

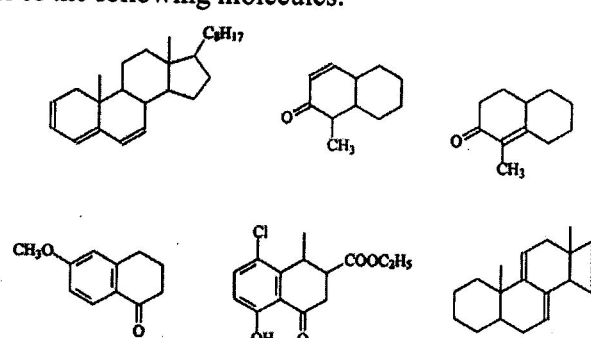
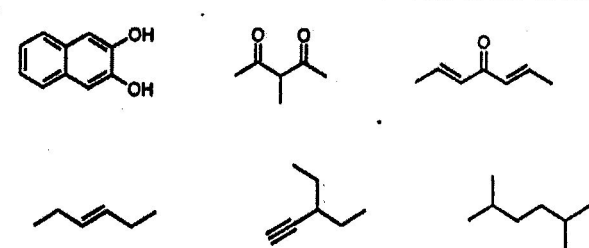
DEPARTMENT OF CHEMISTRY
SCHOOL OF CHEMICAL & LIFE SCIENCES
B.Sc. CHEMISTRY
SEMESTER-VI EXAMINATION, MAY 2025,
PAPER TITLE: FUNDAMENTALS OF SPECTROSCOPY
PAPER CODE: BCHDSC601 TH

Time 2.5 hours

Maximum Marks 60

Attempt all questions

Q.1	Very short type questions: (10x1.5 = 15 Marks)	BTL	CLO	PLO
a.	What is the function of an atomiser in the emission system of Atomic Absorption Spectroscopy?	2	2	2
b.	Draw the normal modes of vibration of the CO ₂ molecule. Which of these are IR active?	2	2	2
c.	What will be the spin of the nucleus if both the no. of protons and neutrons are even?	3	3	3
d.	What is the distance between the centres of the peaks of a doublet called?	3	2	2
e.	Why is the chemical shift range in CMR very wide as compared to PMR spectroscopy?	4	4	4
f.	How many different chemical shifts do you expect for H nuclei in the following molecules? CH ₄ CH ₃ CH ₃ CH ₃ CH ₂ CH ₃ H ₂ C=CH ₂ H ₂ C=CHBr	3	3	3
g.	Write the structure of a base-ion peak at m/z 56 observed in the mass spectrum of 1-hexanol.	6	5	5
h.	How does hydrogen bonding affect IR absorption in carboxylic acids?	3	3	3
i.	Give the molecular formula of a hydrocarbon cation with an m/z value of 29	3	3	3
j.	What will be the number of signals in the NMR spectrum of ethyl bromide?	3	3	3

Section B		10x2=20Marks		
Long Type questions (Attempt <u>any two</u> out of four)				
Q. No	Question	BTL	CLO	PLO
1.	Determine $\lambda_{\max}$ of the following molecules. 	6	6	
	What is a Michelson interferometer? Discuss the difference between a dispersive and FT-IR spectrophotometer	5	4	
	Predict the No. of signals in the ^1H NMR and ^{13}C NMR spectra of the following compounds 	5	6	

4	Describe the working of inductively Coupled Plasma (ICP) Emission spectroscopy	6	2	3
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Section C

Short Type questions. (Attempt all questions)		(5x5=25Marks)		
Q.NO	Questions	BTL	CLO	PLO
1.	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.	Enlist the electronic transition possible when UV light is absorbed by a) HCHO b) Methane c) CH_3Cl d) Acetone e) Ethanol OR How can UV spectroscopy be used to a) Determine the extent of conjugation b) Differentiate between Geometrical isomers	4	2	2
3.	What is the McLafferty rearrangement? Explain its mechanism with suitable examples. OR Account for the peaks observed in the mass spectrum of the following compounds: (i) $\text{CH}_3(\text{CH}_2)_4\text{CH}_2\text{Br}$; $m/z = 135, 137$ and 85 (ii) $(\text{CH}_3)_2\text{CH-O-}(\text{CH}_2)_4\text{CH}_3$; $m/z = 115$ and 71	3	6	2
4.	Deduce the structure of an organic compound with mol.wt, 150 shows the following spectral data: c) UV: 276 nm; IR: 3030-2979, 1695, 1692 cm^{-1} ; $^1\text{H NMR} = 2.1(\text{s}, 3\text{H}), 3.85(\text{s}, 3\text{H}), 7.2(\text{d}, 2\text{H})$ and $7.65(\text{d}, 2\text{H})$ OR How do you distinguish acetanilide and N-methylbenzamide by $^{13}\text{C NMR}$ spectroscopy?	5	4	2
5.	The mass spectrum of 2-methyl-2-butanol shows peaks at m/z 73, 70, 59, and 55. Explain the origin of these peaks and show the fragments formed. OR Explain the nature and splitting of signals obtained in the $^1\text{H-NMR}$ spectrum of CH_3CHO . Draw the suitable diagram.	4	4	2