

(7 pages)

Reg. No. :

Code No. : 20038 E Sub. Code : CMPH 52

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

Fifth Semester

Physics – Core

SPECTROSCOPY

(For those who joined in July 2021 and 2022 only)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer.

1. Which of the following is an application of molecular spectroscopy?
 - (a) Structural investigation
 - (b) Basis of understanding of colors
 - (c) Study of energetically excited reaction products
 - (d) All of the mentioned above

2. The microwave spectrum of a molecule yields three rotational constants. The molecule is
 - (a) CH_4
 - (b) C_4H_4
 - (c) H_2O_2
 - (d) CHCl_3
3. Which of the following statement is correct?
 - (a) Ultraviolet radiation has a longer wavelength than infrared radiation
 - (b) Microwave radiation possesses more energy than infrared radiation
 - (c) Infrared radiation has a shorter wavelength than visible light
 - (d) Infrared radiation has a lower wavenumber than visible light
4. On which factors the vibrational stretching frequency of diatomic molecule depend?
 - (a) Force constant
 - (b) Atomic population
 - (c) Temperature
 - (d) Magnetic field
5. Which of the following cannot be conserved during Raman scattering?
 - (a) Total Energy
 - (b) Momentum
 - (c) Kinetic Energy
 - (d) Electronic Energy

6. The Raman spectrum is said to consist of Stokes lines when _____.
- (a) $\Delta \nu > 0$
 - (b) $\Delta \nu < 0$
 - (c) $\Delta \nu = 0$
 - (d) does not depend on $\Delta \nu$
7. Lambert's law states that the intensity of light decreases with respect to _____.
- (a) Concentration
 - (b) Distance
 - (c) Composition
 - (d) Volume
8. Transmittance is given as $T = P/P_0$. If P_0 is the power incident on the sample, what does P represent?
- (a) Radiant power transmitted by the sample
 - (b) Radiant power absorbed by the sample
 - (c) Sum of Powers absorbed and Scattered
 - (d) Sum of powers transmitted and reflected
9. NMR spectroscopy indicates the chemical nature of the _____ and spatial positions of _____.
- (a) Electrons, Protons
 - (b) Neutrons, electrons
 - (c) Nuclei, electrons
 - (d) Nuclei, neighbouring nuclei
10. NMR spectroscopy is used for determining structure in which of the following materials?
- (a) Radioactive materials
 - (b) Insoluble chemical compounds
 - (c) Liquids
 - (d) Gases

PART B — (5 × 5 = 25 marks)

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

Each answer should not exceed 250 words.

11. (a) Discuss about the effect of isotopic substitution.
- Or
- (b) Summarize a note on linear polyatomic molecules.

12. (a) List out the applications of vibrating diatomic and polyatomic molecules.

Or

- (b) Discuss about the simple harmonic oscillator.

13. (a) Describe the pure rotational Raman spectrum of symmetric top molecules.

Or

- (b) Elucidate in detail about the structure determination from Infrared and Raman spectroscopy.

14. (a) Analyze on the transmittance and absorbance of ultraviolet spectroscopy.

Or

- (b) Explain the analytical uses of ultraviolet spectroscopy.

15. (a) Discuss the techniques and principle of NMR spectroscopy.

Or

- (b) List out the applications of NMR spectroscopy.

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PART C — (5 × 8 = 40 marks)

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

Each answer should not exceed 600 words.

16. (a) Explain about the rotation spectra of diatomic molecules.

Or

- (b) Discuss about the chemical analysis by microwave spectroscopy.

17. (a) Describe about the principle of IR spectroscopy.

Or

- (b) Elucidate in detail about the vibration of polyatomic molecule.

18. (a) Discuss the pure rotational Raman spectrum of linear molecule.

Or

- (b) Explain about the vibrational Raman spectra.

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19. (a) State and explain the principle of ultraviolet spectroscopy.

Or

(b) Explain the working principle of ultraviolet spectrophotometer with its advantages.

20. (a) Explain about the theory of NMR spectroscopy.

Or

(b) Explain about the magnetic resonance imaging (MRI).
