No. of Printed Pages : 6 **MCHE–012**

MASTER OF SCIENCE IN CHEMISTRY (MSCCHEM)

Term-End Examination

June, 2026

MCHE-012 : SPECTROSCOPIC IDENTIFICATION OF ORGANIC COMPOUNDS

Time : 2 Hours *Maximum Marks : 50*

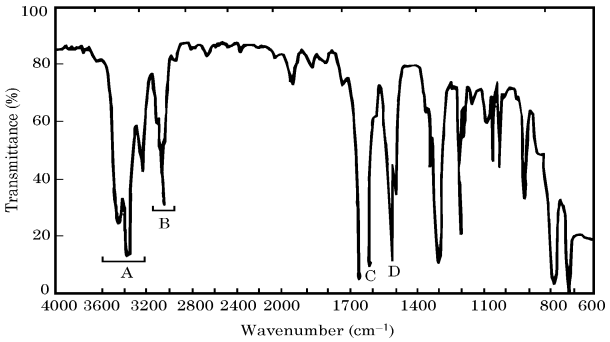
Note : *Answer any* ***five*** *of the following given questions.*

1. (a) Why the UV spectra of saturated organic compounds are not helpful in structure elucidation ? Explain. 5

   (b) Explain the effect of solvents with increasing polarity on α, β-unsaturated compounds. Illustrate your answer. 5

2. (a) How can *o*-hydroxybenzaldehyde and *m*-hydroxybenzaldehyde be distinguished on the basis of IR spectroscopy ? Explain the effect of dilution with a non-polar solvent in these two compounds. 5

(b) Given below is the IR spectrum of an organic compound having molecular formula, C_6H_8N. Identify the peaks marked A, B, C, D and write the structure of the compound. 5



3. (a) How does the intra- and intermolecular hydrogen bonding affect the absorption frequency in IR spectra ? Explain. 5

(b) Name the most commonly used compound as the internal reference in NMR spectroscopy. In what condition it cannot be used as the internal reference ? State the alternative in such a case. 5

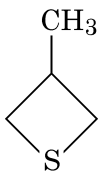
4. (a) Explain the nuclear overhauser effect in the context of ^{1}H-NMR spectroscopy and give its significance. 5

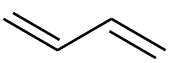
(b) Using ^{1}H-NMR spectroscopy, distinguish between the following pairs : 5

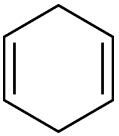
(i) 1, 2-dimethoxyethane and 1, 1-dimethoxyethane

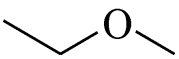
(ii) Acetone and methyl acetate

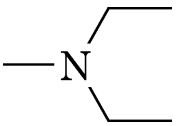
5. (a) Predict the number of signals appearing in the ^{13}C-NMR of the following compounds : 5

(i) 

(ii) 

(iii) 

(iv) 

(v) 

(b) (i) Write the full forms of the following : 3

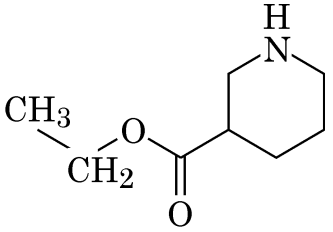
(I) COSY

(II) HETCOR

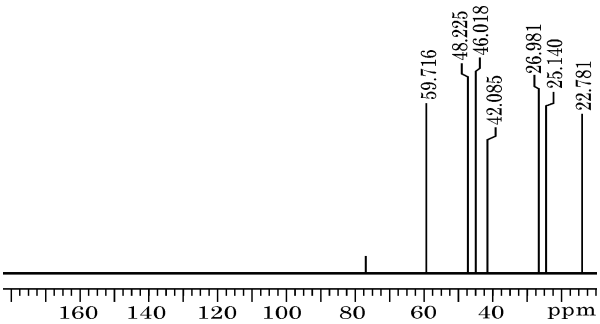
(III) HMQC

(ii) What is INEPT ? What is its purpose and use ? 2

6. (a) The ^{13}C-NMR spectrum of ethyl nipecotate is shown below. The compound has the following structure : 5



Assign various signals to different carbon atoms present in the molecule.



^{13}C-NMR of ethyl nipecotate

(b) Name the three methods of ionisation in mass spectrometry and explain any *one* of these. 5

7. (a) Explain the Stevenson's rule of fragmentation in mass spectrometry. 5

(b) Find out the structure of a compound having molecular formula, C_9H_8O and the following IR, mass and 1HNMR spectral data : 5

IR : Medium intensity absorption at 2119 cm^{-1}, broadband ~ 3292 cm^{-1}, bands at 1603 cm^{-1} and 1455 cm^{-1}

NMR : Multiplet $\approx$ δ 7.19 – 7.50 ppm, broad peak at δ 3.18 ppm

Mass : M^+–1 peak at 131 and signal at M/*z* 77

× × × × ×