



Gandhi Institute of Engineering and Technology University, Odisha, Gunupur (GIET UNIVERSITY)

M.Sc. (Second Semester – Regular/Supplementary) Examinations, May – 2026

24CHPC2004 – Organic Spectroscopy

Chemistry

Time: 3 hrs

Maximum: 60 Marks

Answer ALL questions

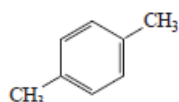
(The figures in the right hand margin indicate marks)

PART – A

(2 x 5 = 10 Marks)

Q.1. Answer **ALL** questions

- a. What are bathochromic (red) shift and hypsochromic (blue) shift?
- b. What are the ranges of IR spectroscopy and classify stretching and bending mode range?
- c. Draw the ^1H NMR spectra of 2-methyl-1-pentene
- d. Predict the number of peaks that you would expect in the proton-decoupled ^{13}C spectrum of each of the following compounds



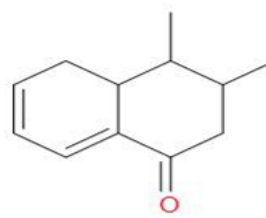
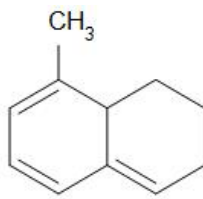
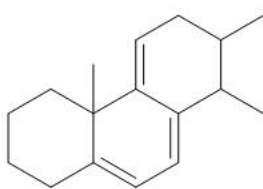
- e. Calculate the intensity ratio if two bromine atoms are present.

PART – B

(10 x 5 = 50 Marks)

Answer **ALL** the questions

2. a. Explain various electronic transitions.
- b. Calculate the λ_{max} of



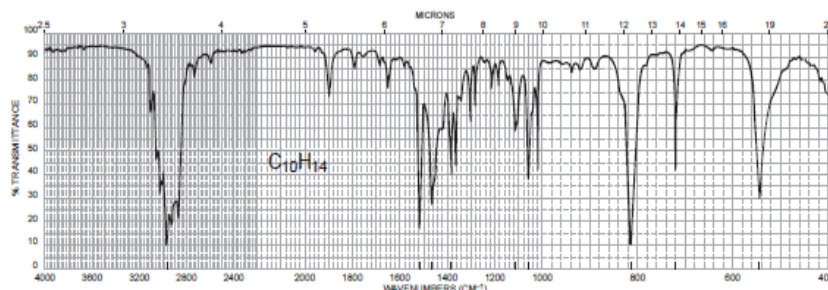
(OR)

- c. Calculate the λ_{max} of 1,3-butadiene and p-amine benzoic acid using Woodward-Fieser rules.
- d. Explain the effect of solvent on electronic transitions with suitable examples.

3. a. In each of the following parts, a molecular formula is given.

(b) $\text{C}_{10}\text{H}_{14}$

Deduce the structure that is consistent with the infrared spectrum. There may be more than one possible answer.

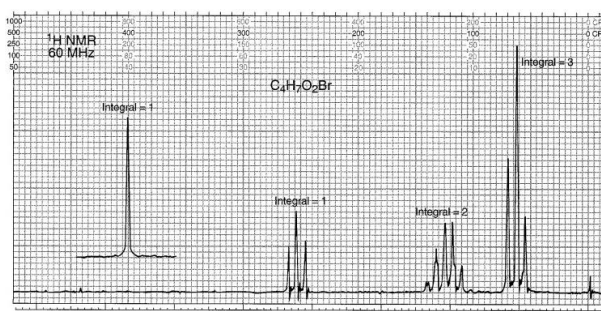


- b. What is first and second overtone?

(OR)

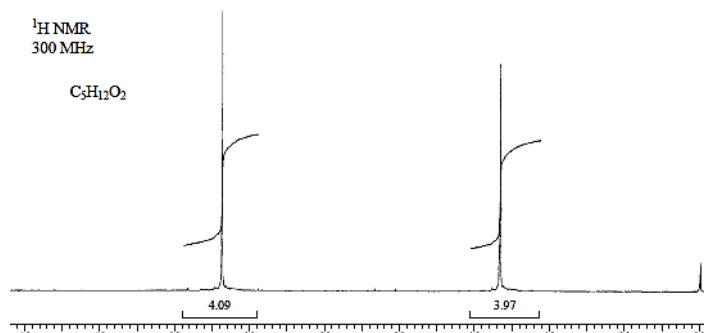
- c. Draw the instrumentation of FT-IR.
- d. Draw the spectrum of aniline and benzoic acid.
4. a. Explain the basic principle of NMR spectroscopy. Discuss nuclear spin, magnetic moment, and resonance condition.

