

(6 pages)

Reg. No. :

Code No. : 20355 E Sub. Code : EEPH 51

B.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2025.

Fifth Semester

Physics

Elective — SPECTROSCOPY

(For those who joined in July 2023 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 linear molecules are
- (a) $I_a = I_b < I_c$ (b) $I_a = 0, I_b = I_c$
(c) $I_a < I_b = I_c$ (d) $I_a \neq I_b \neq I_c$

2. The degeneracy of rotational energy level is given by
- (a) $J(J+1)$ (b) $J(J+2)$
(c) $J(J+3)$ (d) $(2J+1)$
3. Which type of energy transition is shown by IR-spectroscopy?
- (a) rotational (b) vibrational
(c) bond breaking (d) electronic
4. The vibration – rotation spectrum has
- (a) P-branch
(b) R-branch
(c) Both P and R branch
(d) Neither P nor R branch
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 selection rule for the pure rotational Raman spectra is _____.
- (a) $\Delta J = 0, \pm 1$ (b) $\Delta J = \pm 1$
(c) $\Delta J = 0, \pm 2$ (d) $\Delta J = \pm 2$
7. Molecules possessing permanent electric dipole movement gives
- (a) Vibrational spectra
(b) Rotational spectra
(c) Vibration – rotation spectra
(d) No effect
8. ΔJ value corresponding to R-branch in electronic vibration transition is
- (a) -1 (b) +1
(c) 2 (d) -2
9. The appropriate value of methyl proton in NMR is
- (a) 1.3 (b) 1.5
(c) 0.9 (d) 2.5

Page 3 Code No. : 20355 E

10. Signal splitting in NMR arises from
- (a) Shielding effect
(b) Spin-spin decoupling
(c) Spin-spin coupling
(d) Deshielding effect

PART B — (5 × 5 = 25 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) Explain instrumentation of Microwave spectrometer.
12. (a) Describe vibration spectrum of simple Harmonic oscillator.
Or
(b) Describe diatomic vibrating rotator.
13. (a) Explain the quantum theory of Raman effect.
Or
(b) Discuss the pure rotational Raman Spectra of linear molecules.

Page 4 Code No. : 20355 E
[P.T.O.]

14. (a) Explain Frank-Condon principle.

Or

(b) Explain Fortrat parabola.

15. (a) Outline the theory of NMR spectroscopy.

Or

(b) Explain the instrumentation of NMR spectroscopy.

PART C — (5 × 8 = 40 marks)

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

Each answer should not exceed 600 words.

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

Or

(b) Discuss the intensities of spectral lines in microwave spectroscopy.

17. (a) Explain the vibrating diatomic molecule as Anharmonic oscillator.

Or

(b) Distinguish between IR and Microwave spectroscopy.

Page 5 Code No. : 20355 E

18. (a) Explain the classical theory of Raman effect.

Or

(b) Explain about Raman Spectrometer.

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

Or

(b) Explain the intensity of vibrational electronic spectra.

20. (a) Briefly discuss the principle, construction and working of NMR spectroscopy with suitable diagram.

Or

(b) List out the application of NMR Spectroscopy and explain.

Page 6 Code No. : 20355 E