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

Code No. : 30567 E   Sub. Code : SEPH 5 B

B.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2020.

Fifth Semester

Physics — Core

Major Elective – I — SPECTROSCOPY

(For those who joined in July 2017 onwards)

Time : Three hours   Maximum : 75 marks

PART A — (10 × 1 = 10 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) $I_a \neq I_b \neq I_c$

    (c) $I_a = I_b < I_c$ (d) $I_a = I_c \neq I_b$

2. Selection rule for rotational spectra in microwave spectroscopy is

    (a) $\Delta J = +1$ (b) $\Delta J = \pm 2$

    (c) $\Delta J = \pm 1$ (d) $\Delta J = -1$

3. The number of vibrational modes in a linear triatomic molecule is

   (a) 5   (b) 4

   (c) 3   (d) 2

4. The near infrared region range is

   (a) 12, 500 – 4000 cm^{-1}

   (b) 10,000 – 5,000 cm^{-1}

   (c) 4000 – 400 cm^{-1}

   (d) 400 – 50 cm^{-1}

5. The intensity of stokes lines are

   (a) Greater than the anti stokes lines

   (b) Less than the anti stokes lines

   (c) The intensity of both lines are equal

   (d) None of the above

6. Which one of the following depends upon the intensity of Roman lines?

   (a) Polarizability of the molecule

   (b) The intensity of the source

   (c) Both are correct

   (d) Both are wrong

7. Intensity of vibrational lines in electronic spectra are governed by

    (a) Fermi golden rule

    (b) Hund's rule

    (c) Born-oppenheimer approximation

    (d) Fronck-condon principle

8. ΔJ value corresponding to P-branch in electronic vibration transition is

    (a) $+1$ (b) -1

    (c) $+2$ (d) -2

9. The number of mirrors used in double-beam IR spectrometer is

    (a) 1   (b) 2

    (c) 4   (d) 6

10. Chief detectors of IR rays are

    (a) Thermopiles

    (b) Bolometers

    (c) Thermistors

    (d) All

PART B — (5 × 5 = 25 marks)

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

Each answer should not exceed 250 words.

11. (a) Outline the instrumentation technique by microwave spectroscopy.

Or

(b) Explain the symmetric top molecules.

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

Or

(b) Write a note on infrared spectroscopy.

13. (a) Discuss briefly the intensity of Raman lines.

Or

(b) Write the advantages of Raman spectroscopy.

14. (a) Explain fortrat parabola.

Or

(b) Discuss the intensity of electronic vibrational spectra.

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15. (a) Outline the advantages of beam spectrometer.

Or

(b) Discuss the preparation of different 'Samples' used in IR spectrometer.

PART C — (5 × 8 = 40 marks)

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

Each answer should not exceed 600 words.

16. (a) Give a detailed account on classification of molecules.

Or

(b) Explain the rotational spectra of rigid diatomic molecule.

17. (a) Explain the energy of diatomic molecule of harmonic oscillator.

Or

(b) Discuss the normal vibrations of CO_2 and H_2O molecules in infrared spectroscopy.

18. (a) Explain the vibrational Raman spectra.

Or

(b) Explain the quantum theory of Raman effect.

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

Or

(b) Explain in detail Frank-Condon principle.

20. (a) Describe with suitable sketch, the prism type and grating type monochromators.

Or

(b) Describe the single beam spectrometer. Give its advantages.

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