- b. The following compound is a carboxylic acid that contains a bromine atom: $\text{C}_4\text{H}_7\text{O}_2\text{Br}$. The peak at 10.97 ppm was moved onto the chart (which runs only from 0 to 8 ppm) for clarity. What is the structure of the compound?



(OR)

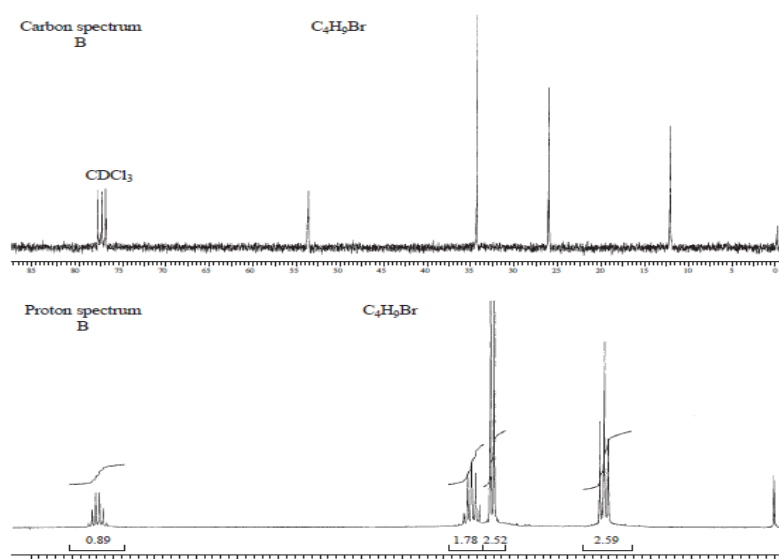
- c. Find out the structure of a compound having molecular formula $C_{10}H_{14}$ with 1.30 ppm (Singlet) 9H, 7.28 ppm (Singlet) 5H. 5 CO3 K6
- d. Draw the structure of an ether with formula $C_5H_{12}O_2$ that fits the following NMR spectra 5 CO3 K4



- 5.a. Find out the structure of a compound having molecular formula C_4H_6O with 28 ppm (quartate), 130 ppm (triplet), 138 ppm (doublet), 188 ppm (Singlet). 5 CO4 K6
- b. Draw the proton decoupled ^{13}C Carbon spectrum of 1-Propanol. 5 CO4 K5

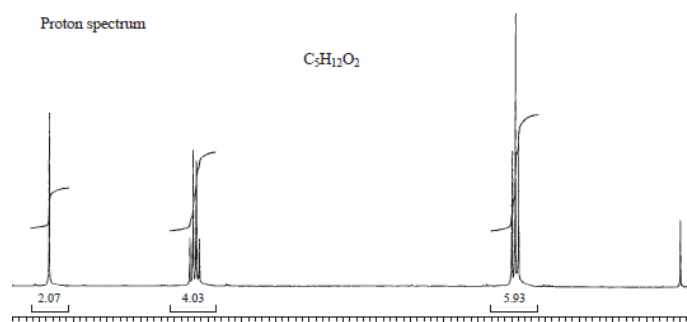
(OR)

- c. Following are the 1H and ^{13}C spectra for each of four isomeric bromoalkanes with formula C_4H_9Br . Assign a structure to each pair of spectra. 5 CO4 K2



- d. The proton NMR spectrum for a compound with formula $C_5H_{12}O_2$ is shown below. The normal carbon-13 NMR spectrum has three peaks. The DEPT-135 and DEPT-90 spectral results are tabulated. Draw the structure of this compound. 5 CO4 K4

Normal Carbon	DEPT-135	DEPT-90
15 ppm	Positive	No peak
63	Negative	No peak
95	Negative	No peak



- 6.a. Explain the instrumentation of electron ionisation techniques 5 CO5 K3
- b. Calculate M, M+1, and M+2 for anthracene. 5 CO5 K4

(OR)

- c. Explain the principle of Mass spectrometry. 5 CO5 K2
- d. Calculate the intensity ratio of isotopic signals M+1 and M+2 with respect to Molecular ion benzene. 5 CO5 K5

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