. William Griffin, *J Chem Edn*, 2004, 81, 385
11. Quinone Synthesis and a Visual Introduction to Column Chromatography: An Undergraduate Experiment Danielle L. Pearson* and Russell R. A. Kitson* *J. Chem. Educ.* 2022, 99, 3731–3734

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO4	PSO5	PSO 6	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	2	-	-	-	2	-	2			1	2	1	
CO 2	2		-	1	1	-	2			2	1	1	
CO 3	2	-		-	-	2	2			2	1		
CO 4	2	-			2	1	2			2	1		
CO 5	2		-	1	1	-	2			2	1		
CO 6	2	-	2		1	2	2		1		2		1

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Practical exam (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Seminar/Group Discussion	Quizzes/viva	Observation Of practical Skill	End Semester Examinations
CO 1	✓	✓				✓
CO 2	✓	✓	✓			✓
CO 3	✓		✓			✓
CO 4		✓	✓	✓		✓
CO 5			✓			✓
CO 6				✓	✓	✓