Reg. No.

III Semester M.Sc. Degree Examination, April/May 2022 INDUSTRIAL CHEMISTRY **Spectroscopic Techniques**

Time : 3 Hours

Max. Marks: 70

- Note : a) Answer any five subdivisions from Part-A and any five full questions from Part-B.
 - b) Figures to the right indicate marks.

PART - A

1. Answer any five sub-divisions.

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- a) Mention any two applications of Raman Spectroscopy.
- b the Beautration, April/May 2013 b) What is Stark effect ?
- GETRIAL CHENISTEN
- c) State Beer Lambart law. rescopic feehriques
- d) Give any two differences between proton and carbon NMR.
- e) Mass spectrometry is the correct terminology but not Mass spectroscopy. number subdivisions irora Part-A. and any Justify the same.
- f) In NMR spectroscopy, what is meant by spin-spin coupling ?
- g) With any one suitable example. Write McLafferty rearrangement.
- h) In vibrational spectroscopy. What is meant by zero point energy ?
 - PART B ηr 8.

Answer any five of the following.

- 2. a) The fundamental vibrational frequency of HCI is 86.63 x 1012 Hz. Calculate zero point energy and force constant for HCI.
 - b) Explain the factors influencing width and intensity of spectral lines.
 - c) Obtain the expression for moment of inertia for rigid diatomic molecule.

(4+4+4=12)

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		$\{\mu_{i}, \mu_{i}\} \in \{1, \dots, n\}$	
	a line se Vicie m Alcie se	ung. Fount fraguency of HOE is 86.63 x 1052 Fb. Folg vand faros bonstam for HOE.	

(5×2=10)

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- 3. a) What are Nuclear and Electron spin interaction ? Explain.
 - b) How does IR spectroscopy differ from Raman spectroscopy ?
 - c) Explain the activity of the following molecules with respect to IR and
 - (4+4+4=12)microwave spectrum H_2 , HCI, CO₂ and CH₄.
- 4. a) Write a short note on factors affecting the positions of UV bands.
 - b) How do you distinguish following pair of compounds by IR spectroscopy ?
 - ii) Acetic acid i) Acetanilide
 - iv) Ethyl benzoate iii) Phenol
 - c) Discuss the applications of UV spectroscopy in the structural study of (4+4+4=12)organic molecules.
- 5. a) With a neat labelled diagram, explain the working principle of IR spectroscopy.
 - b) Describe the factors affecting band positions and intensities hydrogen bonding phase and solvent liquing molecules with respect to if a (6+6=12) 00, and 04,.
- 6. a) Why is it necessary to use deuterated solvents for NMR experiments ?
 - b) Briefly explain spin-spin coupling and spin decoupling.
 - c) Write a short note on double resonance techniques used in NMR (4+4+4=12)it Actatic acro spectroscopy.
 - w. Edwilbenzoste
- 7. a) With neat labelled diagram, explain the working principle of Nuclear Magnetic Resonance spectroscopy in the structural cu
 - b) Briefly explain the terms
 - i) Coupling constant arram, explain the working principle of us
 - ii) Shielding and deshielding.

8.81 (2H, m)

and positions and intersities had a c) A compound (molecular formula $C_9H_{10}O_2$) gives the following spectral data.

IR: 1720 cm⁻¹

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 - y soup ing and spin decoupling. 4.35 (2H, g)
 - uble renormatio tochnim e riused in Me B 7.40 (3H, m)
- Determine the structure of compound, the working principal of National (4+4+4)

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prime a \mathbb{O}_{p} hy, \mathbb{O}_{p}) gives the following construct data

8. a) Predict the fragmentation in the following compounds from their molecular ion

-3-

- i) Benzyl acetate
- ii) I-Phenyl ethanol
- b) How do you distinguish aromatic ester and alcohol by using mass spectroscopy technique ?
- c) An organic compound A (Molecular Formula C₅H₁₀O) exhibits the following spectral data

UV (λ_{max}) : 280 nm

 $IRV_{max}^{(cm-1)}$: 17.5

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¹HNMR(δppm) : 0.9 (3H, t)

fr. 1.60 (2H, m)ha following compounds rout the

2.20 (3H, s)

2.40 (2H, t)

Mass (m/z) : 86, 71, 43 (100%)

- Deduce the structure of compound. ester and aloched of a
- 9. a) Write a short note on double McLafferty rearrangement and Nitrogen rule.

b) Discuss fragmentation pattern for following compounds

- i) Accetanilide
- ii) P-Nitrobenzene.
- c) How does a mass spectrometer detect isotopes ? Explain with example.

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	$(115^{\circ})^{\circ}$	~ 100 %)	
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