(6 pages) **Reg. No. :**

Code No. : 20291 E Sub. Code : SEPH 5 B

B.Sc. (CBCS) DEGREE EXAMINATION, NOVEMBER 2021.

Fifth Semester

Physics

Major Elective — SPECTROSCOPY

(For those who joined in July 2017-2019)

Time : Three hours

Maximum : 75 marks

SECTION A — $(10 \times 1 = 10 \text{ marks})$

Answer ALL questions.

Choose the correct answer.

- 1. The moment of inertia values of symmetric top molecules is
 - (a) $I_a = I_b < I_c$ (b) $I_b = I_c \neq I_a$
 - (c) $I_a = I_c \neq I_b$ (d) $I_a = I_b = I_c$

2. Isotope shift in rotational spectra

- (a) Increases with J (b) Decreases with J
- (c) Zero (d) Does not happen

- 3. The vibration–rotation spectrum has
 - (a) P-branch
 - (b) R-branch
 - (c) Both P and R branch
 - (d) Neither P nor R branch
- 4. The number of vibrational modes in a linear triatomic molecule is
 - (a) 2 (b) 3
 - (c) 4 (d) 5
- 5. In Raman effect stokes line is given by
 - (a) $\gamma = \gamma_0$ (b) $\gamma = \gamma_0 \gamma_m$
 - (c) $\gamma = \gamma_0 + \gamma_m$ (d) $\gamma = 0$
- 6. The rotational energy levels of a linear molecule
 - (a) $E_j = J(J+1)$ (b) $E_j = BJ(J+1)$ (c) $E_j = \frac{B}{J(J+1)}$ (d) $E_i = \frac{J}{B(J+1)}$
- 7. The electronic transition of molecules due to the vibrational energy changes will produce
 - (a) Linear structure (b) Coarse structure
 - (c) Fine structure (d) Hyperfine structure

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- 8. The selection rule for J, in electronic transition
 - (a) $\Delta J = \pm 1$ (b) $\Delta J = +1$
 - (c) $\Delta J = -1$ (d) $\Delta J + 1$
- 9. Most common sources of IR spectroscopy are
 - (a) Globar (b) Nernst glower
 - (c) Both (a) and (b) (d) None
- 10. The number of mirrors used in double beam IR spectrometer is
 - (a) 1 (b) 2
 - (c) 3 (d) 4

SECTION B — $(5 \times 5 = 25 \text{ marks})$

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) Explain the symmetric top molecules.

Or

(b) How does the microwave spectrum of a non rigid rotator differ from that of a rigid rotator?

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12. (a) Derive an expression for the energy of a diatomic molecule.

Or

- (b) Discuss the three modes of normal vibrations of water molecules.
- 13. (a) Explain the quantum theory of Raman effect.

Or

- (b) Discuss the pure rotational Raman spectra of linear molecules.
- 14. (a) State and explain Franck Condon principle.

Or

- (b) Explain Fortrait parabolae.
- 15. (a) Discuss the preparation of different samples used in IR spectrometer.

Or

(b) Give the advantages and disadvantages of double beam spectrometer.

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Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 600 words.

16. (a) Explain the rotational spectra of a rigid diatomic molecules.

Or

- (b) Explain the various component of a microwave spectrometer.
- 17. (a) Explain the vibrations of polyatomic molecules.

Or

- (b) Explain the asymmetry of rotation-vibration band.
- (a) Explain the structure determination from Raman and Infrared Spectroscopy.

Or

(b) Explain the vibrational Raman Spectra.

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19. (a) Explain the rotational fine structure of electronic vibration spectra.

 \mathbf{Or}

- (b) Explain the diatomic molecular electronic spectra.
- 20. (a) Explain the different parts of a IR spectrometer.

Or

(b) Describe the alternated total reflection.

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