QE-5241

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M. Sc. (Sem. III) Examination, December, 2023

CHEMISTRY

PAPER - 3.2

CHEM-632

Spectroscopy

(Common for all Specilization)

Time Allowed : **Three Hours**

Maximum Marks : **70**

Minimum Pass Marks : **28**

Note : *This question paper will be divided into three sections as under :*

SECTION - A **Max. Marks 10**

Will carry 10 marks with 01 compulsory question comprising 10 short answer type questions (maximum 20 words answer) taking two questions from each unit. Each question shall be of one mark.

SECTION - B **Max. Marks 25**

Will carry 25 marks with equally divided into five long answer type questions (answer about in 250 words). Students are instructed to attempt five questions by selecting one question from each unit.

SECTION - C **Max. Marks 35**

Will carry 35 marks with five long answer type questions comprising one complusory question (question no. 12) of 15 marks and four questions of 10 marks each. Students are instructed to attempt total three questions with one compulsory question (answer about in 50 words) and any two more questions (answer about in 400 words) out of remaining three questions.

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SECTION - A

1 (i) Why IR absorption due to > C = 0 stretch occurs at higher frequency than – C = C – stretch ?

(ii) Why ethanol is a good solvent in ultra-violet ?

(iii) What is gyroscopic motion ?

(iv) What are vicinal protons ?

(v) Why greater sensitivity is required to record ^{13}C NMR spectra ?

(vi) Which standard is best for ESR spectroscopy ?

(vii) What is the basic function of mass analyzer ?

(viii) What do you understand by ring rule ?

(ix) Calculate the number of DBE in a compound with molecular formula C_6H_6.

(x) What is the reason behind meta stable peak broadening.

10×1=10

SECTION - B

UNIT - I

2 Define :

(1) Fermi Resonance

(2) Combination bands

$2\frac{1}{2}\times 2 = 5$

3 Explain why

(i) Amines absorb at higher wavelength than alcohol.

(ii) The position of absorption of acetone shifts in different solvent are 279 nm in hexane, 272 in ethanol and 264.5 nm in water.

$2\frac{1}{2}\times 2 = 5$

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UNIT - II

4 Give brief note on shielding and deshielding effects in NMR. 5

5 What is vicinal coupling ? Write the factors that affect the vicinal coupling. 5

UNIT - III

6 Explain the theory on which ESR is based. 5

7 What do you understand by chemical shift ? Give its calculation. 5

UNIT - IV

8 Define :

(i) Mc Lafferty Rearrangement

(ii) Metastable peak

$2\frac{1}{2} \times 2 = 5$

9 Explain the general rules for fragmentation patterns. 5

UNIT - V

10 An organic compound contains 66.6% carbon, 11.1% hydrogen. In UV it gave a characteristic band at 275 nm E_{max} 17, In IR bands are formed at 2941 – 2855 (m), 1715 (s) and 1460 cm^{-1} (m). In NMR, three signals appear at (i) 7.52 τ quartet (2H), 7.88 singlet (3H) and 8.93 τ triplet (3H). Determine the structural formula of the compound. 5

11 Identify the compound whose mass spectrum shows m/c values at 156 (M^+ base peak), 127 and 29. 5

SECTION - C

12 Write short notes on any three :

(i) Spin-Spin coupling

(ii) Applications of ^{13}C NMR spectroscopy.

(iii) Fragmentation modes

(iv) Hyperfine splitting in ESR spectra. $5 \times 3 = 15$

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13 Explain the types of molecular vibrations. Give detailed information about the factors influencing vibrational frequencies.

3+7=10

14 Write short notes on :

(i) Kramer's degeneracy

(ii) Overhauser effect

(iii) Off resonance ^{13}C spectra.

3+3+4=10

15 Write a note on basic principle, instrumentation and applications of ESR spetroscopy.

10

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