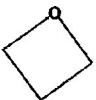
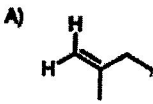
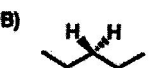
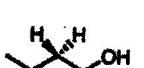
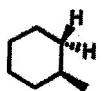


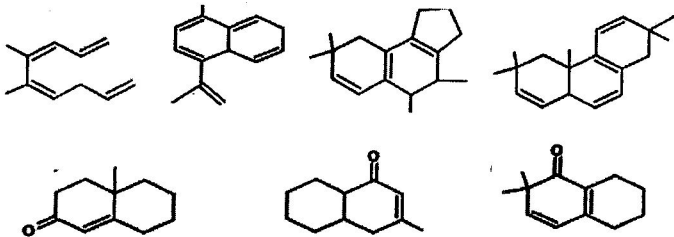
DEPARTMENT OF CHEMISTRY
SCHOOL OF CHEMICAL & LIFE SCIENCES
M.Sc. CHEMISTRY
SEMESTER-II EXAMINATION 2025
PAPER TITLE: APPLICATIONS OF SPECTROSCOPY
PAPER CODE: MCHCC – 204

Time 2.5 Hours

Attempt all questions

Maximum Marks 60

Q.1	Very short type questions: (10x1.5 = 15 Marks)	BTL	CLO	PLO
a.	How many signals for the following compound are observed in ^{13}C NMR Spectroscopy? 	2	2	2
b.	Predict the various electronic transitions possible in the following compounds: CH_3Cl ; $\text{H}_2\text{C}=\text{O}$	2	2	2
c.	Write the structure of an organic compound (MF: $\text{C}_3\text{H}_4\text{Cl}_2\text{O}$) that shows a singlet in its PMR spectrum.	3	3	3
d.	In which of the following molecules are the highlighted hydrogens homotopic? A)  B)  C)  D) 	3	2	2
e.	Define the terms Chromophore and Auxochrome with suitable examples.	4	4	4
f.	Calculate the fundamental modes of vibrations of the following molecules; a) Benzene b) Methane c) Water d) Ammonia	3	3	3
g.	A compound of molecular formula $\text{C}_8\text{H}_7\text{ClO}$ shows a prominent band in its IR spectrum at 1690 cm^{-1} . ^1H NMR spectrum revealed only two major types of protons in the ratio of 5: 2. Propose a structure	6	5	3
h.	What class of compounds is most likely to give a fragment ion at $m/z = M-18$?	3	3	2
i.	Give the molecular formula of a hydrocarbon cation with an m/z value of 91.	3	3	2
j.	What spin-spin coupling patterns do you expect for each distinct set of H nuclei in the following molecules? CH_3CHCl_2 , $\text{CH}_3\text{CHClCH}_3$, $\text{CH}_3\text{OCH}_2\text{CH}_3$?	3	3	2

Section B		10x2=20Marks		
Long Type questions (Attempt <u>any two</u> out of four)				
Q. No	Question	BTL	CLO	PLO
1.	Determine λ_{max} of the following molecules. 	6	6	3

2	a) Differentiate between the following based on IR <chem>OCc1ccccc1</chem> <chem>COc1ccccc1</chem> 	5	4	3
	b) What is the working principle of Attenuated Total Reflectance (ATR), and what are the advantages of using this technique?			
3.	How can ^1H NMR spectra be used to distinguish the six isomers of dimethylphenol. <chem>Cc1ccccc1O</chem> 2,3-dimethylphenol <chem>Cc1cccc(O)c1C</chem> 2,4-dimethylphenol <chem>Cc1cc(C)ccc1O</chem> 2,5-dimethylphenol <chem>Cc1cc(O)ccc1C</chem> 2,6-dimethylphenol <chem>Cc1ccccc1O</chem> 3,4-dimethylphenol <chem>Cc1ccccc1O</chem> 3,5-dimethylphenol	5	6	3
4	a) What is the effect of the solvent on the absorption of UV-Visible spectroscopy? b) How can you differentiate between Inter and intramolecular hydrogen Bonding based on IR spectroscopy		2	3

Section C

Short Type questions. (Attempt all questions)

Q.NO	Questions	(5x5=25 Marks)		
		BTL	CLO	PLO
1.	What is a Michelson interferometer? Discuss the difference between a dispersive and an FT-IR spectrophotometer. How will you distinguish 1° , 2° and 3° amines with the help of IR spectroscopy? OR Discuss the effect of conjugation on the carbonyl group. How do bond angle and ring strain influence the vibrational frequency?	3	2	2
2.	Discuss different fragmentation routes of ketones and aldehydes in mass spectrometry, giving suitable examples. OR The natural abundances of chlorine's two major isotopes are ^{35}Cl (75.5%) and ^{37}Cl (24.5%). If the mass spectrum of chlorobenzene contains a peak at m/z 114 with an abundance of 15.0%, calculate the % abundance of the peak at m/z 112.	4	2	2
3	How will you differentiate 3-methyl- and 4-methyl-cyclohexenes by mass-spectral fragmentation pattern? OR Give the structure of compound $\text{C}_{10}\text{H}_{12}\text{O}$, whose mass spectrum shows m/z values of 15, 43, 57, 91, 105 and 148.	3	6	2
4	What information will you get from HETCOR spectrum of a compound? OR In the PMR of cyclohexane, the vicinal coupling constant 'J' between diaxial protons is larger than the diequatorial protons. Why?	5	4	2
5	Differentiate chemically equivalent and magnetically equivalent protons, using suitable examples OR What is the Nuclear Overhauser Effect, and enumerate its applications.	4	4	2