Registration No.: | | | | | | | | | | |

Total Number of Pages: 02

Course: M.Sc.I
SUB CODE: FCYC803

8th Semester Regular Examination: 2024-25
SUBJECT: SPECTROSCOPIC IDENTIFICATION OF MOLECULES
BRANCH: M.Sc.I(AC)
Time: 3 Hours
Max Marks: 70
Q.CODE: S113

Answer Question No.1 (Part-I) which is compulsory, and any five from the rest (Part-II).
The figures in the right hand margin indicate marks.

337-07/05/2025--1

Part-I

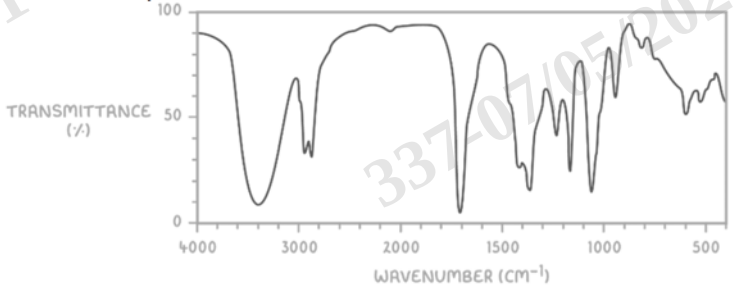
Q1 **Answer the following questions:** **(2 x 10)**

a) What do you mean by the term electromagnetic spectrum?
b) How will you distinguish between primary, secondary, and tertiary alcohol by using IR spectroscopy?
c) The molar absorptivity of a substance is 2.5×10^5 L cm^{-1} mol^{-1}. Calculate the transmittance through a cuvette of path length 1 cm containing 2.5×10^{-5} mol L^{-1} solution of the substance.
d) Write down the significance and limitations of the Woodward-Fisher rules law.
e) Write down the importance of correlation spectroscopy.
f) Discuss the ^1H spectrum of three isomers of xylene.
g) Schematically represent the hyperfine structure in the ESR spectrum of the benzyl radical.
h) Calculate the g-value of the benzyl radical having the center of the spectrum occurred at 330 mT in an ESR spectrometer operating at 9250 MHz.
i) Define the McLafferty rearrangement.
j) The organic compound contains only C, H, and O and has a mass of 288.2089 amu, as determined by high-resolution mass spectrometry. What is the likely molecular formula of the organic compound?

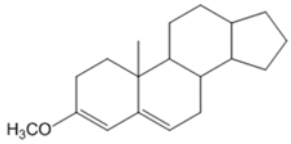
Part-II

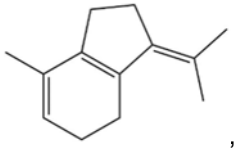
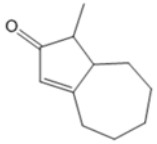
Answer any five out of seven questions:

Q2 **a)** Describe the basic principle of the IR spectroscopy. Assign different absorption peaks observed in the below IR spectrum. **(5)**



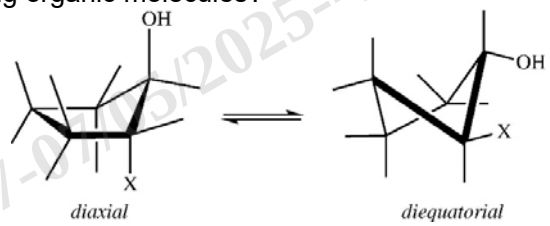
b) Describe Woodward-Fieser rules. Find out λ_{max} of following organic molecules. **(5)**

(i) 

, (ii) 
, and (iii) 

Q3 **a)** Discuss the theory of the spin-spin splitting. Schematically show the ^1H NMR spectrum of *p*-chlorobenzaldehyde. **(5)**

b) Illustrate how NMR is applicable for conformational analysis of organic molecules. How to distingush the following organic molecules? **(5)**



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b) Discuss the Kramer's degeneracy and zero field splitting using energy level diagram. **(5)**

Q5 **a)** Discuss the experimental arrangements and presentation of spectra of mass spectroscopy. **(5)**

b) Describe the fragmentation and rearrangement processes in mass spectroscopy. **(5)**

Q6 Describe basic principle of UV-Vis Spectroscopy. Discuss types of different electronic transitions and factor affecting absorbance and intensity of the electronic transitions. **(10)**

Q7 Elucidate the structure of the organic compound with the following spectroscopic data: (i) UV: no peak, (ii) IR: 1715 (s), 2941–2857 (m), and 1464 (w) cm^{-1}, (iii) NMR: three signal appears 7.52 τ quartet (2H), 7.88 τ singlet (3H), and 8.93 τ triplet (3H), and (iv) MS: m/e = 72, 57, 43, 29, and 27. **(10)**

Q8 **Write short answer on any Two:** **(5 x 2)**

a) Multinuclear NMR of various inorganic and organometallic compounds **(5)**

b) Survey of EPR spectra of first row transition metal ion complexes. **(5)**

c) Fragmentation and rearrangements of different classes of organic molecules **(5)**

337-07/05/2025--1