

Code No. : B02/402

Second Semester Online Examination, May-June, 2022

M. Sc. CHEMISTRY

Paper IV

SPECTROSCOPY

Time : Three Hours]

[Maximum Marks : 80

Note : Part A and B of each question in each unit consist of 'very short answer type question' which are to be answered in one or two sentences. Part C 'Short answer type' and D 'Long answer type' of each question should be answered within the word limit mentioned.

UNIT-I

1. (A) What is the relationship for conversion for wavelength to wave number ? Convert 800 m μ to cm⁻¹. 2
- (B) In general, charge transfer spectra are obtained with remarkable intensities, why ? 2
- (C) Explain the classification of molecules on the basis of their moment of inertia at different co-ordinate axes.

(word limit 200-250) 4

P.T.O.

OR

Draw Jablonsky's diagram and explain representations of radiative and non-radiative processes of an electronically excited molecule.

- (D) How will you compare rigid rotor and non-rigid rotor in terms of their energies and spectral line separations.

(word limit 400-450) 12

OR

Describe Franck-Condon principle and write its significance.

UNIT-II

2. (A) Calculate the vibrational degrees of freedom in the following molecules : 2
 - (i) N₂O,
 - (ii) CHCl₃.
- (B) Explain the term polarizability ellipsoids in relation with the Raman spectroscopy.

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- (C) Arrange giving reasons, the following bands in order of their decreasing vibrational frequencies :

C-Cl, C-Br, C-C, C-O, C-H, C-I

(word limit 200-250) **4**

OR

Why anti-stokes lines are weak than stoke's lines ?

- (D) Explain Morse potential energy diagram. Describe group frequencies and hot bands.

(word limit 400-450) **12**

OR

Explain the classical theory of Raman effect and describe rotational, vibrational and vibrational-rotational Raman spectra.

UNIT-III

3. (A) Which of the following compounds, would be expected to show only a single peak in its NMR spectrum : **2**

(a) Acetone,

(b) Dibromomethane,

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- (c) Methyl acetate,
(d) Chlorobromoethane,
(e) 1-chloro-2-bromo ethane.

- (B) *s*-Orbital electrons are closer to nucleus still they are ineffective in orienting the nucleus, why ? **2**

- (C) Explain shielding and deshielding of nucleus. *(word limit 200-250)* **4**

OR

Write down the applications of NQR spectroscopy.

- (D) Describe FT-NMR and its advantages.

(word limit 400-450) **12**

OR

Describe origin of quadrupole moment and splitting of NQR spectra.

UNIT-IV

4. (A) Predict the number of lines in the ESR spectrum of following radicals : **2**

(a) $[^{13}\text{CF}_2\text{H}]^{\cdot}$,

(b) $[\text{CClH}_2]^{\cdot}$.

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(B) Differentiate between tensor and scalar quantities. **2**

(C) What reference materials are often used in the instruments of PAS and ESR-spectroscopy and Why ?

(word limit 200-250) **4**

OR

Explain Koopman's theorem.

(D) Describe the chemical and surface applications of Photo acoustic spectroscopy. *(word limit 400-450)* **12**

OR

Explain isotopic and anisotropic hyperfine coupling constants in the ESR spectroscopy.

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